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DANIEL GUTZMANN

Use-Conditional Meaning

Studies in Multidimensional Semantics

OXFORD STUDIES IN SEMANTICS AND PRAGMATICS 6

Use-Conditional Meaning

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“This damn book is for you!”

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General preface

Oxford Studies in Semantics and Pragmatics publishes original research on meaning in natural language within contemporary semantics and pragmatics. Authors present their work in the context of past and present lines of inquiry and in a manner accessible to both to scholars whose core areas of expertise are in linguistic semantics and pragmatics, and to researchers in related and allied fields such as syntax, lexicology, philosophy, and cognitive science. The series emphasizes rigorous theoretical analysis grounded in detailed empirical investigation of particular languages.

This is a companion series to *Oxford Surveys in Semantics and Pragmatics*. The *Surveys* series provides critical overviews of the major approaches to core semantic and pragmatic phenomena, a discussion of their relative value, and an assessment of the degree of consensus that exists about any one of them. The *Studies* series equally seeks to put empirical complexity and theoretical debate into comprehensible perspective, but with a narrower focus and correspondingly greater depth. In both series, authors develop and defend the approach and line of argument which they find most convincing and productive.

In this monograph, Daniel Gutzmann draws a bright line between semantics (conditions on truth) and pragmatics (conditions on use, as in Kaplan's "Ouch!"). Adapting traditional tools of formal semantics, he builds this distinction into a grammar that allows expressions to impose grammatical constraints on both kinds of meaning simultaneously. Unlike the pathbreaking work of Potts on expressives such as "damn", Gutzmann's multidimensional fragment is strictly compositional. Gutzmann tests his proposal with two main in-depth case studies: grammatical constraints on sentence mood (whether an utterance serves as a statement or a question or some other kind of speech act); and modal particles in German, which have notoriously elusive discourse effects, including *doch*, *ja*, *wohl*, and others. The result is a carefully worked-out, innovative, and fully compositional approach to multidimensional meaning.

Acknowledgments

The first time I came into contact with formal semantics was when one of my earliest teachers in linguistics, Markus Steinbach, handed me Chris Potts's *The Logic of Conventional Implicatures*. Even though all those formulas and symbols it contains were completely cryptic to me back then, they held a great fascination. With some virtual help from Horst Lohnstein in the form of a well-worn second-hand copy of his introduction to semantics, I somehow managed to get to a point where I could grasp those formulas and worked my way through that book. At that point, I was completely hooked on linguistics, and formal semantics in particular. But even then, I would not have thought that six years later, I would hold a dissertation on semantics in my hand. Fittingly, the dissertation continued the path initially set out by my first contact with semantics. And now, turning a revised version of that dissertation into a book published by the same publisher as published the book that got me started with semantics somehow feels as if I have finally come full circle.

There are many people who influenced me and my linguistic thinking during the time of my first encounter with linguistics up to the submission of the final manuscript of this book and who thereby, directly or indirectly, contributed to its final form. Jörg Meibauer and Markus Steinbach were the first to spark my interest in linguistics and they went on to support me during my time in Mainz. Also at Mainz, Elke Brendel taught me a lot about the logical foundations on which all semantics rests. Erik Stei became a friend and regular discussant for all things philosophical. When I moved on to become a PhD student at the *Graduiertenkolleg* "Sentence Types" at Frankfurt, Elena Castroviejo Miró was "my postdoc" and helped me to dig even deeper into issues of multidimensionality. When I finally got a position at the University of Frankfurt, my part-time office-room-mates Viola Schmitt and Katharina Hartmann kept me both entertained and thinking about other linguistic phenomena unrelated to my thesis.

Eric McCready, whose work I started to follow eagerly when I was still a student, had a huge influence on me as a linguist. Never would I have thought back then when I was checking the semantics archive for more of his work that he would become one of my supervisors. But he did and I think his influence, though never intrusive, shows throughout this book. Besides being a great semanticist and philosopher, he is also one of the coolest guys to hang out with.

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My family, of course, deserves much more gratitude than any words in an Acknowledgments section will ever be able to express. As much as I enjoy my work and like to spend my time thinking about language and linguistics, they are the ones who always bring me back to the real world. Watching my kids growing up a little more every day always reminds me that there are many things that matter much more in life than the latest tech in semantics.

August 2014 D. G.

List of abbreviations, symbols, and typographic conventions

Abbreviations

[±2*d*]	[±2-*dimensional*]
[±*f*]	[±*functional*]
[±*rs*]	[±*resource-sensitive*]
A	adjective
Adv	adverb
C	complementizer
CG	common ground
Conj	conjunction
COP	copula
CP	complementizer phrase
CP^{spec}	specifier position of CP
D	determiner
DP	determiner phrase
FEM	feminine
HON	honorific
LER	lexical extension rule
LF	logical form
IMP	imperative
INF	infinitive
MASC	masculine
MP	modal particle
NEG	negation
NEUT	neuter
N	noun
NOM	nominative
NP	noun phrase
Part	particle
PF	phonological form
Pro	pronoun
PST	past tense

Sf	suffix
TC	truth conditions
TOP	topic
t-content	truth-conditional content
UC	use conditions
u-content	use-conditional content
UCI	use-conditional item
V	verb
VP	verb phrase

Symbols

c	context
c_S	speaker of context c
c_H	hearer of context c
c_W	world of context c
$c_@$	actual context
$w_@$	actual world
$[\![\cdot]\!]$	interpretation of logical expressions
$\|\cdot\|$	interpretation of natural language expressions
$(\!\| \cdot \|\!)^c$	combined semantic information
$\Downarrow_c$	lowering operator for use-conditional content
$\neg$	logical negation
$\vee$	logical inclusive disjunction
$\wedge$	truth-conditional conjunction
$\exists$	existential quantifier
$\forall$	universal quantifier
$\odot$	use-conditional conjunction
☆	use-conditional type shifter
λ	lambda operator
$\diamond$	possibility modal
$\sim$	focus interpretation operator
I_σ	indentity function on type σ
π	projection function
$\Rightarrow$	lexical extension
$\leadsto$	abbreviation function
$\rightarrow$	implication; “implies”
$\not\rightarrow$	“does not imply”
$\gg$	“presupposes”

$\not\gg$	"does not presuppose"
$+>$	"implicates"
$\cap$	set intersection
$\cup$	set union
$\subseteq$	subset relation
$\in$	element relation
$[\cdot]_{F}$	focus feature
$[\cdot]_{T}$	topic feature
prop	a proposition

Typographic conventions

In linguistic examples, I use **boldface** to highlight relevant expressions, and SMALL CAPS to indicate focus accent on an expression. In semantic formulas, **boldface** marks logical constants. In the main text and in quotations, I use *italics* to give emphasis. *Italics* in the main text are also used for expressions in the object language. I use 'single quotation marks' for translations of language examples and "double quotation marks" for all other quoted matter, such as verbatim quotes and scare quotes.

1

Introduction

1.1 Pragmatics and the scope of semantics

Semantics and pragmatics, traditionally contrasted with phonology, morphology and syntax, which all focus on the *form* of linguistic expressions, are the subdisciplines of linguistics that deal with *meaning*. The idea of distinguishing these two approaches to meaning is usually attributed to Morris (1938: 6), according to whom semantics studies "the relations of signs to the objects to which the signs are applicable", while pragmatics studies "the relation of signs to interpreters". Under this view, semantics is as an abstraction from pragmatics, as is explicit in the work of Carnap:

> If in an investigation explicit reference is made to the speaker, or, to put it in more general terms, to the user of a language, then we assign it to the field of pragmatics. [. . .] If we abstract from the user of the language and analyze only the expressions and their designata, we are in the field of semantics. (Carnap 1942: 9)

The question of how this abstraction approach can be spelled out in detail leads to some fundamental questions for the semantic enterprise. In order to distinguish semantics from pragmatics, we must have a clear picture of what semantics is supposed to deal with in the first place. What is the scope of semantics? How much and what kind of meaning should be regarded as semantic aspects of linguistic meaning? An answer to these questions will provide us with some criteria to delimit which aspects of the meaning of linguistic expressions count as semantic, leaving other aspects to the pragmatic side. At the same time, conceptually defining the scope of semantics raises requirements that the formal or empirical tools used to study and describe semantic aspects of linguistic expressions have to meet. Giving answers to these questions and developing the corresponding tools for the resulting conception of semantics is one of the major goals of this book.

While the exact rendering of the distinction between semantics and pragmatics and their interaction has given rise to much discussion and still remains highly controversial,[1] the basic idea, which has not lost any of its intuitive appeal, is very simple. Whereas semantics studies the literal meaning of an expression, the subject of pragmatics is what and how speakers communicate by utterances of that expression. In other words, semantics is more tied to the *conventional* aspects of linguistics meaning as encoded in the lexicon, while pragmatics deals with the *conversational* aspects of speaker meaning in concrete discourse contexts.

The distinction between conventional and conversational aspects of meaning found a theoretical elaboration in truth-conditional semantics in the Fregean tradition, which constitutes a paradigmatic case of a systematic answer to the question of what the scope of semantics is. Semantics concerns those aspects of meaning that are relevant for determining the truth conditions of a sentence. This conception immediately gives us a procedure to test whether two expressions differ semantically in meaning or not. If an expression is substituted by another one while leaving the rest of the sentence as it was and the truth conditions of the sentence change, the two expressions differ in semantic meaning. If, on the other hand, the truth conditions remain the same, their semantic meaning must also be the same. Applying this procedure shows, for instance, that *cat* and *turtle* differ in meaning, because substituting one for the other changes the truth condition of the overall sentence. Example (1.1a) may well be true while (1.1b) is false and vice versa.[2]

(1.1) a. A **cat** sleeps under the couch.
b. A **turtle** sleeps under the couch.

In the same vein, this test establishes that *couch* and *sofa* have the same meaning because, barring quotational contexts, two sentences that differ only with respect to these two words will always have the same truth conditions. There are no situations in which (1.2a) is true while (1.2b) is false or vice versa. Either both are true or both are false.

(1.2) a. The turtle sleeps under the **couch**.
b. The turtle sleeps under the **sofa**.

Expressions like *couch* and *sofa* can be exchanged without changing the truth conditions of the sentence in which they occur. They are truth-conditionally equivalent.

[1] See, amongst others, Bianchi (2004); Borg (2004); Cappelen and Lepore (2005); Carston (2002); Levinson (2000); Preyer and Peter (2005, 2009); Recanati (2004a,b, 2010); Szabó (2005); Turner (1999).

[2] Throughout this book, I will use boldface to highlight relevant aspects of the examples.

In contrast, according to the criterion of truth-conditionality, *non-truth-conditional* meaning that cannot be accounted for by the contribution it makes to the truth conditions of a sentence belongs to the realm of pragmatics. This definition of pragmatics is most famously captured in the so-called Gazdar formula (Gazdar 1978: 2).

(1.3) PRAGMATICS = MEANING − TRUTH CONDITIONS

This definition of pragmatics, and thereby of semantics, means that aspects like conversational implicatures (Grice 1975) are pragmatic, as they are not part of the truth-conditional content of a sentence. Consider the following example uttered at a party:

(1.4) A: Where is Kate?
B: A bunch of people left three minutes ago.
+> 'Maybe Kate left with them.'

In the context of A's question, B's answer implicates that Kate possibly left the party as well. However, this inference is obviously not part of the truth-conditional content of the sentence B uttered. It is true if a bunch of people left the party three minutes before the utterance time, even if Kate left the party alone ten minutes ago, or if she did not leave at all. And obviously, the implicature that Kate left is not part of the conventional meaning of the sentence. Just imagine this sentence in isolation or in a different context like, say, after the question *Where is Dave?*, and it does not convey anything about Kate's whereabouts.

However, when we go beyond simple cases like *cat/turtle* or *couch/sofa*, which I call cases of literal meaning, or conversational implicatures as just discussed, we will notice quickly that *truth-conditionality* as a criterion for semantics does not characterize the same aspects of meaning as the criterion of *conventionality*.

First, in the context of the entire semantics vs pragmatics debate, it has become clear that there is also non-conventional meaning that may nevertheless contribute to the truth conditions of an utterance. Consider, for instance, the following various examples of so-called pragmatic enrichment, taken from Carston (2002: 22) and Bach (1994: 134–5.).

(1.5) a. Paracetamol is better. [*than what?*]
b. He's too young. [*for what?*]

(1.6) a. I have eaten breakfast. [*today*]
b. You're not going to die. [*from this cut*]

In (1.5), there is some constituent missing that is needed in order for the sentence to express a complete proposition, while in (1.6) the proposition is expanded in order to express a more specific and contextually more plausible proposition. Such saturation and expansion processes are considered to be pragmatic since they are governed not by linguistic rules, but rather by conversational principles like salience, plausibility, or relevance. This can be evidenced by the fact that under the right circumstances the content may easily be enriched by something other than what is given in the brackets. However, it seems obvious that the enriched content is truth-conditionally relevant. It makes a difference in truth conditions, if, say, (1.5b) is completed with *to drink alcohol* or *to ride the roller coaster*, as it is easy to think of a situation where the former is true, but the latter is false. Pragmatic enrichment therefore constitutes an aspect of meaning in which truth-conditionality and conventionality as classification criteria pull in different directions. According to the former, they are semantic; according to the latter, they are pragmatic.

However, it is another class of examples in which the two criteria do not line up that will be the main topic that I will study in this book. There are aspects of meaning that, though being part of the conventional meaning of an expression, do not contribute to its truth-conditional content. I will call this *use-conditional meaning*. Consider, for instance, the following minimal pair (Frege 1897/1979: 140):

(1.7) a. This **dog** howled the whole night.
b. This **cur** howled the whole night.

Both sentences have the same truth-conditional content as they both are true in the case that the dog in question howled the whole night. However, (1.7b) expresses a negative speaker attitude towards the dog which is absent from (1.7a). That is, while we can substitute *cur* for *dog* without altering the truth value, it leads to infelicity in contexts in which the speaker has no negative attitude towards the dog.[3] Similar considerations apply to the following example.

(1.8) This **damn** dog howled the whole night.

Like (1.7b), the *damn* of (1.8) expresses a negative attitude towards the dog in question. In contrast to *cur*, this is its sole function as it does not make any truth-conditional contribution. What is crucial for the present discussion is that the negative attitude expressed by *cur* or *damn* is part

[3] Such pairs of expressions are called *propositional synonyms* by Cruse (2004: 155).

TABLE 1.1 Conventions vs truth conditions

	+ truth-conditional	− truth-conditional
+ conventional	descriptive meaning	use-conditional meaning
− conventional	pragmatic enrichment	conversational implicatures

of their lexical and thereby conventional meaning. According to the criterion of conventionality, this aspect of meaning should therefore fall within the scope of semantics. But under the truth-conditional picture, it is pragmatic, as it does not contribute to the truth-conditional content. Therefore, expressive adjectives like *damn* or colored expressions like *cur* constitute another case in which conventions and truth conditions as criteria for categorization yield different results.

Thus, at least for some cases, the two features drag us in different directions and therefore do not define the same aspects of meaning. As depicted in Table 1.1, we can find kinds of meaning for all possible valuations of the two features.

The choice of whether we want to base semantics on conventions or on truth conditions leads to different sets of phenomena respectively falling within the scope of semantics. Without further restriction, a truth-conditional semantics encompasses ordinary descriptive meaning as well as the pragmatic enrichment processes. In contrast, a conventional semantics deals with ordinary descriptive meaning as well with the use-conditional meaning expressed by expressions like *damn* or *cur*.

In this book, I defend a conventionalist view of semantics. I do this mainly indirectly, by developing a properly semantic approach to use-conditional meaning, but I will also provide related conceptual discussion wherever necessary. Judging just by the data, however this class of meaning seems much more amenable to a semantic treatment than does the process of pragmatic enrichment. This is also evident from the questions that will govern my investigation of use-conditional meaning, which are pretty much semantic in nature: How is the use-conditional content of an expression compositionally determined by the content of its parts? How do use-conditional expressions interact with truth-conditional expressions? In contrast, questions about pragmatic enrichment most likely concern pragmatic aspects, like how the enriched content is calculated in the utterance context, which contextual factors guide the hearer to infer it, and similar questions. Furthermore, the conventionalist view still lets us treat semantics as an abstraction from pragmatics, since those aspects of meaning that require reference to speaker intentions and utterance contexts, namely pragmatic enrichment and conversational implicatures, are left to pragmatics. That is, I assume with Kaplan (1999: 42), that semantics should also deal with those "non-descriptive features of language that are associated with certain expressions by linguistic convention".

1.2 Use-conditional meaning

Having proposed a conventionalist approach to semantics in order to relate this book to the overall question of the scope of semantics, let us now come back to the linguistic phenomena that will be the main topic of this work. Due to the dominant truth-conditional orientation of formal semantics, expressions that conventionally contribute use-conditional content have mostly been excluded from formal analyses, even if they have been identified as problematic for the strictly truth-conditional enterprise from the very beginning. For instance, Frege mentions what he calls "colored" variants of purely descriptive expressions, like the pair *cur* and *dog* in (1.7), and other expressions that fall outside the scope of the truth-conditional approach to meaning (cf. Horn 2007). However, this does not force us to abandon the techniques and tools developed in over a century of truth-conditional semantics. Quite the contrary. As Kaplan (1999) suggested and this book will hopefully demonstrate, the methods of truth-conditional semantics can be extended to cover use-conditional aspects of meaning. What I have called conventionalist semantics is hence a rather conservative extension of the scope of semantics, by broadening our conception of meaning and adjusting our formal tools.

Consider again the expressive adjective *damn* in (1.8). Although the negative expressive attitude it displays is not part of the sentence's truth conditions, it nevertheless contributes something else to its overall meaning. For instance, suppose a context in which the speaker does not have any negative feelings towards the addressee's dog she sees for the first time, nor towards dogs in general. Now, suppose that the speaker nevertheless utters the following:

(1.9) #I did not know that you have a **damn** dog.

Even if the speaker lacks the negative attitude, the presence of *damn* does not render her utterance false. It is true as long as she did not know that the addressee has a dog. However, her use of *damn* in such a context makes the utterance infelicitous. This means—and this is the basic idea—that even if *damn* is truth-conditionally irrelevant, it does impose conditions on the felicitous use of the sentence in which it occurs. That is, instead of analysing the meaning of *damn* with reference to its contribution to a sentence's truth conditions, we can talk about the meaning of *damn* by describing the *use conditions* for an utterance in which *damn* is used.

The idea of a theory of meaning as use is of course not new. Such theories, most famously represented in the work of the later Wittgenstein (1953), are generally conceived as being oppositional to formal theories of meaning. It was Kaplan who, notwithstanding this background, sketched in a now classic underground paper (1999) how traditional formal semantics can be enriched by taking a use-conditional perspective on certain expressions.

> For certain expressions of natural language, a correct Semantic Theory would state rules of use rather than something like a concept expressed. (Kaplan 1999: 6)

Kaplan's idea is that once we add use conditions as the basis for the meaning of some expressions to our semantic framework, such expressions become amenable to the standard techniques of formal semantics, so that "we can bring out our old toolbox, and go to work" (Kaplan 1999: 9).

1.3 Hybrid semantics

Importantly, employing the use-conditional perspective does not mean that we should abandon the truth-conditional basis. We now have two *modes of expression* in which content can be conveyed (Kaplan 1999: 16).[4] Some expressions convey only truth-conditional content (*dog*), others contribute only use-conditional content (*damn*), while other contribute both (*cur*). That is, for many complex expressions, we need to state the truth as well as the use conditions to capture their overall meaning. Therefore, we have two dimensions according to which a sentence can be evaluated:

[4] Instead of truth- vs use-conditional, Kaplan (1999) calls these modes *descriptive* and *expressive*. See also Cruse (1986: 271), who speaks of two *semantic modes*, the *propositional* and the *expressive*.

(1.10) a. "The damn dog howled the whole night" is **true** if the dog howled the whole night.

b. "The damn dog howled the whole night" is **felicitously used** if the speaker feels negatively about the dog.

I call expressions that express both truth- and use-conditional content *hybrid* expressions. Accordingly, I use the term *hybrid semantics* for a semantic framework that employs these two dimensions in order to analyse the meaning of natural language expressions. Since such a framework combines two modes of expression, hybrid semantic approaches are multidimensional, which means that linguistic expressions receive two (more or less) independent semantic values. That is, using 1 and 0 for true and false, and ✓ and ↯ for felicitous and infelicitous respectively, the semantic value for a hybrid sentence will be one of the following four tuples:

(1.11) $\langle 1, ✓ \rangle$ $\langle 1, ↯ \rangle$

$\langle 0, ✓ \rangle$ $\langle 0, ↯ \rangle$

The main question for the hybrid semantics approach is the doubled question of compositionality:

How is the *truth*-conditional meaning of a complex expression calculated on the basis of the truth-conditional and use-conditional meaning of its parts and the way they are put together?

How is the *use*-conditional meaning of a complex expression calculated on the basis of the truth-conditional and use-conditional meaning of its parts and the way they are put together?

These two questions will play a major role throughout this book and become especially important when I work Kaplan's suggestions up into a formal framework.

1.4 Goals for the book

Given this background, I formulate three goals that I want to reach in this book. The first is conceptual, the second formal and theoretical, and the third is empirical.

(i) Work out the core idea of hybrid semantics.

This involves laying out the philosophical motivations for such an approach in a little more detail. More importantly, my aim is to find a way to provide denotational semantics for use-conditional content in a way that uses the resources from standard truth-conditional semantics.

(ii) Develop a compositional, multidimensional formal framework for hybrid semantics.

While I take the core idea of hybrid semantics to be relatively independent of any actual formal implementation, my goal is to provide a compositional formal logic, which I will call $\mathcal{L}_{\mathrm{TU}}$, for this framework. As we will see, the influential work by Potts (2005) provides an excellent starting point for my enterprise, but neither plumbs the empirical depth of use-conditional phenomena, nor is strictly compositional.

(iii) Put the formal framework to use for actual linguistic analyses.

Even if the first two goals are rather technical in nature, I do not want the development of $\mathcal{L}_{\mathrm{TU}}$ to be an exercise in logic. Primarily, I want it to be a useful tool for the purposes of natural language semantics. Therefore, I will test the framework by using it for analyses of two use-conditional phenomena in German, namely sentence mood and modal particles. My aim is to show that $\mathcal{L}_{\mathrm{TU}}$ offers helpful tools to account for these phenomena and that it can provide new insights into these complex subjects.

1.5 Notes on terminology

Before I give an overview of the chapters to follow, let me make a few remarks regarding terminology. I have chosen the term *use-conditional* for the second mode of expression, in analogy to the truth-conditional first mode. Obviously, this term already derives from the approach I have in mind. Of course, the idea that the meaning of some expressions goes beyond mere truth-conditional relevance has been given many different names over the years. Amongst these are: *colored* (Frege 1897/1979), *emotive* (Jakobson 1960; Stevenson 1937), *evaluative* (Hare 1952), *expressive* (Kaplan 1999; Potts 2007b), *procedural* (Bezuidenhout 2004), *non-cognitive* (Cruse 1986), *non-descriptive* (Davis 2005; Kaplan 1999), *non-ideational* (Davis 2005), and, of course, also *use-conditional* meaning (Recanati 2004b). Not all of these terms are synonymous, but the empirical overlap between all these concepts is so great that in many cases these labels can be substituted for each other. However, out of all these terms, *use-conditional meaning* most perfectly captures the core ideas of the approach I will develop, and, in addition, is descriptively relatively neutral in contrast to, say, *emotive* or *evaluative* meaning. Therefore, I will stick to Recanati's (2004b) suggestion, which is also mentioned by Kaplan (1999). I will often abbreviate *use-conditional content* as *u*-content and contrast it with the *truth-conditional* or *t*-content. In the same vein, expressions or constructions that contribute use-conditional content will be referred to as *UCIs*, for *use-conditional items*.

1.6 Overview of the individual chapters

In what follows, I give a brief overview of the structure of this book and short summaries of what the individual chapters are about. I will start with the empirical, theoretical, and philosophical background for understanding use-conditional meaning.

Chapter 2 In the next chapter, I elaborate on Kaplan's (1999) vision of a theory of meaning as use. I sketch the core ideas of his proposal and highlight the parallels and differences between truth and use conditions. To spell out Kaplan's ideas explicitly, I suggest that the denotations of use-conditional propositions are provided in the form of sets of contexts. The felicity of an utterance can then be defined as the inclusion of the current context in a context set, analogously to the way in which truth conditions are defined with respect to traditional propositions. Since many expressions will exhibit both kinds of content, I introduce the idea of *hybrid semantics*, according to which the overall semantic information of an expression is given by both its truth- and use-conditional content. I then continue by reflecting on Kaplan's idea of an extended notion of semantic validity. In the second half of the chapter, I provide a brief overview of the descriptive and terminological foundations for this book, where I distinguish between five kinds of use-conditional items (UCIs) which differ with respect to how they interact with other content. This survey will build the empirical testing ground for the next part of this book, in which the formal framework for hybrid semantics will be developed.

Chapter 3 Before developing my own multidimensional logic to provide a formalization of the basic ideas of hybrid semantics, I review some **previous approaches to multidimensional meaning**. I start with Potts's (2005) logic $\mathcal{L}_{\mathrm{CI}}$, which provides a multidimensional semantics for conventional implicatures and has been very influential. Since multidimensionality is one of the key aspects of hybrid semantics, and the category of conventional implicature has been shown to be closely related to use-conditional meaning, his formal framework provides a good starting place for developing a formal logic for hybrid semantics. I present and review his logic $\mathcal{L}_{\mathrm{CI}}$ in detail, before assessing it by examining how it can deal with various kinds of UCIs as well as with other constructions involving use-conditional meaning. As it turns out, $\mathcal{L}_{\mathrm{CI}}$ proves to be too restrictive. It is not able to deal with mixed UCIs. Therefore, I continue with a similar review of McCready's (2010) extension $\mathcal{L}^{+}_{\mathrm{CI}}$ that introduces new types and composition rules. As the assessment shows, it can deal with all kinds of UCIs, but still has problems with some of the other constructions. I conclude by addressing an issue of compositionality that is common to both variants of the logic, which I collectively refer to as $\mathcal{L}^{\star}_{\mathrm{CI}}$. This problem is rooted in the specific way the two dimensions are treated. As I will explicate, $\mathcal{L}^{\star}_{\mathrm{CI}}$ exhibits only what I call *interpretational* multidimensionality, by which I mean that the expressions are all one-dimensional, in the sense that it is only the interpretation of an entire semantic structure (either in the form of a parsetree or a proof) that delivers multidimensional content. The procedure by which this is achieved is problematic for compositionality, because it has to take into account arbitrarily embedded constituents, instead of just the immediate ones, in order to calculate both meaning dimensions of a complex expression.

Chapter 4 On the basis of my reviews of $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$, I develop **a multidimensional logic for hybrid semantics** that tries to solve the problems raised in Chapter 3. The new logic, which I call $\mathcal{L}_{\mathrm{TU}}$, is capable both of dealing with the entire range of UCIs and accounting for the additional constructions that have been shown to be problematic for $\mathcal{L}^{\star}_{\mathrm{CI}}$. The key innovation of $\mathcal{L}_{\mathrm{TU}}$ that enables resolutions of the problems previously identified is that it embraces true multidimensionality: that is, every natural language expression is represented by a three-dimensional meaning profile in the compositional semantics. In contrast to the interpretational multidimensionality of $\mathcal{L}^{\star}_{\mathrm{CI}}$, I call this *compositional multidimensionality*. I begin the development of $\mathcal{L}_{\mathrm{TU}}$ by showing how the core ideas of $\mathcal{L}^{\star}_{\mathrm{CI}}$ can naturally be reformulated and extended in such a framework and how this will help to simplify the system by reducing the number of types and composition rules. In contrast to the previous approaches, $\mathcal{L}_{\mathrm{TU}}$ does not impose many restrictions on possible multidimensional expressions. Instead, restrictions are formulated as conditions on the lexicon–syntax interface of the logic. Besides helping to keep the compositional semantics simple, this move makes it possible to keep the lexicon simpler too. Since the derivational system needs three-dimensional meaning profiles, however, there is a gap between lexical and compositional semantics. This gap is bridged by so-called *lexical extension rules* that expand the one- or two-dimensional lexical representations into proper three-dimensional profiles that can be used in semantic derivations. I conclude with an assessment of $\mathcal{L}_{\mathrm{TU}}$ that parallels the assessments of $\mathcal{L}^{\star}_{\mathrm{CI}}$, and which shows that $\mathcal{L}_{\mathrm{TU}}$ can indeed deal with all the cases discussed before. Having set up the formal framework for hybrid semantics, the third part of this book consists of case studies in which the system is applied to analyses of two linguistic phenomena.

Chapter 5 The first case study is an examination of the notion of **sentence mood**. Sentence mood is understood as the semantic correlate of syntactic sentence types and as a restrictor of the speech acts that can be performed by an utterance. Given the traditional philosophical assumption that the meaning of a sentence can be divided into its sentential content and its mood, the main question is how these two kinds of meaning interact with each other to yield a sentence's overall content. I review three kinds of approach to this question. What differentiates these three kinds of approach is where they locate the contribution of sentence mood. Integrative approaches unite sentence mood operators and sentential content in a single semantic representation, which leads to false predictions regarding truth conditions. Implicit approaches do not use sentence mood operators, but attempt to derive the different moods directly from the denotational type of a sentence, which only works for the three main moods but not for more specialized versions. Multidimensional approaches distribute the contribution of mood and content into two different meaning dimensions, so that explicit mood operators can be used, while avoiding the problems of integrative approaches. However, this particular instance of a multidimensional approach does not explain where these operators come from. I therefore present and review Truckenbrodt's (2006b) complex approach to the syntactic constitution of sentence mood in German. Although it is shown to have some conceptual problems, these can be overcome if his approach is transferred into the hybrid semantic framework of $\mathcal{L}_{\text{TU}}$, which is what I do at the end of the chapter.

Chapter 6 The second case study deals with **modal particles in German**. These particles constitute an entire class of functional expletive UCIs, which are characterized by peculiar syntactic and semantic properties that set them apart from other kinds of particles. After providing an overview of their properties and behavior, I show that the great majority of them can be derived directly from their use-conditional nature. In order to show this, I develop a formal analysis by using the tools of $\mathcal{L}_{\text{TU}}$ and, based on that, illustrate how several properties of modal particles fall out of this semantics and its interaction with other components. In addition, I address their interaction with the sentence mood, building on the semantics developed in Chapter 5. I argue that there are actually two kinds of modal particles, free modifiers and real sentence mood operators, and show that the restrictions to specific sets of sentence types are based on a clash of semantic types or an incompatibility of the use conditions expressed by the particles and mood operators.

Chapter 7 I use the final chapter of this book to step into **uncharted dimensions**. I highlight some topics which, I think, are fruitful fields for further investigation. I discuss two directions in which the framework of hybrid semantics and its implementation in $\mathcal{L}_{\text{TU}}$ can be elaborated or extended. First, I examine the notion of *at-issue content*, which was introduced by Potts (2005), and argue that the distinction between truth- and use-conditional content is orthogonal to the distinction between at-issue content and side issues, because the former pair cannot be reduced to one or the other of the latter. Secondly, I suggest that the relations between the different meaning dimensions in $\mathcal{L}_{\text{TU}}$ and the various kinds of updates on the discourse components like the common ground or the question under discussion that have recently been discussed should be investigated thoroughly. In addition to these possible elaborations on $\mathcal{L}_{\text{TU}}$, I briefly address two fields of linguistic analysis for which, as I hope, the conceptual and formal tools offered by the hybrid semantic framework may prove to be helpful: the diachronic analysis of pragmaticalization processes, and typological studies of use-conditional meaning.

2

The case for use-conditional meaning

2.1 Use-conditional semantics

The starting point for the formal approach to use-conditional meaning that I will develop in this book is the insights of David Kaplan. In his very influential though still not formally published paper of 1999, Kaplan sketches a vision of semantic theory that goes way beyond the borders of standard truth-conditional semantics. At the heart of his project lies the observation that

> For certain expressions of natural language, a correct Semantic Theory would state **rules of use** rather than something like a concept expressed.
>
> (Kaplan 1999: 6, my emphasis, DG)

This is of course not a new idea since it goes back to the traditions of ordinary language philosophy and is most famously articulated by Wittgenstein in his *Philosophical Investigations*:

> For a *large* class of cases—though not for all—in which we employ the word "meaning" it can be defined thus: the meaning of a word is its use in the language [. . .].
>
> (Wittgenstein 1953: §43)

However, what is important for Kaplan—something that is arguably not the case for Wittgenstein—is that the theory of meaning he envisions is still a *semantic* theory. He stresses that the conditions of use he has in mind are regulated by linguistic convention and are associated with certain expressions, and that they are therefore part of the semantics of these expressions.

> [B]y clarifying the relation between speaker intention and linguistic convention in regard to the expressive use of language, we strengthen the argument that **there are non-descriptive features of language that are associated with certain expressions by linguistic convention, and thus belong to semantics**, and not to a separable discipline,

pragmatics, in which attitudes and intentions of language users that go beyond what is conventionally associated with the expressions they use come into play.

(Kaplan 1999: 42, my emphasis, DG)

According to this conception, the scope of semantics and its delimitation from pragmatics becomes less a question of truth-conditionality, and much more a question of conventionality, in line with my discussion above the Introduction.

In the following, I will try to elaborate on Kaplan's core ideas for a use-conditional semantics and what the denotation for such use-conditional content should be. This will not only provide us with the basis for a formal approach to use-conditional meaning, but will also lead to a vision of semantics that is based on both truth and use conditions and which I therefore call *hybrid semantics.* I will also provide a brief discussion of differences between UCIs which will serve as an important measure of the empirical adequacy of the formal framework for hybrid semantics that I will discuss in the remainder of this book.

2.1.1 Denotations for use-conditional content

We have already seen that the core idea of Kaplan's (1999) vision of a semantics for certain natural language expressions, like *oops, ouch*, or *goodbye*, is to ask for their use conditions instead of for the contributions they make to a sentence's truth conditions. Let us now investigate his suggestions as to how this can lead us to a proper semantic treatment of such expressions. First, note once more that we are talking about use conditions that are associated with an expression by linguistic convention and which, given the conventionalistic perspective, are therefore (part of) the expression's semantic content.

I ask, "What are the conditions under which the expression is correctly or accurately used?" This seems a much more fruitful line of inquiry for a word like "Goodbye". To the degree that such conditions reflect linguistic convention, **the information that such conditions obtain is carried in the semantics of the expression**.

(Kaplan 1999: 5, my emphasis, DG)

Since "attitudes and intentions of language users" do not play a role in determining what a use-conditional expression means (i.e. which use conditions it is associated with), Kaplan argues that use-conditional content can receive a formal semantic treatment, just like the notion of truth conditions that has dominated the semantic tradition since its very first days.

> First, it seems to me quite possible to extend semantic methods, even formal, model theoretic semantics, to a range of expressions that have been regarded as falling outside semantics, and perhaps even as being insusceptible to formalization.
>
> (Kaplan 1999: 42)

However, even if he gives some clues about what a general formal approach to use-conditional meaning may look like, Kaplan does not work it out. Hence, the aim of the following is to present the core ideas of Kaplan's sketches and to examine how his vision of a theory of "meaning as use" can be put into a formal setting.

The core idea Kaplan puts forward is that what is expressed by a UCI can be captured by asking under which circumstances a UCI is felicitously *used*, instead of asking about its *meaning* in the sense of a contribution to descriptive truth conditions. Consider, for instance, the interjection *oops*, one of the examples he uses (Kaplan 1999: 17). Instead of asking what an utterance of *Oops!* means or what it takes to make it true, we should better ask when it can be felicitously uttered. Let us go with the use conditions Kaplan (1999: 17) provides for illustration.

(2.1) "Oops!" is felicitously used, if the speaker just observed a minor mishap.

Keep in mind that the actual use conditions may be more subtle, but the details do not matter for the point I am making here.[1] What is crucial here is that this way of giving use conditions for *oops* is quite akin to the traditional condition (T) that lies at the heart of truth-conditional semantics (Tarski 1936). By analogy, the use condition in (2.1) can thus be viewed as an instance of what can be called condition (U). To investigate these parallels in rather more detail, let us display (2.1) side by side with a traditional truth condition:

(T)	$_1$ "Snow is white"	(U)	$_1$ "Oops!"
	$_2$ is **true**,		$_2$ is **felicitously used**,
	$_3$ iff snow is white.		$_3$ iff the speaker observed a minor mishap.

Both (T) and (U) connect an expression (line 1) with a condition (line 3) that is supposed to capture the meaning of that expression. The crucial difference is the way in which they are connected (line 2). In the case

[1] See McCready and Wechsler (2012) for some problems connected with such a simple analysis. They construe Gettier-style examples for UCIs, which illustrate that the speaker must be in a position to correctly judge why the event she observed was a mishap.

of (T), it is truth that connects the sentence with a condition, while it is felicitous use in condition (U). This difference is what Kaplan (1999: 41) calls the *mode of expression*.[2] Two sentences may be connected with the same condition, and hence express the same information or state of affairs. Yet they may differ in the mode of expression. For instance, given that the third line of (U) captures the use conditions for *oops*, an utterance of (2.2) is connected with the same condition in the third line.

(2.2) $_1$ "I observed a minor mishap"
$_2$ is **true**,
$_3$ iff the speaker observed a minor mishap.

Utterances of *Oops!* and its descriptive counterpart *I observed a minor mishap* are therefore informationally equivalent (Kaplan 1999: 16), even if they express this information in a different mode.

What is crucial to Kaplan's vision, however, is that even in the use-conditional schema (U), the third line is a simple condition. This means that even if *oops* is connected by felicitous use instead of truth with that condition, "what it expresses or displays is the case" (Kaplan 1999: 9). This is important, because the notion of truth is sneaked back into the framework, which enables us to use common techniques to model their meaning. Or, as Kaplan puts it,

> If what is displayed is to either be or not be the case, it must have sentential form. [. . .] This is critical to my line of development of the project, since once we have the use-conditional content in sentential form, we can bring out our old toolbox, and go to work. (Kaplan 1999: 8–9)

The similarities of the two approaches to the two modes of expression should, however, not belie their differences. Truth is independent of actual use and depends on possible states of affairs, while felicitous use obviously is tied to a use case. So how can we transform the use conditions for a UCI into something that models its meaning in terms of common semantic notions?

> We can get an equally useful measure of the expressive information that is in a sentence—or, in the case of exclamatories like "ouch" and "oops", in an expressive standing alone—by looking at **all the contexts at which it** [. . .] **is expressively correct**.
> (Kaplan 1999: 15, my emphasis, DG)

[2] Interestingly, this distinction had already been made by Cruse (1986: 271). He actually uses quite similar terminology. He distinguishes two *semantic modes*, the *propositional* mode and the *expressive* mode.

Here is another, more specific quote that expresses the same idea by spelling out the use conditions for *ouch*.

> What is the semantic information in the word "ouch" on this analysis? The semantic information in the word "ouch" is—more accurately, is *represented by*—**the set of those contexts at which the word "ouch" is *expressively correct*** (since it contains no descriptive information), namely, the set of those contexts at which the agent is in pain. That set of contexts represents the semantic information contained in the word "ouch".
> (Kaplan 1999: 15–16, my emphasis, DG)

According to this view, use-conditional meaning in sentential form is therefore modeled by a set of contexts, which is equivalent to a function from contexts to truth values (Kaplan 1999: fn. 24). Speaking in type-theoretic terms, sets of context and functions from contexts into truth values both have the semantic type $\langle c, t\rangle$. This conception of (completely saturated) use-conditional content is obviously very similar to the standard representation of ordinary propositional content as sets of worlds or, alternatively, as functions from worlds into truth values, both of which amounts to type $\langle s, t\rangle$. That is, sentential use-conditional content can be understood as a special kind of proposition, namely as a proposition that, instead of being based on possible worlds, is based on contexts.[3]

I will call such propositions "*u*-propositions" and refer to ordinary truth-conditional propositions as "*t*-propositions". Likewise, I will speak of the *t*-content and the *u*-content of a sentence respectively. Note that even if the prefixes in the new terms are obviously intended to be reminiscent of *truth* and *use* respectively, and even if, conceptually, truth and felicitous use are what define the mode of expression and connect the expression with its content, notions of truth and use do not play an active role in the theoretic modeling of their respective denotations. Instead, the difference is captured by the different kinds of object from which the sets that represent their denotation are built: worlds of type s on the one hand, and contexts of type c on the other.[4]

In order to distinguish the two dimensions of content, I use, for the moment, two different interpretation functions, which are differentiated

[3] Using sets of contexts to model content plays an important, though different, role in the work of Lewis (1979) and Stalnaker (1978).

[4] The fact that truth values play a crucial role in both kinds of proposition does not mean that both are based on truth. Truth values, i.e. objects of type t, are merely needed for the technical implementation of the idea of sets in type-theoretic terms, as sets are modeled by their characteristic functions. The characteristic function χ_A of a subset $A \subseteq X$, is a function $\chi_A : X \mapsto \{1, 0\}$ defined such that $\chi_A(x) = 1$ if $x \in A$ and $\chi_A(x) = 0$ if $x \notin A$.

by a superscripted t and u respectively. Then, for a simple descriptive sentence, the t-content is rendered as the set of worlds, while the u-content amounts to a set of contexts. For the two simple examples in (T) and (U), we then arrive at the following denotations for their respective t- and u-content:

(2.3) $\|\text{Snow is white}\|^t = \{w\colon \text{ Snow is white in } w\}$

(2.4) $\|\text{Oops}\|^u = \left\{c\colon\ c_S \text{ observed a minor mishap in } c_W\right\}$

Given these denotations, we can now reformulate the conditions (T) and (U) from above in a more formal manner. For the truth-conditional case, this is nothing new. A sentence is true in a world w iff that world w is in the t-proposition denoted by the sentence.

(2.5) "Snow is white" is true in a world w, iff $w \in \|\text{Snow is white}\|^t$.

In a similar vein, one can state that an expression is felicitously used in a context c iff that context c is in the u-proposition it expresses, i.e. iff c is in the set of contexts that is its denotation.

(2.6) "Oops" is felicitously used in context c, iff $c \in \|\text{Oops}\|^u$.

Conditions like this are the heart of a formal rendering of a theory of meaning as use, as Kaplan envisions it, or, at least, as I interpret his outlines. Adopting Recanati's (2004b) clever terminology, I call this *use-conditional semantics*.

However, as is explicit in the quote given on page 14, Kaplan's (1999) intention is not to substitute truth-conditional semantics entirely by a use-conditional semantics, but to supplement the traditional picture by this new perspective on meaning. According to this picture, traditional truth-conditional semantics and a specific understanding of a theory of meaning as use are not competing approaches to the meaning of natural language sentences. Instead, they complement one another, since each of them deals with its own kind of content, both of which can be found in natural language and have to be accounted for. Moreover, these components are not absolutely separate, as they both deal with the conventionally expressed content of a sentence. They thus have the same domain, although they may often be responsible for different pieces of one puzzle. And indeed, when we extend our examples just a little, as we will do in a moment, we will immediately notice that things are not always as straightforward as apparently assumed so far. In the end, we will need something that keeps track of both truth and use conditions and allows for interaction between them, in order to provide an adequate semantic analysis of UCIs and their behavior.

2.1.2 Hybrid semantics

Instead of being neatly separated into truth-conditional and use-conditional expressions, most utterances do not have *either t-* or *u-*content, but both. For UCIs like *oops*, it may be the case that they have content in just one meaning dimension, and for simple descriptive statements like *Snow is white* this may seem to be the case as well.[5] However, many expressions, simple or complex, do have both *t-* and *u*-content. To start with, there are UCIs that, in contrast to isolated interjections like *oops* or *ouch*, contribute lexical content to both dimensions of meaning. In the parlance I will introduce below, such expressions are called *mixed* UCIs. Take, for instance, the ethnic slur *Kraut*. Under the approach just sketched, *Kraut* expresses two independent kinds of content. In the truth-conditional dimension, it denotes what the neutral predicate *German* denotes, while expressing a derogatory attitude towards Germans in the use-conditional dimension:

(2.7) a. $\|\text{Kraut}\|^t = \|\text{German}\|^t$
b. $\|\text{Kraut}\|^u = \{c : c_S \text{ has a derogatory attitudes toward Germans in } c_W\}$

Lexical sources of mixed content like *Kraut* are not the only case of expressions that contribute both kinds of content. If we look at complex expressions, we find even more examples. For instance, plugging a UCI into a plain descriptive sentence adds use conditions to an otherwise purely truth-conditional expression. Consider, for instance, Kaplan's (1999: 9–10) example, whose two dimensions can be given as follows, using his own paraphrases.[6]

(2.8) $\|\text{That damn Kaplan was promoted}\|^t = \{w : \text{Kaplan was promoted in } w\}$

(2.9) $\|\text{That damn Kaplan was promoted}\|^u = \{c : c_S \text{ has a derogatory attitude toward Kaplan in } c_W\}$

[5] In Chapter 5, I question this assumption, since, as I argue, the declarative sentence mood contributes *u*-content as well.

[6] The use of the demonstrative *that* instead of the plain definite determiner enhances the expressive nature of the epithet; cf. Lakoff (1974); Potts and Schwarz (2010) for the expressive function of demonstratives in English.

Note that on its own, *damn* arguably exhibits just *u*-content, while *Kaplan* features only *t*-content. It is only when we form the complex expression *(that) damn Kaplan*, that we have get a two-dimensional expression as the result. That is, there are two sources of multidimensionality. First, there are mixed UCIs (McCready 2010) that are lexically specified for *t*- and *u*-content. And secondly, the composition of a truth-conditional and a use-conditional item can lead to a complex two-dimensional expression, even if the components themselves are not two-dimensional. Informally, this can be illustrated by means of a fraction-like notation with the *u*-content on top of the *t*-content:

(2.10) $$\frac{\text{damn}}{\emptyset}\left(\frac{\emptyset}{\text{Kaplan}}\right) = \frac{\text{damn Kaplan}}{\text{Kaplan}}$$

I will reserve the term *mixed* for lexically two-dimensional expressions. As a general notion to cover both lexically and compositionally determined two-dimensionality, I will call expressions that contribute to both dimensions *hybrid expressions*. Accordingly, I would like to call a semantics which takes into account both modes of expression *hybrid semantics*. While the core idea of truth-conditional semantics is to describe the meaning of an expression by the contribution it makes to the truth conditions of a sentence, the core idea of hybrid semantics is that the entire *semantic information* an expression encodes (to use Kaplan's terminology once more) lies in its contribution to both the truth *and* use conditions of a sentence. The overall interpretation of an expression hence delivers two dimensions (rendered as a tuple), one corresponding to its *t*-content and one to its *u*-content. For illustration, we use again Kaplan's (1999: 9–10) example, this time with a slightly different paraphrase in order to save space.

(2.11) $$\|\text{That damn Kaplan got promoted}\| = \Big\langle \underbrace{\big\{w : \text{Kaplan was promoted in } w\big\}}_{t\text{-content}}, \underbrace{\big\{c : c_S \text{ dislikes Kaplan in } c_W\big\}}_{u\text{-content}} \Big\rangle$$

More generally, the core idea of hybrid semantics is distilled in the following schema, where A is an expression, and $\textsc{tc}(A)$ and $\textsc{uc}(A)$ are its (interpreted) *t*- and *u*-content respectively:[7]

(2.12) $$\|A\| = \langle \textsc{tc}(A), \textsc{uc}(A) \rangle$$

[7] The superscripted interpretation function used above can then be derived from (2.12) by using a projection function. That is, $\|A\|^t = \pi_1(\|A\|)$ and $\|A\|^u = \pi_2(\|A\|)$.

This is the core idea of hybrid semantics and it will serve as the heart of my endeavor in the remainder of this book. However, even if I will be quite explicit as to how I expand (2.12) into a fleshed-out formal framework, hybrid semantics, as I conceive it, is a *general* idea of a semantic theory of meaning. As such, it is, to some degree, independent of concrete formal explication, even though the actual predictions made for specific linguistic phenomena will certainly depend on the actual formal framework.

Probably the most important question that every elaboration of hybrid semantics has to face is that of compositionality, which is, so to speak, doubled in this framework, as laid out in Chapter 1 (p. 8). Not only do we have to explain how the *t*-content of a complex expression is computed from the *t*- and *u*-content of its parts (and the way they are combined), but also how the *u*-content of a complex expression is computed from the *t*- and *u*-content of its parts (and the way they are combined). This is by no means trivial and any framework that builds on hybrid semantics and that wants to be linguistically relevant should be explicit about it. So far, I have left this completely unaddressed and have only stated the truth and use conditions for expressions, without talking about how we arrive at them. To address the question of compositionality and develop an explicit formal framework for hybrid semantics is one of my main goals what follows.

2.1.3 Reasoning in hybrid semantics

Before I leave this rather conceptual section of the argument, however, let me take up a further issue that Kaplan (1999) raises in his paper: namely the question of reasoning with UCIs, or more generally, the question of validity in hybrid semantics. One caveat: I will not provide a fully-fledged theory. I will however sketch the general direction of how I envision the working up of Kaplan's ideas into a system of logical reasoning in hybrid semantics.[8]

Kaplan (1999) provides the following two arguments as a starting point for his discussion of deduction with UCIs. While he takes the first one to be valid, intuitively the second one is invalid.

[8] See also Predelli (2010, 2013), who presents an analysis similar to mine, but (i) does not develop a compositional framework as I will do in the second part of this book, and (ii) only addresses expressive validity and not Kaplan's "validity-plus".

(2.13) $\dfrac{\text{That damn Kaplan was promoted.}}{\text{Kaplan was promoted.}}$ ✓ (2.14) $\dfrac{\text{Kaplan was promoted.}}{\text{That damn Kaplan was promoted.}}$ ✗

Now, from a purely truth-conditional perspective, and this is what underlines most notions of validity, both arguments are supposed to be acceptable, as the expressive adjective is not relevant for the truth conditions of the sentence. In fact, both arguments are trivial under such a traditional perspective. However, I think that there is indeed a strong intuition that the two arguments are of differing validity. If one accepts the premise of (2.13), then one will certainly accept its conclusion. The same certainly does apply the other way round, as in (2.14): one can easily accept the premise, while rejecting its conclusion (using *accepting* and *rejecting* in an intuitive sense). According to Kaplan (1999: 10–12), this pattern of logical consequence could be explained if we broaden our understanding of truth, such that it encompasses not only the semantic information of a sentence's *t*-content but also its *u*-content. This broader way of thinking about truth may be called *truth-plus* or *truth with an attitude* (Kaplan 1999: 10–11). Now, although I prefer to use a narrower conception of truth, I am inclined to agree with his idea that logical arguments can involve both modes of meaning and that the notion of logical validity should be enriched to include such cases as well. This can be done without changing the notion of truth, by using the notion of *semantic information*, which is employed by Kaplan as a cover term for both *t*- and *u*-content. Then, logical validity can be understood as *information delimitation*:

> Because I do not regard Argument [(2.14)] as a logically valid argument, I would come to the conclusion that logical validity is not about truth-preservation but rather about what I might call *information delimitation*. [Footnote: I wouldn't call it this if I could come up with a more graceful phrase.] **There must be no semantic information in the conclusion that is not already contained in the premises.**
>
> (Kaplan 1999: 10, my emphasis, DG)

How can this new notion of validity be captured by means of the formal characterizations of the two kinds of content? A general idea might go like this. To get the semantic information of a sentence, we somehow need to combine the two contents. This, however, cannot be done directly, because the two contents are modeled by different kinds of sets. Hence, in contrast to combining two *t*-propositions or two *u*-propositions, set intersection is not a straightforward option. We can nevertheless easily transform the set of contexts that make the *u*-proposition into a set of worlds that is suitable for the purposes of determining the semantic information *in the current context*. In order to do so, we fill in the contextual parameters of the context set with the values they have in the current context, except for the world parameter, and then take the set of worlds in which the derived condition holds. The rationale behind this is the following: if we accept that a sentence is felicitous in a given context, we accept that that context is in the set of contexts which constitutes its *u*-propositional content. We thereby also learn something about the world of the context, namely that the use condition for the expression with the values set to the current context holds in that world. The entire *u*-content therefore can be "lowered" to become a set of worlds. For illustration, consider our standard example:

(2.15)
$$\begin{array}{c} \left\{c : c_S \text{ dislikes Kaplan in } c_W\right\} \\ \Big\downarrow {\scriptstyle c_@ = \langle c_{@S} = \text{Hans}, \ldots\rangle} \\ \left\{w : \text{Hans dislikes Kaplan in } w\right\} \end{array}$$

Here, we make use of the (theory-internal) fact that a context is a tuple of parameters such as speaker, hearer, world, time, judge, etc. Focusing just on the speaker and the world, the reasoning from above can be stated as follows. Assume a $c_@ = \langle \text{Hans}, i\rangle$. Now, if *That damn Kaplan was promoted* is felicitous in $c_@$, then it is the case that $\langle \text{Hans}, i\rangle \in \left\{\langle x, w\rangle : x \text{ dislikes Kaplan in } w\right\}$. From this we can then conclude that $i \in \left\{w : \text{Hans dislikes Kaplan in } w\right\}$.

In order to employ this reasoning for our definition of validity, let us introduce an operator "$\Downarrow$" that takes a context and a context set and does exactly this kind of lowering of the *u*-content. I will give an example definition using just the speaker, hearer, and world, but it can easily be generalized to more parameters.

(2.16) *Lowering of the* u-*content*

If $c = \langle c_S, c_H, c_W\rangle$ is a context and $CS = \{\langle x, y, w\rangle : R(x, y, w)\}$ is a set of contexts given by a relation R, then

$\Downarrow_c(CS) = \{w' : R(c_S, c_H, w')\}$

The combined semantic information of a sentence S in a context c, written as $(\!|S|\!)^c$, then can be defined as follows.

(2.17) *Combined semantic information*

$(\!|S|\!)^c = \|S\|^t \cap \Downarrow_c \|S\|^u$

With this notion in place, we are now in a position to define Kaplan's (1999) new notion of semantic validity as information delimitation. A set of premises P warrants a conclusion Q iff for every context, the combined semantic information of the premises taken together is a subset of the combined semantic information of the conclusion.

(2.18) *Semantic validity as information delimitation*
(unrestricted version)

$$\{P_1, \ldots, P_n\} \vdash Q \quad \text{iff} \quad \bigcap_{1 \leq x \leq n} (\!|P_x|\!)^c \subseteq (\!|Q|\!)^c, \text{ for all contexts } c.$$

However, as Kaplan argues, this notion of validity seems to be too liberal, as (2.18) does not care in which mode the information is conveyed. This does not seem to be correct as Kaplan (1999: 22, 24) illustrates with the following contrast:

(2.19) That damn Kaplan was promoted.
———————————
I dislike Kaplan. ✓

(2.20) Kaplan was promoted.
I dislike Kaplan.
———————————
That damn Kaplan was promoted. ✗

If the intuitions about these arguments are correct, then it is allowed to covert u-content into t-content, but not vice versa. Such a restricted notion of validity can be achieved if we assume that the t-content of the conclusion must be entailed by the combined t- and u-content of the premises and that the conclusion's u-content is entailed by the u-content of the premises.

(2.21) *Semantic validity as information delimitation*
(one-way restricted version)

$$\{P_1, \ldots, P_n\} \vdash Q \text{ iff } \bigcap_{1 \leq x \leq n} (\!|P_x|\!)^c \subseteq \|Q\|^t$$
$$\text{and } \bigcap_{1 \leq x \leq n} \|P_x\|^u \subseteq \|Q\|^u, \text{ for all contexts } c.$$

However, if you do not accept the argument in (2.19) as valid, then we may need an even more restricted version that has the strong requirement that the t-content of the conclusion is contained in the t-content of the premises and that the u-content of the conclusion is contained in the u-content of the premises.

(2.22) *Semantic validity as information delimitation*
(strongly restricted version)

$$\{P_1, \ldots, P_n\} \vdash Q \text{ iff } \bigcap_{1 \leq x \leq n} \|P_x\|^t \subseteq \|Q\|^t$$
$$\text{and } \bigcap_{1 \leq x \leq n} \|P_x\|^u \subseteq \|Q\|^u.$$

To be sure, all these foregoing considerations are not at all close to a full definition of a deductive logic for hybrid semantics and many details are left out of consideration. However, the suggestions presented thus far may hint at the directions to go in were one to develop such a system. Furthermore, the intuitions about the validity of these arguments are not clear, which makes it hard to decide which of the three presented versions may be the correct one for reasoning with both dimensions of meaning simultaneously. I certainly do not want to do that here (if even Kaplan did not). In the end, one may reject Kaplan's idea of enriching the notion of validity, and argue as well for a traditional definition in which only the truth-conditional dimensions matter for the logical validity of an argument. The question of the felicity of an argument then becomes something completely different, and one could say that the utterance of an argument is felicitous if all of its premises are felicitous and so is the conclusion (without saying anything about their relation). Such a view would keep the notion of validity as it is, while at the same time taking seriously the performative and immediate nature of use-conditional content, one of its main properties (Gutzmann 2013; Potts 2007b). However, it is also clear that we can say something about the entire information that is conveyed by a hybrid sentence in a specific context, so that the notion of combined semantic information may be useful anyway; for instance, in the event that we want to say something about how hybrid statements affect the common ground. However, I will leave these questions as they are for now and not return to then in the present volume.

2.2 Varieties of UCIs

While making a conceptual case for use-conditional and hybrid semantics in the previous section, I followed Kaplan's lead and did not make much use of linguistic examples to further justify my claims, though natural languages in fact employ a huge variety of devices to express use-conditional content that go beyond Kaplan's *ouch, oops*, and *damn*. This will of course be remedied in the course of my argument, as Chapters 5 and 6 will present two detailed case studies. However, let me start with a brief presentation of some varieties of UCIs. This will not only give me the opportunity to introduce data that will be relevant in the following chapters that deal with the formalization of multidimensional content, but also enable us to diagnose and systematize some distinctions between various UCIs, because, as we will see, not all UCIs behave in the same way. This will lead to a typology of UCIs on the basis of how they interact with other content. I will start this brief empirical survey with expressives in the narrow sense, like *damn*, which play an important role in the next section, before I discuss particles and non-lexical UCIs. However, keep in mind that the following will only scratch the surface of the diversity of UCIs in natural languages. For a more detailed overview of UCIs across the different layers of language and a discussion of their properties, I refer the reader to Gutzmann (2013).

2.2.1 Expressives in the narrow sense

The group of UCIs that has received the most attention in formal semantics is what I refer to as *expressives in the narrow sense*, i.e. expressions that express some emotional and evaluative attitude with a high degree of affect. Thanks to the work of Potts (2005, 2007a, b, 2012), who picks up the theme as laid out by Kaplan (1999), expressives have received a lot of attention during the last few years. Standard examples include pejorative epithets and attributive adjectives.

(2.23) *Epithets*
   a. That **bastard** Kresge is famous. (Potts 2007b: 168)
   b. That **idiot** Kresge dropped the bottle again.

(2.24) *Expressive attributive adjectives*
   a. I hear your **damn** dog barking.
   b. My **friggin'** bike tire is flat again. (Potts 2005: 18)

Both epithets and expressive attributive adjectives contribute use-conditional content and no truth-conditional meaning. From a truth-conditional point of view, such expressions are therefore optional. Adding or omitting them does not alter the truth conditions of a sentence. Accordingly, all the variants of (2.24a) in (2.25) are truth-conditionally equivalent.

(2.25)
$$\text{I hear your} \left\{ \begin{array}{c} \text{Ø} \\ \text{blasted} \\ \text{bloody} \\ \text{damn} \\ \text{fucking} \end{array} \right\} \text{dog barking.}$$

Following Cruse (2004: 57), I call such expressives and other UCIs that do not contribute anything to the truth-conditional dimension of meaning *expletive* UCIs.[9]

Of course, the expressive attitude conveyed by expletive UCIs like *damn* or *bastard* is lost if they are omitted, or a different emotion may be displayed when you use *awesome* instead of *damn*, but the truth-conditional content remains unaffected.

The entire meaning of (2.24a) consists of its truth conditions that equal those of the variants in (2.25)—that the speaker hears the addressee's dog barking, plus whatever use-conditional content is expressed by applying *damn* to *dog*, such as that the speaker has a negative attitude towards the addressee's dog. In the informal fraction notation:

(2.26) I hear your damn dog barking = $\dfrac{\text{damn dog}}{\text{I heard your dog barking}}$

Further examples of expressives in the narrow sense are interjections (Ameka 1992) such as *ouch* and *oops*, as famously discussed by Kaplan (1999). In addition, some otherwise truth-conditional expressions like *man* or the already expressively loaded *shit* can be used as expressive interjections. Expressive adjectives like *damn* can regularly be used interjectively as well:

(2.27) *Interjections*
- a. **Ouch**, I've hit my thumb! (Kaplan 1999)
- b. **Oops**! (Kaplan 1999)
- c. **Oh**, I have another suit. (Ameka 1992)
- d. It's hot, **man**. (McCready 2009)
- e. **Shit**, I've lost my keys!
- f. **Damn**, I've lost my keys!

Like expressive adjectives and epithets, interjections like these are expletive UCIs and do not add anything to the truth conditions of the sentence. However, what makes many interjections interesting is that they do not seem to interact with the truth-conditional content at all (*man* being an exception; see below). In contrast to the expressives discussed above, interjections do not need a truth-conditional argument—they are already saturated and convey a use-conditional attitude without further ado. Therefore, just as interjections can be omitted without any effect

[9] Such semantic expletives must not be confused with syntactic expletives like *it* in *It's raining*, which are semantically empty but are syntactically obligatory.

on truth conditions, the rest of the sentence can be dropped, leaving the use-conditional attitude intact:

(2.28) a. Damn! c. Oops!
b. Ouch! d. Oh!

That is, even without any truth-conditional content, the examples in (2.28) express attitudes of anger, pain, awkwardness, or surprise respectively. Semantically, they are more isolated from the rest of the sentence than expressive adjectives or epithets are. This is mirrored by the syntactic fact that they appear only in peripheral positions:

(2.29) a. *I've lost my oops keys.
b. *It's man hot!

Following Potts (2005: 65), I call such examples *isolated* UCIs. In contrast to the informal description of the meaning of a sentence containing an argument-seeking expressive like *damn* given in (2.26), the composition for (2.27a) looks like (2.30). That is, the truth-conditional meaning of a sentence containing an already saturated, isolated interjection consists of the semantic content of sentence without the interjection, while its use-conditional part is given solely by the use-conditional content of the interjection itself.

(2.30) Ouch, I've hit my thumb $= \dfrac{\text{ouch}}{\text{I've hit my thumb}}$

A further group I want to subsume under the caption of expressives in the narrow sense are what could be called *expressively colored* expressions (after Frege's *Färbung* 'coloring'). These kinds of UCIs differ crucially from the expressions discussed so far. They are lexical items that have an ordinary truth-conditional denotation, but in addition have a use-conditional component that displays some (in most cases negative) attitude towards the denotation. A classic example comes from Frege (1897/1979: 140):

(2.31) *Colored expression*
a. This **dog** howled the whole night.
b. This **cur** howled the whole night.

The difference between *dog* and *cur* is that while the former is expressively neutral and just refers to the set of dogs, the later additionally expresses a negative attitude towards members of the set or the set as a whole. A systematic set of expressively colored expressions is ethnic slurs. By this label, I mean expressions that, beside denoting some kind of nationality or ethnic group, convey a derogatory racist attitude.[10] As examples, I use the antiquated *Boche* and *Kraut*, both being derogatory variants of *German*.

(2.32) *Ethnic slurs*
a. Lessing was a **Boche**. (Williamson 2009: 149)
b. Hitler was a **Kraut**. (Saka 2007: 39)

The composition of colored items is therefore very different from all the kinds of expression discussed so far because, in contrast to expletive UCIs, they do make a truth-conditional contribution. In the case of *Kraut*, the relevant truth-conditional part equals that of *German*, and for *cur*, it equals that of *dog*. Following McCready (2010), I will call UCIs that conventionally contribute both truth-conditional and non-truth-conditional meaning *mixed UCIs*.

As shown above, expletive UCIs can be omitted from a sentence without altering its truth-conditional content. Since they also contribute truth-conditional content, this does not hold for mixed UCIs. The following example illustrates this point.[11]

(2.34) a. That Kraut Lessing wrote a lot of books. $\rightarrow$ Lessing was a German.
b. Lessing wrote a lot of books. $\nrightarrow$ Lessing was a German.

The sentence in (2.34a) containing *that Kraut* implies that Lessing was a German. If the mixed UCI is omitted as in (2.34b), that entailment is lost, since the property of being German is contributed by the truth-conditional dimension of *Kraut*.

If you want to get rid of the negative attitude conveyed by ethnic slurs or another expressively colored expression without altering the truth conditions of the sentence, you have to substitute the racist slur by the corresponding neutral expression:

(2.35) a. Lessing was a German.
b. Hitler was a German.
c. This dog howled the whole night.

[10] Amongst many others, cf. Croom (2008), (2011); Green and Kortum (2007); Hom (2008), (2010); Hornsby (2001).

[11] Note that we have to change the example to one in which the mixed UCI is used attributively, because otherwise omitting it would render the sentence ungrammatical:

(2.33) *Lessing was a.

What the truth-conditionally equivalent, but expressively neutral, expression for a mixed UCI is cannot be directly read off from the expression. This has to be encoded in the lexicon.

The informal schema used above to illustrate the composition of the meaning of a sentence containing UCIs therefore needs some lexical knowledge for colored expressions. For (2.32), for instance, the use-conditional part of the sentence consists of the negative attitude expressed by it, while the truth-conditional part corresponds to the same sentence with *German* substituted for *Kraut*:

(2.36) Lessing was a Kraut $= \frac{\text{Kraut}}{\text{Lessing was a German}}$

This already shows an interesting fact about the semantic composition of mixed UCIs, namely that while their truth-conditional component may fall under the scope of some semantic operator—like the past tense in the example—its use-conditional component does not (Potts 2005; 2007b). That is, whereas the truth-conditional part of *Lessing was a Kraut* means that there is some time prior to the utterance time for which *Lessing is a German* is true, the negative or jocular attitude towards Germans displayed by *Kraut* is not evaluated with respect to that point in the past but is attributed to the utterance time and speaker. The same holds for other semantic operations like negation or questions (Cruse 2004: 57). Even the negated variant of *Lessing was a Kraut* and the corresponding question convey the anti-German sentiment. This is shown by the fact that the following discourse continuations are impossible:

(2.37) Descartes was not a Kraut. #But I like Germans.
A: Was Descartes a Kraut?
B: #No, Germans are nice.

Using again the informal fraction notation, the negation and question operators only show up at the lower truth-conditional level and not on the use-conditional layer on top of it:

(2.38) Descartes was not a Kraut $= \frac{\text{Kraut}}{\neg(\text{Descartes was a German})}$

(2.39) Was Descartes a Kraut? $= \frac{\text{Kraut}}{?(\text{Descartes was a German})}$

This feature may be called *scopelessness* (Potts 2005: 41) and it is the reason why ethnic slurs cannot be denied by a simple negation or used in a question without enfolding their offensive content. This corresponds to a feature that Potts (2007b: 167) calls *immediacy*, by which he means that like "performatives, expressives achieve their intended act simply by being uttered."

A further observation to be made is that the colored expressions discussed so far can be regarded as being *isolated* UCIs as well. On the one hand, they are of course more integrated than expletive UCIs because they also contribute to the truth-conditional tier and hence cannot be omitted without affecting the truth conditions or grammaticality of a sentence. But, on the other hand, their UC-content is isolated because the negative attitude does not apply to a specific argument in the sentence. That is, while the truth-conditional part of *Kraut* predicates over Lessing in the example, the negative attitude does not apply to Lessing, but to Germans in general (cf. McCready 2010). Using an informal paraphrase of *Kraut* to make this explicit, we have the following characterization of the sentence's truth- and use-conditional content:

(2.40) $$\text{Lessing was a Kraut} = \frac{\text{Generally, I don't like Germans}}{\text{Lessing was a German}}$$

A negative attitude towards Lessing is not directly expressed by the ethnic slur. However, it can be inferred if the two levels of meaning are taken together. This is supported by the observation that a negative attitude towards Lessing can be cancelled, whereas this is not possible for the negative evaluation of Germans.

(2.41) a. Lessing was a Kraut, but he was a fine guy.
b. # Lessing was a Kraut, but generally, I like Germans.
c. # Generally, I like Germans, but Lessing was a Kraut.

Before we leave our descriptive survey of expressives in the narrow sense, let me briefly mention too the problem that many expressives are multifunctional. For instance, a UCI like *damn* can be used as an expressive attributive adjective or as an expressive interjection. In the same vein, many UCIs are multifunctional. Other UCIs, like *fucking*, can either function as expressive adjectives or modify other expressives. To study the relations between different functions of expressives and, more generally, UCIs is an interesting research question that, to my knowledge, has not been addressed so far, but which I also have to leave for further research.

2.2.2 Particles

Besides all the different types of expressive in the narrow sense, there are many classes of expression in different languages that arguably contribute to the use conditions of an utterance instead of affecting its truth-conditional meaning.

An entire "part of speech" that seems to have some kind of affinity with the use-conditional domain is *particles*. In general, many of the different kinds of particle found amongst the world's languages do not have any influence on the truth conditions of a sentence, but rather impose appropriacy conditions on its use. For instance, modal particles in German have been regarded as conveying non-truth-conditional meaning since the early functional studies (Helbig 1977; Weydt 1969) and even in a formal semantics framework, there are some early attempts to relate them to use-conditional meaning (Kratzer 1999). German modal particles are a small, more or less closed set of specific lexical items that convey information about the discourse participants' beliefs and attitudes towards the propositional content. For instance, in rough approximation, *wohl* expresses that the speaker merely assumes that the propositional content is true and *ja* roughly conveys that the hearer may already know the proposition:

(2.42) a. Hein ist **wohl** auf See.
Hein is MP *at sea*
'(As I assume) Hein is at sea.' (M. Zimmermann 2004a: 543)

b. Webster schläft **ja**.
Webster sleeps MP
'(As you may know) Webster sleeps.' (Kratzer 1999: 4)

Like expressive attribute adjectives or epithets, modal particles are expletive UCIs, as they are optional and leaving them out does not alter a sentence's truth conditions. That is, all the variants in (2.43) are true iff Webster sleeps regardless of what kind of attitude is conveyed by the modal particles.

(2.43)
$$\text{Webster schläft} \left\{ \begin{array}{c} \text{Ø} \\ \text{doch} \\ \text{halt} \\ \text{ja} \\ \text{wohl} \end{array} \right\}. \qquad \text{‘Webster sleeps Ø/MP.’}$$

While all being true if Webster sleeps, the variants in (2.43) are, of course, not all appropriate in the same contexts. For instance, using *ja* in such a context as (2.44), in which the hearer cannot reasonably be assumed to have already known what the speaker is telling her, renders sentence (2.44a) infelicitous. In the same context, the utterance becomes felicitous if the modal particle is left out, as shown in (2.44b).

(2.44) [Context: A happy father rushes out of the delivery room]

a. #Es ist **ja** ein Mädchen!
It is MP *a girl*
'It's a girl!'

b. Es ist ein Mädchen!
It is a girl
'It's a girl!'

Furthermore, modal particles mirror expressive attributive adjectives and epithets insofar as they are not saturated and hence not as isolated as the interjections discussed in the previous section. What distinguishes modal particles from the attributive use of *damn* and the like is that they take the entire propositional content of the sentence as their argument.[12]

(2.46) $\text{Webster schläft ja} = \dfrac{\text{ja(Webster sleeps)}}{\text{Webster sleeps}}$

Modal particles exhibit many interesting syntactic and semantic features and, building on my previous work (Gutzmann 2008, 2009), I will argue in Chapter 6 that many of them can plausibly be derived from their use-conditional character.

Of course, German modal particles are not the only class of use-conditional particles. However, there are far too many cases to go through all of them here. For some illustrative studies of certain particles in Japanese from a multidimensional semantic perspective, see Davis (2011) and McCready and Takahashi (2013).

2.2.3 Non-lexical UCIs

Up to this point, every UCI we have presented has been a simple lexical item. However, there are also cases in which the use conditions cannot be traced back to a single expression, but instead are contributed by intonation, syntactic operations, or even a combination thereof. Let me briefly discuss a case of each.

[12] This is, however, arguably also possible for expressive adjectives like *damn*, even if they still take a DP as their argument in the syntax:

(2.45) I've spilled that damn bottle again.

The most natural reading of (2.45) is one in which the speaker has a negative emotion regarding his spilling of the bottle, not regarding the bottle or bottles in general.

Intonation may be one of the most prominent and obvious means for expressivity.[13] By intonation, one can express all kinds of emotions and attitudes, ranging from joy to anger, and interest to boredom.[14]

Furthermore, intonation can be used to signal special communicative functions, like irony, sarcasm, or hyperbole, that may guide the pragmatic interpretation of a sentence. Used to indicate emotions or rhetorical ploys, intonation is said to be paralinguistic, as it sits on top of ordinary linguistic signs without constituting a sign itself. However, there are cases in which intonation is in fact a genuine "part of the language system" and is reflected in the structure of grammatical constructions and their semantic interpretation. The best-studied case by far is the semantic effect of focus intonation in focus-sensitive constructions.

(2.47) a. Piet only wears a PINK tie at work.
b. Piet only wears a pink tie at WORK.

While (2.47a) is falsified if Piet wears a non-pink tie to work, (2.47b) allows Piet to wear any tie at work as long as he does not wear a pink tie anywhere else than at work. Different accents lead to different semantic interpretations.[15]

Besides the effect focus accentuation can have on a sentence's truth-conditional status in cases like (2.47), it is clear that, in the absence of any focus-sensitive expression, the focus accent does not contribute truth-conditional content but, rather, influences the conditions which determine the felicity of an utterance. This is most obvious in the case of question–answer pairs.

(2.48) A: Who likes Bruce?
B: #Rachel likes BRUCE.
B′: RACHEL likes Bruce.

13 Cf. for instance Ladd (1990), who reviews earlier work by Bolinger: "[T]he unifying idea of B's work is [...] the general claim that intonational features, including accent placement, are beyond grammar and are directly linked to emotion." (Ladd 1990: 806).

14 For an overview of the linguistic encoding of emotions, cf. Fries (2007), (2009). For general considerations regarding the role of emotion in language, cf. Jay and Janschewitz's (2007) reply to Potts (2007b).

15 For approaches to the syntax and semantics of focus-sensitive particles and various focus-sensitive constructions, cf. amongst many others, Altmann (1976); Beaver and Clark (2008); Büring and Hartmann (2001); Horn (1969), (1996); Jacobs (1983); König (1991); Kratzer (2004); Rooth (1985), (1992); Schmitz (2008); Sudhoff (2010). Interestingly, Kratzer (2004) proposes some interpretational effects of focus that are in fact best understood as contributing use-conditional meaning.

In the context of the question in (2.48), an utterance of (2.48B) is infelicitous since it bears the focus accent at a given constituent (Schwarzschild 1999). If the accent pattern is changed to the expected one in (2.48B′), the sentence can be felicitously uttered.

Besides intonation, another way to alter the use conditions of a sentence without affecting its truth-conditional content is by using certain, often non-canonical, syntactic structures. Many of those are associated with specific functions of information-structuring which commonly have no influence on the truth conditions of a sentence. For instance, topicalization imposes use conditions on an utterance without any truth-conditional effect (Birner and Ward 1998; Frey 2010).

(2.49) *Topicalization*
John, Mary loves.

Whatever the exact use of conditions imposed by topicalization may be, it is clear that they do not have any influence on the truth conditions of the sentence, which are the same as the truth conditions of the corresponding sentence with canonical word order. That is, both (2.50a) and (2.50b) are true iff Mary loves John.

(2.50) a. John, Mary loves.
b. Mary loves John.

The use-conditional contribution of topicalization has to be given in information-structural terms. Of course, giving a paraphrase for such functions means leaving aside many of the details of the use conditions for topics. But for the sake of illustration, let us adopt Portner's (2007: 418) formulation that the speaker's "mental representation" of the topical element is active. We thus have the following truth and use conditions for (2.49):

(2.51) John, Mary loves = $\dfrac{\text{The speaker's mental representation of John is active}}{\text{Mary loves John}}$

That the contribution of topicalization puts such a requirement on the discourse context can be illustrated by the following examples:

(2.52) [Rushing into the room:]
#John, Mary loves.

(2.53) A: What's up with Mary?
B: #John, Mary loves.

In (2.52), there is a neutral context in which there is nothing active in the mental representation. In (2.53), A asks a question about Mary and thereby activates B's mental representation of Mary but not of John. Therefore, topicalizing *John* is infelicitous in such contexts.

Not only can intonation and syntactic operations be associated with use-conditional content, but sometimes they can conspire to express rather specific use conditions. A case in point may be found in exclamative sentences which combine syntactic operation with what have been called *exclamative* or *unexpectedness* intonation (Castroviejo Miró 2008; d'Avis 2002; Rett 2008; Zanuttini and Portner 2003).

(2.54) *Exclamatives*
  a. How TALL Michael is!
  b. Wie GROSS Michael ist!

Exclamative sentences like these express the speaker's surprise or astonishment at the degree of Michael's height. That "unexpectedness intonation" is really part of the language system of English and German is shown not only by the fact that its realization is very consistent from a phonological point of view (Oppenrieder 1989), but also that it is directly reflected in their grammars, as they do not show any inversion even though they are introduced by a question expression that otherwise induces syntactic inversion.

What is special about *how*-exclamatives is that they only have use-conditional meaning and no truth-conditional content. An utterance like (2.54) is not a statement about or an assertion of Michael's height. For instance, it cannot serve as an answer to a query about Michael's height. In contrast, an assertion that Michael has a surprisingly high degree of tallness is fine:

(2.55) A: How tall is Michael?
  B1: #How tall Michael is!
  B2: Surprisingly tall.

Furthermore, the unexpectedness is also not part of the truth-conditional content. This is shown by the fact that it can neither be denied nor even affirmed.

(2.56) A: How tall Michael is!
  B1: #That's not true. I don't think this is unexpected at all.
  B2: #You're completely right. That is unexpected.

In *how*-exclamatives, no truth-conditional content seems to be left behind. If this were the case, there would be an empty lower level in the informal fraction notation.

(2.57) How tall Michael is! = $\dfrac{\text{It is unexpected how tall Michael is}}{\emptyset}$

Therefore, an exclamative like this constitutes an additional kind of UCI insofar as it affects the truth-conditional content. Informally, it takes its truth-conditional argument with it to the use-conditional layer and does not leave it behind as all the other UCIs do. In a paper on various kind of use-conditional content, McCready (2010) calls such items *shunting* UCIs.

Exclamatives are interesting from the perspective adopted here not only because they are an instance of the shunting variant of UCIs, but also because they are constituted by an interplay between various linguistic factors. This will be relevant in as much as the first case study I will carry out later in Chapter 5 will present a use-conditional analysis of sentence mood, which is another aspect of meaning that is constituted by a complex interplay between lexical filling and syntactic operation.

2.2.4 Types of UCIs

The selected examples of UCIs I discussed in the previous sections highlighted some variations regarding which levels of meaning a UCI contributes to and how it interacts with truth-conditional content. In this section, I will systematize this variation and introduce terminology for talking about it.

There are at least two binary dimensions with respect to which UCIs may differ, and therefore we can distinguish at least four different types of UCI. The first distinction concerns the question of whether a UCI has only use-conditional content or whether it carries truth-conditional meaning as well. I call this criterion *dimensionality*. A UCI that only conveys UC-meaning is said to be one-dimensional, whereas an expression that contributes both kinds of meaning is two-dimensional. I will render this as the binary feature [±2-*dimensional*], or [±2*d*] for short. I call UCIs that are [−2-*dimensional*], i.e. UCIs that contribute only use-conditional but no truth-conditional content, *expletive* UCIs, following Cruse (2004: 57). For UCIs that contribute content to both dimensions of meaning, I adopt the term *mixed* UCIs from McCready (2010). These are specified as [+2-*dimensional*]. Examples of expletive UCIs are expressive attributive adjectives (2.24) or modal particles like *ja*

(2.42b). Removing or adding these to a sentence does not affect its truth-conditional content, since they convey only use-conditional meaning. Mixed UCIs include ethnic slurs (2.32), which in addition to the use-conditional racist attitude contribute truth-conditional content that equals that of their neutral, non-racist counterparts.

The second difference does not concern what content a UCI delivers but what it needs. Interjections and ethnic slurs have use-conditional content that is already saturated as it does not need any further argument to unfold its meanings. As illustrated in (2.30), the interjection *ouch* directly expresses the emotion of pain without needing an argument. It comes equipped with complete use conditions and is not a function from (an) argument(s) to use conditions. The same holds for the use-conditional component of *Kraut* (2.40). The negative attitude it expresses towards Germans does not depend on any argument, even if *Kraut* needs an argument in the truth-conditional dimension. In contrast, other UCIs seek an argument to which their use-conditional content can apply. An expressive like *damn* conveys an attitude towards a nominal argument, and modal particles like *ja* display an attitude towards a propositional argument. I call this locus of variation *functionality*. I use the binary feature [±*functional*], or [±*f*], to distinguish *functional* UCIs from what I label *isolated* UCIs (after Potts 2005: 65).

Given the two binary features of dimensionality and functionality, we can distinguish at least four different types of UCIs. However, this leaves out of the picture the so-called *shunting* UCIs (McCready 2010). These are functional UCIs that do not leave their truth-conditional argument unmodified in the truth-conditional dimension as functional expletive UCIs do. Instead, they "shunt" their argument over to the use-conditional dimension. Exclamatives, for instance, can be understood as an example of shunting UCIs, as they do not give any truth-conditional content back, as discussed above (pp. 37–8). Since both functional expletives and shunting UCIs need an argument and contribute only to the use-conditional dimension, they have the same features. Therefore, we need an additional feature to distinguish between functional UCIs that shunt and those that do not. Because, as McCready (2010) points out, shunting UCIs consume their arguments whereas the arguments of functional expletives can be reused in a semantic derivation, we can use resource sensitivity [±*r-sensitive*], or [±*rs*], as a distinguishing feature.[16]

[16] Resource sensitivity figures prominently in linear logic (Girard 1987) and has been adopted in certain varieties of natural language semantics (Asudeh 2005; Barker 2010).

TABLE 2.1 Types of use-conditional items

	f	*2d*	*rs*
isolated expletive UCIs	–	–	
isolated mixed UCIs	–	+	
functional UCIs, expletive	+	–	–
shunting	+	–	+
functional mixed UCIs	+	+	

However, this feature only makes sense for one-dimensional functional UCIs. Since isolated UCIs do not take any argument, the question of whether an application is resource-sensitive does not arise. For functional mixed UCIs we cannot meaningfully distinguish between two variants of functional mixed UCIs. In some sense, they are [+*rs*], because they do not give back their argument unmodified. In another sense, they are [–*rs*], since their argument is used in both dimensions. Taking the distinction between expletive and shunting functional UCIs into account, we hence end up with five different types of UCIs. Table 2.1 gives an overview of the five kinds and their features, while Figure 2.1 on the facing page highlights the relations between them regarding their feature structure.

Having established this typology of UCIs, let us now systematize how the five types interact with other expressions. In order to give a schematic representation for each of the five cases, I will generalize the informal fraction representations used above.

The simplest schema is the one for isolated expletives which do not interact with the rest of the sentence in any interesting way. When an interjection like *ouch* is used together with a sentence, the truth-conditional content of the sentence is not affected by its presence, and the use-conditional content is given by the emotion conveyed by *ouch*. To schematize this, I make use of the following notational conventions. The variable S ranges over sentences, and ε over use-conditional expressions. I use brackets to denote that something is included in a sentence. That is, $S[\dots\varepsilon\dots]$ denotes a sentence that includes an UCI in a not-specified position. For isolated expletives, we thus have the following schema:[17]

[17] In order keep the schemata simple, I ignore the possibility that a sentence might contain more than one UCI. The formal system I will develop in this book will of course be able to deal with such cases.

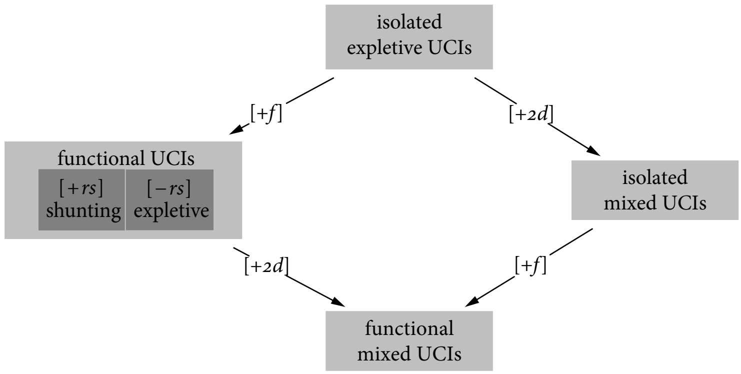


FIGURE 2.1 Relations between the five types of use-conditional items

(2.58) *Schema for isolated expletives*

$$S[\ldots\varepsilon\ldots] = \frac{\varepsilon}{S}$$

In contrast, the use-conditional content of functional expletives is a function which, as such, needs an argument, for which I use the variable α. Not all functional expletives modify their argument at the truth-conditional layer. However, depending on whether the application is [$-rs$] or not, we have to distinguish between two schemata. Functional expletives like *damn* pass their argument back to the truth-conditional layer. That is, *the damn dog* makes the same truth-condtional contribution as *the dog*. Therefore, the argument α has to show up on the lower level of the fraction representation in addition to being the argument for the UCI at the use-conditional layer.

(2.59) *Schema for expletive functional UCIs*

$$S[\ldots\varepsilon(\alpha)\ldots] = \frac{\varepsilon(\alpha)}{S[\ldots\alpha\ldots]}$$

This contrasts with the schema for shunting functional UCIs in which the argument α is not reused at the truth-conditional level, but only shows up at the use-conditional tier.

(2.60) *Schema for shunting functional UCIs*

$$S[\ldots\varepsilon(\alpha)\ldots] = \frac{\varepsilon(\alpha)}{S}$$

Isolated mixed UCIs contribute to both meaning dimensions; they are [+2-*dimensional*]. Their use-conditional component is [–*functional*] since it does not depend on an argument. To indicate two-dimensionality, I make use of subscripted t and u to label the truth- and use-conditional content of mixed UCIs. Since the use-conditional content does not need an argument, α does not show up on the top layer of the following representational schema for isolated mixed UCIs:

(2.61) *Schema for isolated mixed UCIs*

$$S[\ldots \varepsilon(\alpha) \ldots] = \frac{\varepsilon_u}{S[\ldots \varepsilon_t(\alpha) \ldots]}$$

In contrast, the use-conditional component of functional mixed UCIs is a function and therefore needs an argument α. And since it has mixed content, such an item contributes something to the truth-conditional dimension as well. The schema for functional mixed UCIs hence involves an argument α that is present in both dimensions of meaning. In the truth-conditional tier, it is modified by ε_t, the truth-conditional meaning component of the mixed expressive, while on the use-conditional level on top of it, α serves as the argument for the use-conditional content ε_u.

(2.62) *Schema for functional mixed UCIs*

$$S[\ldots \varepsilon(\alpha) \ldots] = \frac{\varepsilon_u(\alpha)}{S[\ldots \varepsilon_t(\alpha) \ldots]}$$

These five schemata are useful for illustrating the differences and similarities between the four types of UCIs. They will serve as a good starting point when I discuss previous approaches to UCIs in the next chapter.

2.3 Chapter summary

Following Kaplan's (1999) paper on the meaning of *ouch* and *oops*, I have discussed his ideas on how to extend the scope of semantics to cover expressions whose conventional meaning goes beyond truth-conditional relevance. The basic idea is to employ the parallel with truth conditions, as embodied in the traditional condition (T), and specify the meaning of non-truth-conditional expressions by means of their conditions of use. Instead of asking what an expression contributes to a sentence's truth conditions, we ask what the conditions are under which it can be uttered felicitously. Crucially, these use conditions can be fulfilled in an utterance context, or not, which enables us to model use-conditional content formally as a set of contexts, just as ordinary truth-conditional content is rendered as a set of worlds.

Since most expressions do actually carry both truth- and use-conditional content, the basic ideas of use-conditional semantics then lead us to the notion of hybrid semantics, which employs both truth and use conditions to capture the overall meaning of natural language expressions in a multidimensional way. I briefly discussed Kaplan's thoughts on the ramifications this has for logical reasoning and sketched how his notion of validity as information delimitation can be mapped out formally.

Having presented the foundation of hybrid semantics, I then turned to a short presentation of various UCIs and the different behavior they show with respect to how they interact with other content. This led to a typology of five kinds of UCIs which differ with respect to whether they contribute to both meaning dimensions, whether their *u*-content needs an argument, and whether they return their argument unmodified. These five types of UCIs will serve as test patterns, as I evaluate previous approaches to multidimensional meaning in terms of how they account for the attested variation presented in the next chapter.

3

Previous approaches to multidimensional meaning

3.1 Introduction

In the framework of hybrid semantics developed in the Chapter 1, the meaning of a sentence is given by its truth and use conditions. And since these are two separate levels of meaning, each of which can receive its value independently of the other, we can think of hybrid semantics as a two-dimensional approach to meaning. The aim of this chapter is to review some of the formal tools that have already been developed to describe and analyse the multidimensionality introduced by use-conditional items. Most of these approaches have been developed with a particular class of phenomena in mind. I will therefore test how the frameworks developed so far can deal with the different kinds of UCIs presented in Chapter 2. However, I will not provide a broad overview of all multidimensional semantics ever developed. Instead, I will concentrate on the most recent and influential ones that have been developed for expressives and will discuss them in detail to analyse their virtues and disadvantages. This will help to clarify what is needed when I develop a formal model for hybrid semantics in the next chapter.

3.2 $\mathcal{L}_{\mathrm{CI}}$—The logic of conventional implicatures

In his major monograph on conventional implicatures, Chris Potts (2005) develops a multidimensional logic to model how conventional implicatures (CIs) contribute to the overall meaning of the sentence in which they occur. His book has been very influential and brought a lot of attention to the topic of CIs and multidimensional content in general, as well as the question of what a proper formalization of multidimensional content should look like. And since Potts also addresses expressive content, his work proves to be a good place to start my review.

Potts (2005) deals with two broad classes of expressions, both of which, he argues, convey conventionally implicated content and for which he develops a multidimensional logic. First, he addresses a class of phenomena that he calls *supplements* and which includes expressions like that in (3.1), namely non-restrictive relative clauses (3.1a), *as*-parentheticals (3.1b), nominal appositives (3.1c), evaluative adverbs (3.1d), or utterance modifiers (3.1e).

(3.1) *Supplements* (Potts 2005: 90)
a. Ames, **who was a successful spy**, is now behind bars.
b. Ames was, **as the press reported**, a successful spy.
c. Ames, **a successful spy**, is now behind bars.
d. **Luckily**, Ames is now behind bars.
e. **Confidentially**, Ames is a successful spy.

As a second class of phenomena, Potts (2005) studies what he calls *expressives*, by which he means what I have referred to as *expressives in the narrow sense* in §2.2.1. As examples, he mostly uses expressive attributive adjectives as in (3.2a) and epithets as in (3.2b).

(3.2) *Expressives* (Potts 2005: 18)
a. I have seen most **bloody** Monty Python sketches!
b. That **bastard** Kresge got promoted.

As we have seen in Chapter 2, such expressives are UCIs *par excellence* and are the subject of Potts's (2007a,b) later work in which he develops a more use-conditionally orientated approach.[1] Like supplements, expressives in the narrow sense display a set of properties which Potts (2005: 11) regards as being definitional for the class of CIs and which sets them apart from all other kinds of meaning (Potts 2005: § 2.4). First of all, the meaning they convey is independent of the descriptive content ("at-issue content" in Potts's older terminology). This meaning is a non-cancelable entailment and is determined by the conventional meaning of the items in question, and what they display is mostly speaker-oriented. Since Potts uses expressives as one of his main empirical sources to define the category of conventional implicatures, it is no surprise that his definition of CIs comes close to the notion of use-conditional content in many respects. Besides (re)establishing CIs as a kind of meaning *sui*

[1] The gist of Potts's (2007b) later approach is to let expressives manipulate so-called expressive indices, which are contextual parameters that encode the emotion between two individuals. However, this is rather specific to expressives in the narrow sense and hence the approach lacks generality. See Gutzmann (2012: 90) for some criticism.

generis, the main aim of Potts's 2005 monograph is to develop a formal logic to deal with CIs and to formalize their particular properties.

The logic for conventional implicatures—called $\mathcal{L}_{\text{CI}}$ by Potts—is basically a variant of type-driven translation (Klein and Sag 1985) and the spirit of the overall approach does not differ very much from traditional model-theoretic semantics like Montague's intensional semantics (Montague 1974; Dowty, Wall, and Peters 1981). However, it differs in three crucial respects from standard textbook incarnations of model-theoretic semantics as found in for example Gamut (1991) or Chierchia and McConnell-Ginet (2000). First, it introduces new basic types for CIs that are used to distinguish syntactically regular expressions from those that contribute conventionally implicated content. These are accompanied by the addition of corresponding new construction rules that regulate how complex types are put together from these new building blocks and how complex expressions for the logic $\mathcal{L}_{\text{CI}}$ are built if expressions of these new types are involved. Secondly, $\mathcal{L}_{\text{CI}}$ makes use of what Potts (2005: 222) calls *tree-admissibility conditions*. These are basically well-formedness conditions on the semantic parsetrees that regulate how expressions of the various types are combined with each other during the semantic derivation. The last new ingredient of $\mathcal{L}_{\text{CI}}$ is a process called *parsetree interpretation* (Potts 2005: §3.6.6), according to which the denotation of a sentence is given by the interpretation of an entire semantic tree instead of just a single formula. As will soon become clear, the motivation for this is that Potts wants a simple mechanism to interpret conventionally implicated content in a separated dimension without having to represent it at each node of the semantic representation.

In the following, I will go through the different ingredients of $\mathcal{L}_{\text{CI}}$ in more detail and explain how Potts uses them to model the characteristic behavior of conventional implicatures.

3.2.1 Types for $\mathcal{L}_{CI}$

As we saw above, one of the respects in which $\mathcal{L}_{\text{CI}}$ deviates from standard type-driven semantics is in the set of types it makes use of. The type system is where Potts (2005) sets out whether an expression contributes conventionally implicated content or ordinary descriptive/at-issue meaning. This seems a good place to make this distinction, since, as I have argued, which dimension of meaning an expression adds content to is a lexically-determined feature. We start with the type definitions.

(3.3) *Basic types for $\mathcal{L}_{CI}$* (cf. Potts 2005: 55)
a. e^a, t^a, and s^a are basic at-issue types.
b. e^c, t^c, and s^c are basic CI types.
c. Nothing else is a basic type for $\mathcal{L}_{\mathrm{CI}}$.

Clause (3.3a) provides us with the standard types for entities, truth values, and worlds. The only thing new here is that Potts uses a superscripted "*a*" (for *at-issue*) to indicate that we are dealing with the normal types. This keeps them distinct from the new conventional implicature (CI) types that are superscripted with a "*c*". As with ordinary at-issue types, we have CI types for entities, truth values, and worlds. However, the types e^c and s^c are used nowhere in Potts (2005).

With the addition of the new basic CI types, we also need new rules for building complex types out of them. This is where Potts (2005) already builds some restrictions on conventionally implicated content into the logical system.

(3.4) *Types for $\mathcal{L}_{CI}$* (cf. Potts 2005: 55)
a. If σ is a basic type for $\mathcal{L}_{\mathrm{CI}}$, then σ is a type for $\mathcal{L}_{\mathrm{CI}}$.
b. If σ and τ are at-issue types for $\mathcal{L}_{\mathrm{CI}}$, then $\langle\sigma, \tau\rangle$ is an at-issue type for $\mathcal{L}_{\mathrm{CI}}$.
c. If σ is an at-issue type for $\mathcal{L}_{\mathrm{CI}}$ and τ is a CI type for $\mathcal{L}_{\mathrm{CI}}$, then $\langle\sigma, \tau\rangle$ is a CI type for $\mathcal{L}_{\mathrm{CI}}$.
d. The entire set of types for $\mathcal{L}_{\mathrm{CI}}$ is the union of the at-issue and CI types.

The first two clauses of this definition are nothing special. Clause (3.4a) ensures that all basic types from (3.3) are types for $\mathcal{L}_{\mathrm{CI}}$, while clause (3.4b) equals the ordinary recursive type definition and allows us to build complex functional at-issue types out of two at-issue types. What is new and interesting is clause (3.4c). This clause specifies that we can take an at-issue type and a CI type and combine them to form a new functional CI type. However, order matters in this clause, since it allows only for functional types that have an at-issue type as their argument type and a CI type as their output.[2] That is, the following conceivable type definitions are absent from $\mathcal{L}_{\mathrm{CI}}$.

[2] To avoid the cluttering by superscripts, I will often drop the superscript for the at-issue types when there is no danger of confusion. CI types, however, will always be marked explicitly. Hence, I will abbreviate along the following lines:

(3.5) a. $\langle\sigma^a, \tau^a\rangle \leadsto \langle\sigma, \tau\rangle$
b. $\langle\sigma^a, \tau^c\rangle \leadsto \langle\sigma, \tau^c\rangle$

(3.6) a. *If σ^c and τ^c are CI types for $\mathcal{L}_{\mathrm{CI}}$, then $\langle \sigma^c, \tau^c \rangle$ are CI types for $\mathcal{L}_{\mathrm{CI}}$.

b. *If σ^c is a CI type for $\mathcal{L}_{\mathrm{CI}}$ and τ^a is an at-issue type for $\mathcal{L}_{\mathrm{CI}}$, then $\langle \sigma^c, \tau^a \rangle$ is a {CI/at-issue} type for $\mathcal{L}_{\mathrm{CI}}$.

The absence of functional types built according to the these missing clauses means that there is an asymmetry between at-issue and CI meaning, directly built into the type system of $\mathcal{L}_{\mathrm{CI}}$ (Potts 2005: 57). At-issue content can serve as the argument to either functional at-issue and CI expressions to produce at-issue or CI content, respectively (cf. Potts 2005: 58).

(3.7) a. At-issue content applies to at-issue content to produce at-issue content.

b. CI content applies to at-issue content to produce CI content.

In contrast, as is implicit in these glosses and the definitions above, expressions that have a CI type can never be the argument of an at-issue or of a CI expression. I make these prohibitions explicit by giving paraphrases for them, as well.

(3.8) *Prohibition against CI arguments*
CI types are only output types, i.e.:
a. At-issue content never applies to CI content. (Potts 2005: §3.5.1)
b. CI content never applies to CI content. (Potts 2005: §3.5.2)

This prohibition against CIs serving as arguments to functional expressions—regardless of the output type—is indeed one of the major empirical claims that Potts (2005) makes about the phenomena he analyses. I will come back to the question of whether or not this prohibition is supported by the data in §3.3.2.

For illustrative purposes, I present the space of possible types for $\mathcal{L}_{\mathrm{CI}}$, as determined by the type definitions in (3.4), by means of Table 3.1,

TABLE 3.1 The type system of $\mathcal{L}_{\mathrm{CI}}$

		RANGE	
		at-issue	CI
DOMAIN	at-issue	✓(at-issue)	✓(CI)
	CI	✗	✗

which shows which combinations are allowed and which possibilities are prohibited in $\mathcal{L}_{\mathrm{CI}}$.

The Table tells us that if we have a complex type that has an at-issue type in both its domain and range, the result is well-formed and again of an at-issue type. If the input is an at-issue meaning and the output a CI, then the functional expression is a CI expression. The other two combinations that have a CI serving as an argument are not allowed, regardless of their output type.

Restricting what types are possible in $\mathcal{L}_{\mathrm{CI}}$ is Potts's (2005) way of implementing some of the characteristic properties of CIs, like appositives or expressive adjectives, directly into the semantic system he uses. For instance, the fact that they cannot be displaced by attitude predicates or semantic operators like modals falls out naturally from the way the types are defined in $\mathcal{L}_{\mathrm{CI}}$. Consider the following example in which the expressive attribute *damn* occurs in a sentence that is embedded under a speech report verb:

(3.9) Bush says the damn Republicans deserve public support.
(Potts 2005: 59)

Abstracting away from the question of how the actual composition works in $\mathcal{L}_{\mathrm{CI}}$ (I will come to that soon), the sentence in (3.9) expresses a conventionally implicated negative attitude concerning the Republicans by virtue of the meaning of *damn*. That is, we have the expression **damn**(**republicans**) and since that is a conventional implicature, it is of type $\langle s, t^c \rangle$. A standard translation for *say* is therefore unable to target that expression because this would lead to an ill-formed expression:

(3.10)

undefined

$\lambda p \lambda x.\mathbf{say}(p)(x) : \langle\langle s^a, t^a\rangle, \langle e^a, \langle s^a, t^a\rangle\rangle\rangle$ $\quad$ $\mathbf{damn}(\mathbf{republicans}) : \langle s^a, t^c\rangle$

However, the type system of $\mathcal{L}_{\mathrm{CI}}$ does not allow one to adjust the type of *say* or other semantic operators to take the CI expression **damn**(**republicans**) as their argument. In order to do so, *say* must have the type $\langle s^a, t^c \rangle$ in its domain and would therefore be of the form $\langle \sigma^c, \tau^c \rangle$, a type that is not allowed for by the definitions in (3.4) on page 47; cf. also Table 3.1 on the facing page.

Similar reasoning lies behind the prohibition of expressions that map CI content to CI content. For instance, Potts (2005: 169) argues that the

CI content of expressive adjectives cannot be modified by an intensifier, even if they are related to an underlying scale of emotive strength.

(3.11) *That's a $\left\{\begin{array}{c}\text{quite}\\ \text{very}\\ \text{really}\\ \text{super}\end{array}\right\}$ damn dog.

I will challenge this argument later on the basis of examples, like the following, which actually involve what I call *use-conditional modifiers* (Gutzmann 2011a), i.e. expressions that take UCIs as their argument and return a modified UCI of the same type (cf. also Geurts 2007):

(3.12) *Use-conditional modifiers*

a. That $\left\{\begin{array}{c}\text{damn}\\ \text{fucking}\\ \text{bloody}\end{array}\right\}$ bastard Burns got promoted!

b. That idea was $\left\{\begin{array}{c}\text{absolutely}\\ \text{really}\\ \text{totally}\end{array}\right\}$ fucking brilliant.

Nevertheless, if we assume that the generalizations in (3.8) are true, the type system of $\mathcal{L}_{\mathrm{CI}}$ is an easy and straightforward way to implement them.

Besides the prohibition against CI arguments (3.8), Potts (2005) makes an additional empirical claim, namely, that expressions are fully committed to one dimension of meaning. I call this the prohibition against mixed content.

(3.13) *Prohibition against mixed content* (Potts 2005: 7)
No lexical item contributes both an at-issue and a CI-meaning.

In the overview of different use-conditional phenomena in Chapter 2, we saw various UCIs that seem to contribute to both dimensions of meaning and suggest that the prohibition in (3.13) is too strong. To account for such expressions while still keeping the core ideas of $\mathcal{L}_{\mathrm{CI}}$ intact is one of McCready's (2010) motivations for his extension of $\mathcal{L}_{\mathrm{CI}}$, to which I will turn in §3.4.

In $\mathcal{L}_{\mathrm{CI}}$, the type system restricts how complex CI expressions can be built and how they can combine with at-issue meaning. In order to give them a special interpretation that models their special status when compared to ordinary descriptive meaning, the logic $\mathcal{L}_{\mathrm{CI}}$ needs some further ingredients.

3.2.2 Modes of composition

Since the types for $\mathcal{L}_{\text{CI}}$ do not implement all of the particular properties of CI expressions, Potts makes use of different means to formalize their special behavior, specifically by imposing constraints on the well-formedness of semantic parsetrees. These constraints, called *tree-admissibility conditions* (Potts 2005: 62), regulate how a local semantic parsetree for the combination of two expressions of various types has to look in order to be well-formed.[3] That is, in addition to the conditions the types impose on the combination of two expressions, we have additional constraints to which the trees that represent the structure of complex expressions have to adhere.[4] That is, at least for each way of forming complex expressions allowed by (3.8), we need a corresponding tree-admissibility condition. The simplest is, of course, the one for functional application:

(3.14) *Functional application*

$$\begin{array}{c} \alpha(\beta) : \tau \\ \diagup \quad \diagdown \\ \alpha : \langle \sigma, \tau \rangle \qquad \beta : \tau \end{array}$$

However, since $\mathcal{L}_{\text{CI}}$ distinguishes between at-issue and CI types, we have to reflect that distinction in the tree-admissibility condition for functional application. And, just as the definition of complex types for $\mathcal{L}_{\text{CI}}$ distinguishes between the application of two at-issue expressions and the application of a CI expression to an at-issue argument, $\mathcal{L}_{\text{CI}}$ employs two different tree structures for functional application. The first involves only at-issue content and hence is called *at-issue application* (Potts 2005: 62). It equals the tree for standard functional application given in (3.14), except in two features. First, the superscripted *a* indicates that we are dealing with at-issue type expressions. Second, the material in the dotted boxes indicates optional material, the role of which should become clear with the next tree-admissibility condition. Except in these regards, (3.15) restates as a tree-admissibility condition what a simple rule for functional application would look like.

[3] By "local tree", I mean the smallest tree that consists of a mother and one or two daughters.

[4] Semantic parsetrees thereby become crucial to $\mathcal{L}_{\text{CI}}$, a point I will come back to later.

(3.15) *At-issue application*

$$\begin{array}{c} \alpha(\beta) : \tau^a \\ \begin{array}{cc} \alpha : \langle \sigma^a, \tau^a \rangle & \beta : \tau^a \\ \bullet & \bullet \\ \boxed{\gamma : \rho^c} & \boxed{\delta : \phi^c} \end{array} \end{array}$$

Including the optional material inside the dotted boxes is necessary because such material can be introduced by the tree-admissibility condition for *CI application* (Potts 2005: 64). This condition basically involves a functional CI expression that is applied to an at-issue argument. However, the condition for CI application is not merely a recasting of functional application, but introduces a new twist to the way CI expressions are combined with their argument. Note that the types alone do not say what the output of an application of a CI expression to its argument is, but only that the functional application of the two expressions is well-typed. What the tree-admissibility condition for CI application adds is that it ensures that we get not only the functional application of the two input expressions as output but, in addition, the argument expression.[5]

The two independent expressions at the node are separated by the metalogical symbol "•" (called *bullet*).

[5] The definition given in the main text corrects an error in Potts's (2005: 64) definition of CI application. Originally, the rule allowed for optional material not only at the node of the at-issue argument but also at the node of the CI expression functor:

(3.16)

$$\begin{array}{c} \beta : \sigma \\ \bullet \\ \alpha(\beta) : \tau^c \\ \begin{array}{cc} \alpha : \langle \sigma^a, \tau^c \rangle & \beta : \sigma^a \\ \bullet & \bullet \\ \boxed{\gamma : \rho^c} & \boxed{\delta : \phi^c} \end{array} \end{array}$$

An expression that would give rise to a node decorated with two independent CI expressions would have to have a CI type in its domain. However, this is not licensed by the type system of $\mathcal{L}_{\mathrm{CI}}$ as given in (3.3) (p. 47), as is also stated in the prohibition against CI arguments in (3.8) and illustrated in Table 3.1.

(3.17) *CI application*

$$\beta : \sigma^a$$
$$\bullet$$
$$\alpha(\beta) : \tau^c$$
$$\alpha : \langle \sigma^a, \tau^c \rangle \qquad \beta : \sigma^a$$
$$\bullet$$
$$\boxed{\delta : \phi^c}$$

The important point of this condition is that it is not resource-sensitive. As McCready (2010: 12) puts it, a resource-sensitive rule "consumes resources as they are used". This holds for standard functional application and its incarnation in $\mathcal{L}_{\text{CI}}$ as at-issue application, and indeed for the great majority of standard semantics. Consider, for instance, the functional application in a simple predicational sentence:

(3.18)

$$\textbf{sleeps}(\textbf{john}) : t$$
$$\textbf{sleeps} : \langle e, t \rangle \qquad \textbf{john} : e$$

When the two expressions are combined, we get a new expression. Even if it is the case that the new expression consists of the two expressions from which it was built, the old expressions "are consumed and no longer available for further composition" (McCready 2010: 12). That is, you can use **john** and **sleep** only once, since after functional application only the new expression **sleeps**(**john**) is accessible. In contrast, this does not hold for CI application since, in addition to the application, that rule returns the argument expression unmodified, which then can take part in further derivations. For instance, consider the semantic tree for *that damn Kermit* with the scissor-illustration that I have borrowed from Potts (2005: 65).

(3.19)

$$\textbf{kermit} : e$$
$$\bullet$$
$$\textbf{damn}(\textbf{kermit}) : t^c$$
$$\textbf{damn} : \langle e, t^c \rangle \qquad \textbf{kermit} : e$$

$$\Rightarrow$$

$$\textbf{kermit} : e$$
$$|$$
$$\textbf{kermit} : e$$

The expressive **damn**, which is a CI expression of type $\langle e, t^c \rangle$ in $\mathcal{L}_{\mathrm{CI}}$, takes **kermit** as an argument and yields both the application **damn**(**kermit**) of type t^c as well as the unmodified at-issue argument **kermit**. An at-issue expression is therefore "always insensitive to the presence of adjoined CI operators" and the at-issue content of a semantic tree can be thought of being derived "by pruning all nodes dominating items with a CI semantics" (Potts 2005: 65), as illustrated in (3.19). The argument is passed up the semantic tree unmodified by the rule of CI application and hence can take part in further derivations, as if the CI had never been there.[6] The complex expression *damn Kermit* therefore combines with other expressions as if it were a simple NP, for instance, when it serves as the subject for a predicate.

(3.20) That damn Kermit is a frog.

$$\mathbf{frog}(\mathbf{kermit}) : t$$

$$\mathbf{kermit} : e \qquad \mathbf{frog} : \langle e, t \rangle$$

$$\bullet$$

$$\mathbf{damn}(\mathbf{kermit}) : t^c$$

$$\mathbf{damn} : \langle e, t^c \rangle \qquad \mathbf{kermit} : e$$

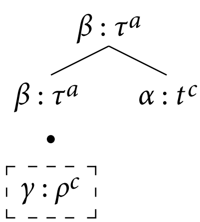
The non-resource-sensitivity of CI application accounts for the supplemental character of the expressions Potts deals with. While the at-issue content is not affected by CI application, the CI content is left behind and is not accessible for further derivation. From this feature of $\mathcal{L}_{\mathrm{CI}}$, many of the special properties of UCIs can be accounted for, foremost their scopelessness and that they do not influence the main truth-conditional content of a sentence, because this tree-admissibility condition ensures that UCIs are not passed up the parsetree. Therefore, neither can they be the argument for any descriptive expression nor can they fall within the scope of any higher operator, like modals, negation, or quantifiers, simply due to the fact that they are no longer present at dominating nodes. Furthermore, since they are not present at the root node of the whole tree, which represents the truth-conditional content of the utterance, they have no effect on its (at-issue) truth conditions. Of course, we nevertheless want the CI content to be interpreted in some

[6] That is, for the CI part, CI application is resource-sensitive.

way. This is where the mechanism of parsetree interpretation comes in, to which I will turn in §3.2.3.

There are two further tree-admissibility conditions that Potts (2005) introduces. The first one takes care of CI expressions that do not interact in any meaningful way with the surrounding at-issue content and which are called *isolated CIs*, a term which I adopted in the typology of use-conditional meaning in Chapter 2.

(3.21) *Isolated CIs*



This rule basically strips off a CI expression that already expresses a CI proposition of type t^c on its own. In contrast to the rule for CI application, the rule for isolated CI does not make use of the bullet notation. Instead, the isolated CI expression does not show up at the mother node.[7] The following examples illustrate the (non)-combination of isolated expressives with the rest of the sentence.

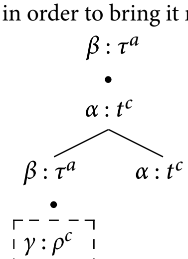
(3.23) a. **Ouch**, I have hit my thumb with the hammer. (Gutzmann 2008: 80)

b. That's fantastic **fucking** news! (Potts 2005: 65)

The expressives in these examples are isolated insofar as they serve neither as a function nor as an argument to anything in the rest of the

[7] In Gutzmann (2008: 80), I used the following different definition that employs the bullet as well in order to bring it more in line with the way CI application is formulated:

(3.22)



Of course, this is only a notational variant and does not change anything about the way the logic works. However, I liked the idea that separated CI content is always indicated by the bullet so that one can detect it on the spot. It also "felt" more compositional to have both daughter expressions present at the mother node in some way.

sentence. In cases like these, the contribution of the CI expressions does not involve anything more integrated than that the speaker expresses some specific emotion by using the expressive (Potts 2005: 65). Crucially, the emotion is directed towards something that is not specified by anything in the sentence. For instance, the "target" of the expressive in (3.23a) is pain and not the event of the hammer hitting the speaker's thumb—that is only the cause for the pain. This contrasts with integrated uses of expressives in which they apply to specific arguments, like *damn* in (3.20). Thus, the important point about isolated CI expressions is that they do not interact with descriptive expressions. The semantic tree for (3.23a) can be given as follows.[8]

(3.24) Ouch, I have hit my thumb with the hammer!

hit-with-hammer(**thumb**)(**the-speaker**) : t

ouch : t^c **hit-with-hammer**(**thumb**)(**the-speaker**) : t

Like CI application, the tree-admissibility condition for isolated CIs helps to remove CI expressions from the semantic parsetree and thereby accounts for many linguistic properties of CI expressions. [9]

The last condition plays an important role in Potts's (2005) analysis of supplements and will also be discussed extensively below in my comparison between his logic and McCready's (2010) extension of it. It is called *feature semantics* and it models the semantic contribution of certain syntactic features by allowing us "to introduce features without requiring that they be terminal elements in the syntax or the semantics" (Potts 2005: 66).

[8] For simplicity and to keep the example focused, I simply translate *I* with **the-speaker**, *hit with the hammer* as an atomic predicate, and neglect the possessive and the definite article as well as the tense.

[9] As I will show when I discuss McCready's (2010) extensions of $\mathcal{L}_{\text{CI}}$ in §3.4, a rule akin to the condition for isolated CIs can be used to simplify the formulation of the others as well, by rendering the optional material in the rules obsolete.

(3.25) *Feature Semantics*

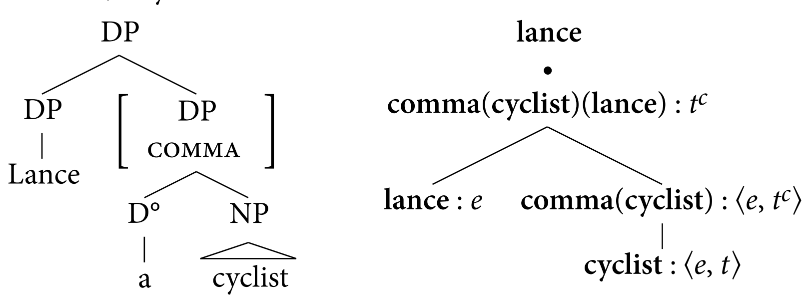
$\beta(\alpha) : \tau$ (where β is a designated *feature term* of type $\langle \sigma, \tau \rangle$)

|

$\alpha : \sigma$

The main use of this tree-admissibility condition is to analyse CI-triggering supplements. Potts (2005: §4.3) suggests that supplements like appositives are built from ordinary at-issue expressions, but that a special feature called COMMA switches the expression from at-issue to CI content. The feature is called COMMA because Potts (2005: 98) suggests that it comes with a special intonation pattern that disintegrates the supplemental material phonologically by intonational boundaries and which is realized in written English by the commas which, for instance, distinguish between restrictive relative clauses and supplementary non-restrictive ones. He assumes the following syntactic and semantic form for a nominal appositive (Potts 2005: 66):

(3.26) Lance, a cyclist



The syntactic COMMA feature gets translated into the $\mathcal{L}_{\text{CI}}$ expression **comma**, but crucially, that expression is not introduced on a terminal node, either in the semantics or in the syntax. The expression **comma** is defined as a type-shifting operator that just shifts an at-issue function into a CI function, but contributes nothing else.

(3.27) $\textbf{comma} \stackrel{\text{def}}{=} \lambda f \lambda x. f(x) : \langle \langle e, t \rangle, \langle e, t^c \rangle \rangle$

Potts's main motivation for assuming the COMMA feature is that, otherwise, he would have to assume that there is a systematic doubling of lexical entries for expressions that can appear either as ordinary at-issue expressions or as CI expressions, which is indeed not a very plausible assumption, at least not for supplements. However, the comma hypothesis is not without empirical and technical problems. In their detailed review of Potts's book, Amaral, Roberts, and Smith (2007: 720–2) criticize the use of the COMMA feature on the basis that there seems to be no one-to-one relation between intonation and supplementary status, especially when it comes to adverbs, as shown by Bonami, Godard, and Kampers-Mahne (2004). They also point out some technical problems. What I am interested in here, however, is that there is a conceptual issue with this rule that runs deeper into the core of $\mathcal{L}_{\mathrm{CI}}$. Recall that one of the characteristic features of CI expressions is that they compose with their arguments in a non-resource-sensitive way. They always give the argument back unmodified. The rule for feature semantics, however, sneaks resource-sensitivity back into the realm of CI expressions. A look at the definition of **comma** in (3.27) shows that it is a CI function that is, in principle, not different from, say, **damn**, since it takes an at-issue argument to yield a CI expression. If we just used the (non-resource-sensitive) role for CI-application to combine **comma** with its argument, we would get the following result, instead of that in (3.26):

(3.28)

$$\mathbf{cyclist} : \langle e, t\rangle$$
$$\bullet$$
$$\mathbf{comma}\ (\mathbf{cyclist}) : \langle e, t^c\rangle$$
$$\mathbf{comma} : \langle\langle e, t\rangle , \langle e, t^c\rangle\rangle \qquad \mathbf{cyclist} : \langle e, t\rangle$$

This is, of course, an undesired result, since the application of **comma** to **cyclist** is isolated and we are just left with the plain at-issue predicate **cyclist** for further derivations. In order to shift the at-issue type of **cyclist** to a CI type, we need to combine **comma** with **cyclist** in a way that respects resource-sensitivity. When we rewrite the unary branching rule for feature semantics in (3.25) to one that branches binarily, we see that feature semantics is indeed resource-sensitive. And since it is not restricted to specific types of "feature", it actually looks like ordinary functional application.

(3.29)

$$\mathbf{comma}(\mathbf{cyclist}) : \langle e, t^c\rangle$$
$$\mathbf{comma} : \langle\langle e, t\rangle , \langle e, t^c\rangle\rangle \qquad \mathbf{cyclist} : \langle e, t\rangle$$

$$\beta(\alpha) : \tau$$
$$\beta : \langle \sigma, \tau\rangle \qquad \alpha : \sigma$$

Even if Potts (2005) does not say this explicitly, this seems to be the main reason for introducing feature semantics. It allows for the resource-sensitive combination of a CI expression with an at-issue argument.

This is, of course, not a problem per se, and as we will see later, a similar composition rule may be needed anyway. The problem however is that, as the type system is specified, it is not determined when feature semantics has to be employed instead of CI application. Just looking at the types does not help, since a function of $\langle\langle e, t\rangle, \langle e, t^c\rangle\rangle$ and an argument of $\langle e, t\rangle$ are capable of being composed according to either of the two rules. This introduces some indeterminacy into $\mathcal{L}_{\text{CI}}$ that is undesirable in a type-driven system, since the types alone should determine the composition. As we will see in §3.4, this problem is solved in McCready's (2010) revision of $\mathcal{L}_{\text{CI}}$ by the introduction of new types and construction rules for resource-sensitive CIs. The other problem that the tree-admissibility condition for feature semantics poses for the spirit of $\mathcal{L}_{\text{CI}}$ is that it can, in principle, also allow for feature expressions that take CI-type arguments, since there is no restriction on the semantic type of the feature. This would run counter to Potts's prohibition against CI arguments rendered in (3.8) on page 48. However, as I will argue later on, this prohibition is too strong, because such expressions are, in fact, attested. It will turn out that the composition of the COMMA feature can be maintained without the need for a special composition rule. Whether the use of such a feature is an empirically adequate way of analysing supplemental expressions is of course a different question, that I will not pursue here.

3.2.3 Interpretation

Having presented the tree-admissibility conditions of $\mathcal{L}_{\text{CI}}$ that regulate how at-issue and CI content interact with each other, I will now turn to the question of how CI content is interpreted.[10] Recall that the function of the CI-specific tree-admissibility conditions is to separate CI expressions from the at-issue content in order to prevent them from percolating up the semantic tree and showing up at the root node.

[10] Potts (2005: 63) defines a further rule for *at-issue intersection* that conjoins two at-issue expressions in order to model modificational structures. However, since this rule is neither particular to $\mathcal{L}_{\text{CI}}$ nor plays any substantial role in the analysis of CIs, I omitted it from the main text.

(3.30)
$$\begin{array}{ccc} & \lambda X.\alpha(X) \wedge \beta(X) : \langle\sigma^a, \tau^a\rangle & \\ \alpha : \langle\sigma^a, \tau^a\rangle & & \beta : \langle\sigma^a, \tau^a\rangle \\ \bullet & & \bullet \\ \boxed{\gamma : \rho^c} & & \boxed{\delta : \phi^c} \end{array}$$

Consider how the two expressives in the following example are isolated by means of the rules for CI application (3.17) in the case of *damn* and for isolated CIs (3.21) in the case of *oops*:

(3.31) **Oops**, I lost the **damn** key.

- $\textbf{lost}(\textbf{the-key})(c_S) : t$
  - $\boxed{\textbf{oops} : t^c}$
  - $\textbf{lost}(\textbf{the-key})(c_S) : t$
    - $c_S : e$
    - $\lambda y.\textbf{lost}(\textbf{the-key})(y) : \langle e, t \rangle$
      - $\lambda x \lambda y.\textbf{lost}(x)(y) : \langle e, \langle e, t \rangle \rangle$
      - $\textbf{the-key} : e$
        - $\bullet$
        - $\boxed{\textbf{damn}(\textbf{the-key}) : t^c}$
          - $\textbf{damn} : \langle e, t^c \rangle$
          - $\textbf{the-key} : e$

The root node of the derivation contains just the at-issue proposition that the speaker lost her key. The CI propositions—highlighted by the boxes—are left behind during the construction of the tree. If the meaning of the sentence were just given by the root node of the semantic tree (as in standard Montagovian semantics), the CI isolated content would be completely lost and would have no interpretation at all. Therefore, we need a way to ensure that even CI content that sticks around in the parsetree is interpreted as well.

Potts (2005: 68) discusses three options to achieve this, which he takes to be "linguistically equivalent". The first possibility consists of leaving the independent CI expressions as they are, unmodified, but passing them all up the tree until they reach the root node. This could be achieved by an identity function on CI content. The root node of a parsetree containing n independent CI expressions inside itself would thus be an $n+1$-tuple consisting of the n CI expression plus the ordinary descriptive expression that decorates the root node. Actually, this would recall one of the heritage functions of Karttunen and Peters (1979). However, Potts argues that the heritage function needed for such cases would be somewhat redundant as it has no interesting function besides passing CI content along the tree by ensuring identity. Moreover, the CI content may be in danger of falling into the scope of an operator if it is present at other nodes. But ensuring that CI content is always scopeless was one motivation for setting up the tree-admissibility conditions as they are. Hence, Potts argues, the heritage solution would be rather counterproductive. A further problem with such an approach for the overall spirit of $\mathcal{L}_{\mathrm{CI}}$ (not mentioned by Potts) is that it would run counter to the prohibition against CI arguments (3.8) and the restricted type definitions of $\mathcal{L}_{\mathrm{CI}}$, since an identity function on CI content is a function from CI content into CI content.

A second way to enable the interpretation of independent CI expressions inside a parsetree is to define a "store" for CI expressions. During the derivation of a parsetree, all independent CI expressions are added to the CI store. The interpretation of a sentence would then be determined by the interpretation of the root node of the tree plus the interpretation of all expressions put into the store. This option would deliver the same result as the first one, as the interpretation of a sentence with n independent CI expressions would again be an n+1-tuple. However, since the CI expressions are not passed up the tree, they are not in danger of falling under the scope of anything and no function from CI content to CI content is needed.

The third option, which Potts (2005) actually chooses for the interpretation of his conventional implicatures, delivers the same results as the first two suggestions but keeps the derivation simpler, because nothing is added to the derivation rules given so far. His idea is to "leave the CIs where they are, but interpret the entire parsetree" (Potts 2005: 68). This constitutes a major deviation from the common practice in semantics of identifying the interpretation of a sentence with the root node of its semantic parsetree. To achieve this effect, he proposes the notion of *parsetree interpretation* which states that the interpretation of a semantic parsetree is the interpretation of the expression at its root node plus the set of interpretations of all independent conventionally implicated propositions in it.

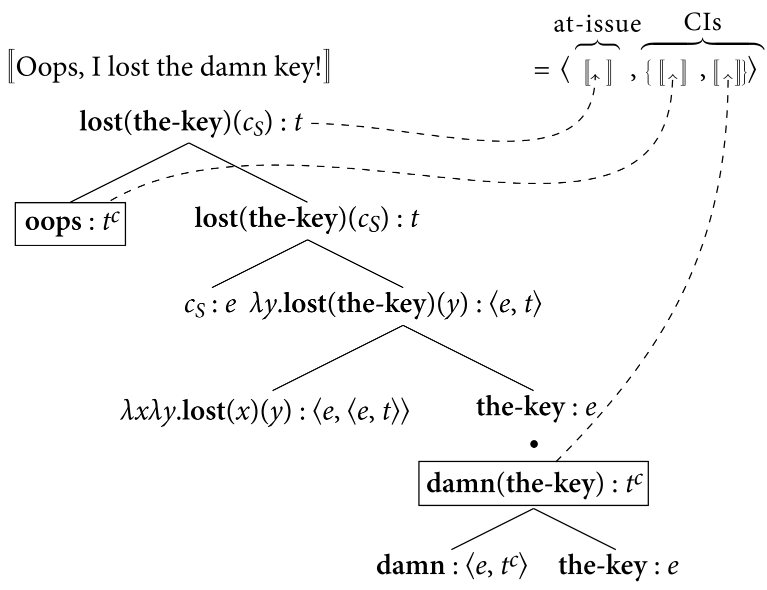
(3.32) *Parsetree interpretation* (Potts 2005: 68)
Let $\mathcal{T}$ be a semantic parsetree with the at-issue term $\alpha : \sigma^a$ on its root node, and distinct terms $\beta_1 : \langle s^a, t^c \rangle, \ldots, \beta_n : \langle s^a, t^c \rangle$ on nodes in it (extensionally, $\beta_1 : t^c, \ldots \beta_n : t^c$). Then the interpretation of $\mathcal{T}$ is the tuple

$$\left\langle [\![\alpha : \sigma^a]\!]^{\mathcal{M}_i, g}, \left\{ [\![\beta_1 : \left\langle s^a, t^c \right\rangle]\!]^{\mathcal{M}_i, g}, \ldots, [\![\beta_n : \left\langle s^a, t^c \right\rangle]\!]^{\mathcal{M}_i, g} \right\} \right\rangle$$

where $[\![\cdot]\!]^{\mathcal{M}_i,g}$ is the interpretation function, taking formulae of the meaning language to the interpreted structure $\mathcal{M}_i$, relative to a variable assignment g.

Note that the way in which semantic trees are derived in $\mathcal{L}_{\mathrm{CI}}$ is, in itself, not multidimensional. Each expression has just a single denotation. It is the rule of parsetree interpretation that introduces multidimensionality into the semantics, since it defines the interpretation of a semantic parsetree as a tuple. Its first element is given by the interpretation of the root node of the tree and represents the ordinary at-issue dimension of meaning of the sentence for which the tree is built. The second element of the tuple is given by the set of all (propositional) CI expressions that have been isolated from the at-issue content by the derivation rules and which are stuck inside the tree. Speaking informally, parsetree interpretation takes the expression at the root node and collects all the CI content scattered inside the tree, before putting it into the first and second dimension of meaning respectively. The following example visualizes the parsetree interpretation for the semantic tree in (3.31):

(3.33)



$= \langle [\![\mathbf{lost}(\mathbf{the\text{-}key})(c_S)]\!], \{[\![\mathbf{oops}]\!], [\![\mathbf{damn}(\mathbf{the\text{-}key}]\!]\}\rangle$

The interpretation of the entire sentence therefore has two dimensions. The at-issue dimension is given by the proposition that the speaker of the utterance lost her key, while the CI dimension contains two expressive propositions. Since the difference between expressions of type t^a and objects of type t^c only affects their combinatorics but not their interpretation, an utterance of the sentence in (3.33) will receive three independent truth values as its (extensional) interpretation. For this reason, it can be regarded as a two- or multidimensional semantics. However, as already mentioned above, the expressions of $\mathcal{L}_{\text{CI}}$ by themselves only have one denotation, except for sentences which receive their multidimensional semantics by means of parsetree interpretation. I call this *interpretational multidimensionality.*

3.3 Assessment of $\mathcal{L}_{\text{CI}}$

Having presented Potts's (2005) logic of conventional implicatures in detail, I will now examine how it fares with the five types of use-conditional items (UCIs) introduced in Chapter 2. I will also point out some further problems with $\mathcal{L}_{\text{CI}}$ that are not directly related to the five types.

3.3.1 Types of UCIs in $\mathcal{L}_{\text{CI}}$

I will start the assessment of $\mathcal{L}_{\text{CI}}$ by looking at the five types of UCI that I introduced in §2.2.4 and checking which of those types can be analysed by the tools $\mathcal{L}_{\text{CI}}$ offers. Recall that the five types I have defined are distinguished by three binary features called dimensionality, functionality, and resource-sensitivity, abbreviated as *f*, *2d*, and *rs*, respectively. For reference, I repeat Table 2.1 below.

A UCI is [+*2-dimensional*] if it contributes both use-conditional content and truth-conditional content simultaneously, and it is [+*functional*] if it does not come into play completely saturated, but needs at least one argument. A functional UCI is [+*resource-sensitive*], if it consumes its argument instead of passing it back unmodified. Let us

TABLE 2.1 Types of expressives

	f	*2d*	*rs*
isolated expletive UCIs	–	–	
isolated mixed UCIs	–	+	
functional UCIs, expletive	+	–	–
shunting	+	–	+
functional mixed UCIs	+	+	

walk through the five types of UCI defined by these features and check how they can be modeled by $\mathcal{L}_{\mathrm{CI}}$.

3.3.1.1 Isolated expletive UCIs in $\mathcal{L}_{\mathrm{CI}}$ The most simple types of UCI are isolated expletives, as they show no interaction with any other linguistic material whatsoever. Interjections are typical examples of isolated expletives, as they express fully saturated use conditions on their own without the need for further semantic composition. Their isolated status is illustrated by the fact that speakers use different ways of connecting an interjection when writing. The following Google examples show the range of realizations. Of course, bare *ouch*-utterances as in (3.34f) are also possible.

(3.34)
a. **Ouch!** I've been stung by a fire ant.
b. **Ouch!** … I've just been stung by a wasp.
c. **Ouch,** I just burnt my tongue.
d. **Ouch…** I broke my leg today.
e. **Ouch**—I got bit! HARD!
f. **Ouch!**

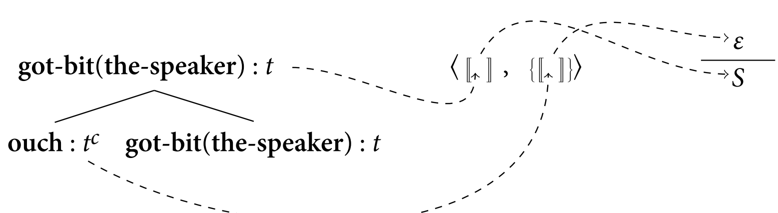
The way in which isolated expletives interact or, more precisely, do not interact, with the rest of the sentence is illustrated by the following schema which I repeat here from Chapter 2:

(2.58) *Schema for isolated expletives*

$$S[\ldots \varepsilon \ldots] = \frac{\varepsilon}{S}$$

What takes care of isolated expletive UCIs in $\mathcal{L}_{\mathrm{CI}}$ is of course the tree-admissibility condition for isolated CIs given in (3.21) on page 55. This rule keeps the saturated expressive content away from the descriptive content. A partial parsetree for (3.34e), for instance, looks as follows:

(3.35)



Parsetree interpretation ensures that the at-issue expression at the root node of the tree and the isolated CI expression end up at the appropriate dimension in the interpretation. The tree-admissibility condition for isolated CIs therefore directly accounts for the (non-)combinatorics of isolated UCIs.

There is one exception that $\mathcal{L}_{\text{CI}}$ cannot deal with. This exception is noted by McCready (2010: 31–2) for his extension of $\mathcal{L}_{\text{CI}}$, but it is also true of Potts's original logic. Consider an utterance that consists of just a single interjection as in (3.34f). Of course, since **ouch** is an expression of $\mathcal{L}_{\text{CI}}$, the single-noded tree consisting of **ouch** alone will be a well-formed tree for $\mathcal{L}_{\text{CI}}$ (Potts 2005: 222).[11]

(3.37) **ouch** : t^c

However, such a semantic tree cannot be interpreted by parsetree interpretation as stated in (3.32) because it is only defined for trees that have an at-issue expression at their root node. This problem applies to all the complex trees given so far, as (3.32) is unable to assign an interpretation to the nodes at which CI expressions were introduced. Therefore, parsetree interpretation cannot give interpretations to every subtree in a tree containing CI expressions. Furthermore, the problem applies to the mirror situation as well. If a tree does not contain any CI expressions but only at-issue content, the tree is not subject to the rule for parsetree interpretation. A more general definition of parsetree interpretation is therefore needed. I will come back to this issue later, since McCready (2010) provides just such a broadening of parsetree interpretation, at least for the first case.

3.3.1.2 Functional expletive UCIs in $\mathcal{L}_{\text{CI}}$ Functional expletives are UCIs that only contribute use-conditional content, and do nothing to the descriptive dimension of meaning. They are [–*2-dimensional*] like isolated expletives, but are not saturated and come with at least one argument slot to be filled.

(2.59) *Schema for functional expletives*

$$S[\ldots\varepsilon(\alpha)\ldots] = \frac{\varepsilon(\alpha)}{S[\ldots\alpha\ldots]}$$

[11] This is ensured by the last tree-admissibility condition for $\mathcal{L}_{\text{CI}}$, that I have not represented in the main text (Potts 2005: 222):

(3.36) $\alpha : \sigma$ (where $\alpha : \sigma$ is a meaningful expression in $\mathcal{L}_{\text{CI}}$)

The great majority of expressions dealt with in Potts's (2005) book belong to this class as well as many German modal particles, which I will deal with in Chapter 6.

(3.38) Webster schläft **ja**.
Webster sleeps MP
'(As you may know) Webster sleeps.' (Kratzer 1999: 4)

The contribution of *ja* is that it takes the propositional descriptive content that Webster sleeps as an argument and expresses the use-conditional speaker attitude that the hearer may already know that Webster sleeps. What is important is that the application of *ja* to its propositional argument returns the proposition unmodified. It does not affect the descriptive content at all. That is, the use-conditional content of *ja* combines with its argument in a way that is [−*resource-sensitive*].

Since functional expletives are the primary phenomena $\mathcal{L}_{\mathrm{CI}}$ is designed to deal with, it is no wonder that $\mathcal{L}_{\mathrm{CI}}$ can directly account for them by the tree-admissibility condition for CI application, the most important innovation of the logic.

(3.39)

$$\begin{array}{c} \mathbf{sleeps(webster)} : \langle s, t\rangle \\ \bullet \\ \mathbf{ja(sleeps(webster))} : \langle s, t^c\rangle \\ \mathbf{ja} : \langle\langle s, t\rangle, \langle s, t^c\rangle\rangle \qquad \mathbf{sleeps(webster)} : \langle s, t\rangle \end{array} \qquad \frac{\varepsilon(\alpha)}{S[\ldots\alpha\ldots]}$$

That is, functional expletive UCIs receive a straightforward analysis in $\mathcal{L}_{\mathrm{CI}}$.

3.3.1.3 Functional shunting UCIs in $\mathcal{L}_{\mathrm{CI}}$ Like their expletive counterparts, functional shunting UCIs are [+*functional*] and need at least one argument to unfold their use-conditional meaning. They are also [−2-*dimensional*], as they do not introduce content into both dimensions of meaning. However, in contrast to functional expletives, shunting UCIs respect resource-sensitivity and do not return their arguments, but "shunt" them into the use-conditional dimension. That means that the argument of a shunting UCI is not represented any more in the truth-conditional layer. Schema (2.60), which I repeat here, illustrates this.

(2.60) *Schema for functional shunting UCIs*

$$S[\ldots\varepsilon(\alpha)\ldots] = \frac{\varepsilon(\alpha)}{S}$$

As an example, McCready (2010: § 3.3) presents the case of the sentential adverb *yokumo* in Japanese. Glossing over some of the detail of the complex lexical meaning of this expression, the basic idea is that *yokumo* takes a (truth-conditional) proposition as its argument and expresses a speaker's attitude of surprise and negative evaluation.

(3.40) **Yokumo** Dallas to kekkon shita na!
yokumo Dallas with marry did PT
'He did an amazingly stupid and shocking thing by marrying Dallas!'
(McCready 2010: 40)

What is crucial is that an utterance of (3.40) does not have any at-issue content, since it is taken to the use-conditional dimension by *yokumo*, without copying it into the descriptive layer. This can be witnessed by the fact that (3.40) cannot directly be denied, which would be expected if it had at-issue content. That is, answering (3.40) with (3.41a) or (3.41b) is impossible (McCready 2010: 40):

(3.41) a. #sore-wa hontoo janai
that-TOP *truth* COP.NEG
'That's not true.'

b. #uso da
lie COP
'That's a lie!'

Informally, the contribution by *yokumo* can be rendered as in (3.42). Since it takes the entire proposition as its argument (which corresponds to the *S* in the schematic illustration above), nothing is left in the truth-conditional layer.[12]

(3.42) $yokumo(p) = \dfrac{\mathbf{bad}(p) \wedge \mathbf{surprise}(p)}{\varnothing}$

Can a shunting UCI like *yokumo* be dealt with by $\mathcal{L}_{\mathrm{CI}}$? The answer is that it certainly cannot. To see why, start by considering how it should be typed in $\mathcal{L}_{\mathrm{CI}}$. Since *yokumo* contributes non-at-issue content, it is clear that it should be analysed as a CI expression, and being a function on propositions, it must be of type $\langle\langle s,t\rangle, \langle s,t^c\rangle\rangle$. Now consider what

[12] Since I am not interested in the particular lexical semantics of the negative attitude, I just represent it here by the generic constant **bad**, which I will use for both use-conditional propositional attitudes and for type $\langle e,u\rangle$ expressives.

happens when *yokumo* is applied to its propositional argument. Since it is a CI expression, the responsible tree-admissibility condition is again CI application:[13]

(3.43)
$$\begin{array}{c} p : \langle s, t \rangle \\ \bullet \\ \textbf{yokumo} : \langle s, t^c \rangle \\ \diagup \qquad \diagdown \\ \textbf{yokumo} : \langle \langle s, t \rangle , \langle s, t^c \rangle \rangle \qquad p : \langle s, t \rangle \end{array}$$

The problem is that CI application is the only sensible way in which an expression of type $\langle \langle s, t \rangle , \langle s, t^c \rangle \rangle$—or any expression of type $\langle \sigma , \tau^c \rangle$ for that matter—can be combined with its argument. But as we have seen, the special property of CI application is that it is not resource-sensitive. It always gives back the argument. In case of *yokumo*, this means that its propositional argument would still be represented in the truth-conditional dimension of meaning, which is not what we are after. While the non-resource-sensitivity of CI application makes it an ideal rule to deal with functional expletives, it makes it likewise inadequate for an analysis of shunting UCIs, whose special feature is precisely that they are [+*resource-sensitive*]. For this reason, shunting UCIs cannot be accounted for by $\mathcal{L}_{\mathrm{CI}}$.[14]

3.3.1.4 Isolated mixed UCIs in $\mathcal{L}_{\mathrm{CI}}$ Isolated mixed expressives are [–*functional*] like isolated expletives. However, only their expressive content is isolated and does not interact with any other content. In contrast to isolated expletives, isolated mixed UCIs are [+2-*dimensional*] as they also contribute descriptive content which, of course, may interact with other descriptive content, for instance, by taking an argument.

[13] To illustrate the problem, I just use p for the propositional argument.

[14] In §3.2.2, I noted that the rule for feature semantics (3.25) introduces a resource-sensitive way of combining CI expressions with at-issue arguments. This would make an analysis like the following possible:

(3.44)
$$\begin{array}{c} \textbf{yokumo}(p) : \langle s, t \rangle^c \\ | \\ p : \langle s, t \rangle \end{array}$$

However, this would be quite ad hoc, as there is no way in which *yokumo*, an adverbial, could reasonably be regarded as a *feature* of the sentence. Furthermore, feature semantics, stated as liberally as in (3.25), comes with more severe problems for $\mathcal{L}_{\mathrm{CI}}$. See the discussion p. 58–9.

(2.61) *Schema for isolated mixed UCIs*

$$S[\dots\varepsilon(\alpha)\dots] = \frac{\varepsilon_u}{S[\dots\varepsilon_t(\alpha)\dots]}$$

In §2.2.1, I discussed ethnic slurs as an example of isolated mixed UCIs. They express a fully saturated racist attitude on their own, while simultaneously predicating the slur's non-racist counterpart at the at-issue dimension.

(3.45) Piet is a **Kraut** $= \dfrac{\text{Generally, I don't like Germans}}{\text{Piet is German}}$

How does $\mathcal{L}_{\mathrm{CI}}$ account for such expressives? A quick answer would be that it does not. Recall that one of Potts's (2005: 7) main claims is the prohibition against mixed content (3.13) that says that an expression either conveys truth-conditional or use-conditional meaning, but never both. Mixed UCIs are not designated in $\mathcal{L}_{\mathrm{CI}}$. However, ethnic slurs and many other colored expressions seem to be perfect examples of mixed content (cf. Gutzmann 2011a; Kubota and Uegaki 2011; McCready 2010, for further examples and discussion).

Nevertheless, one way to provide some kind of analysis of mixed expressives in $\mathcal{L}_{\mathrm{CI}}$ is to stipulate the lexical decomposition of mixed expressive items, as discussed (and rejected) by McCready (2010). Under this view, the descriptive and expressive meanings are introduced at different nodes of the semantic parsetree, so that the rule of $\mathcal{L}_{\mathrm{CI}}$ could deliver the right composition. In order for this to work, we have to stipulate that the expressive component takes precedence (McCready 2010: 24) and that in the case of pejoratives, the expressive component takes the descriptive part as its argument (McCready 2010: 16):

(3.46)

$$\mathbf{german}(\mathbf{piet})$$

$$\mathbf{piet} : e \qquad \lambda x.\mathbf{german}(x) : \langle e, t\rangle$$

$$\bullet$$

$$\mathbf{bad}({}^{\cap}\mathbf{german}) : t^c$$

$$\lambda x.\mathbf{german}(x) : \langle e, t\rangle \qquad \lambda P.\mathbf{bad}({}^{\cap}P) : \langle\langle e, t\rangle, t^c\rangle$$

However, such a decomposition seems to be very ad hoc, a conclusion also drawn by McCready. That is not to say, however, that there are no cases of mixed content that cannot plausibly be accounted for by a decompositional approach. In the realm of expressive morphology, discussed for instance by Fortin (2011), there are suffixes that could plausibly be argued to form mixed expressive items and could be taken to decorate their own node in the parsetree, even if they are not independent words, but bound morphemes. In the case of pejoratives like *Kraut*, however, the only motivation for such a decomposition would be to keep the type system of $\mathcal{L}_{\mathrm{CI}}$ and its modes of composition as they are.

In contrast to functional mixed UCIs (to be discussed next) however, there is a way to analyse *isolated* mixed UCIs after all, at least for some kinds like the ethnic slurs we are currently dealing with. This way is more true to the isolated nature of the expressive component of these expressions. If we just assumed that the negative attitude of *Kraut* is already specified towards Germans, then it would be possible to translate *Kraut* directly into a "dot"-expression of $\mathcal{L}_{\mathrm{CI}}$ whose use-conditional part expresses a CI proposition without taking its own descriptive content as argument:

(3.47) *Kraut* $\rightsquigarrow$ $\begin{array}{c} \lambda x.\mathbf{german}(x) : \langle e, t\rangle \\ \bullet \\ \mathbf{bad}({}^{\cap}\mathbf{german}) : t^{c} \end{array}$

With such a lexical entry for *Kraut*, the following semantic parsetree can be derived, making use only of the tree-admissibility condition for the $\mathcal{L}_{\mathrm{CI}}$-version of functional application (3.14), which allows for optional independent CI content dangling at the daughter nodes of the application.[15]

(3.49)

$\mathbf{german}(\mathbf{piet}) : t$

$\mathbf{piet} : e$ $\quad$ $\begin{array}{c} \lambda x.\mathbf{german}(x) : \langle e, t\rangle \\ \bullet \\ \mathbf{bad}({}^{\cap}\mathbf{german}) : t^{c} \end{array}$

$\dfrac{\text{Generally, I don't like Germans}}{\text{Piet is a German}}$

[15] However, in order for this to be licensed, the tree-admissibility condition for lexical insertion—as reproduced in footnote 11 on p. 65 —must be modified to allow for the insertion of dot-objects as well:

(3.48) $\begin{array}{c} \alpha : \sigma \\ | \\ \alpha : \sigma \\ \bullet \\ \boxed{\gamma : \rho^{c}} \end{array}$

This delivers the desired two-dimensional interpretation without introducing the meaning dimensions of *Kraut* at two distinct nodes of the parsetree. However, it must be noted that Potts (2005: 84) explicitly excludes lexical expressions such as (3.47) that already come equipped with two independent meaning dimensions. In the official version of $\mathcal{L}_{\text{CI}}$, isolated mixed UCIs cannot therefore be properly dealt with.

3.3.1.5 Functional mixed UCIs Functional mixed UCIs, the last of the five types, are [+2-*dimensional*] as well as [+*functional*]. That is, they contribute both truth-conditional and use-conditional meaning and both dimensions are functions seeking (at least) one argument.

(2.62) *Schema for functional mixed UCIs*

$$S[\dots\varepsilon(\alpha)\dots] = \frac{\varepsilon_u(\alpha)}{S[\dots\varepsilon_t(\alpha)\dots]}$$

A typical class of functional mixed UCI is afforded by honorific verbs like Japanese *irassharu* 'come.HON' which are "instances of mixed content which are predicative in both dimensions of meaning" (McCready 2010: 17).

(3.50) sensei-ga **irasshaimasi**-ta
teacher-NOM *came*.HON-PST
'The teacher came (the teacher is being honored)'

In the descriptive meaning dimension, *irassharu* states that the teacher came, while in the use-conditional dimension it displays that the teacher is honored. Informally:

(3.51) $$\text{irassharu(the teacher)} = \frac{\text{honored(the teacher)}}{\text{came(the teacher)}}$$

For an analysis of functional mixed UCIs within $\mathcal{L}_{\text{CI}}$, the same holds as for functional expletives. The type system of the logic does not license a mixed functional UCI like *irassharu* to be translated into $\mathcal{L}_{\text{CI}}$ as a single expression. This is due to the prohibition against mixed content—see (3.13) on page 50—that is directly built into the core of the semantic system. There is no way to combine both dimensions of *irassharu* at a single node without the expressive component being lost for further composition. For illustration, let us assume that *irassharu* is translated into a dot-expression of $\mathcal{L}_{\text{CI}}$, as for *Kraut* in (3.47):

(3.52) *irassharu* $\rightsquigarrow$ $$\begin{array}{c} \lambda x.\mathbf{come}(x) : \langle e, t\rangle \\ \bullet \\ \lambda x.\mathbf{honor}(x)(\mathbf{the\text{-}speaker}) : \langle e, t^c\rangle \end{array}$$

Such a translation would capture the intuition that *irassharu* independently makes two different contributions to each level of meaning. However, the rules of $\mathcal{L}_{\mathrm{CI}}$ include no possibility of letting the expressive component take part in any derivation. The only tree that can be built from (3.52) using just the tree-admissibility conditions discussed in §3.2.2 is the following, in which the use-conditional part is left behind and will therefore never be able to find its argument:

(3.53)

$$\mathbf{come}(\iota x.\mathbf{teacher}(x)) : t$$

$$\iota x.\mathbf{teacher}(x) : e \qquad \lambda x.\mathbf{come}(x) : \langle e, t\rangle$$

$$\bullet$$

$$\lambda x.\mathbf{honor}(x)(\mathbf{the\text{-}speaker}) : \langle e, t^c\rangle$$

Besides a stipulated decomposition-based analysis, functional mixed UCIs therefore cannot be satisfactorily accounted for under $\mathcal{L}_{\mathrm{CI}}$.

Table 3.2 summarizes the discussion of the types of UCIs that $\mathcal{L}_{\mathrm{CI}}$ can handle. Two of the three kinds of non-mixed UCIs receive a natural representation within $\mathcal{L}_{\mathrm{CI}}$. This is of course no surprise, since $\mathcal{L}_{\mathrm{CI}}$ was developed with these types of UCI in mind. Functional shunting UCIs, however, cannot be dealt with by the combinatoric devices of $\mathcal{L}_{\mathrm{CI}}$. The reason is that, in $\mathcal{L}_{\mathrm{CI}}$, non-at-issue content always combines non-resource-sensitively, whereas the crucial thing about shunting UCIs is that they are resource-sensitive and do not return their descriptive argument. The two kinds of mixed UCIs also pose puzzles for $\mathcal{L}_{\mathrm{CI}}$. This of course comes as no surprise either, since $\mathcal{L}_{\mathrm{CI}}$ implements Potts's

TABLE 3.2 Types of UCIs accounted for by $\mathcal{L}_{\mathrm{CI}}$

isolated expletive UCIs	✓
isolated mixed UCIs	✗[16]
functional UCIs, expletive	✓
shunting	✗
functional mixed UCIs	✗

[16] In the official version of $\mathcal{L}_{\mathrm{CI}}$, isolated mixed UCIs cannot be dealt with, since Potts (2005: 84) rejects the possibility of expressions that lexically contain an attached CI proposition. However, this could easily be fixed without changing much of the logic.

(2005) main claim—which I have called the prohibition against mixed content (3.13)—that "[n]o lexical item contributes both an at-issue and a CI meaning." While isolated mixed UCIs can be assigned a proper representation, if we allow lexical entries containing dotted objects, the functional variety of mixed content cannot be analysed in any well-motivated way. Accounting for these as well is the main motivation behind McCready's (2010) extension of $\mathcal{L}_{CI}$, which I will discuss in §3.4. Before that, let us consider some further cases that prove to be problematic for $\mathcal{L}_{CI}$.

3.3.2 Use-conditional modifiers

Mixed content is not the only gap volitionally built into the logical core of Potts's semantics. An additional gap concerns the question of what kinds of arguments expressives can take. This gap can be read off from the recursive type definition given in (3.4) on page 47 or Table 3.1 on page 48 which illustrates that only two of the four possible combinations of CI and at-issue types are licensed in $\mathcal{L}_{CI}$. Complex expressions can have a CI expression in their range, but they must not have one in their domain. Accordingly, there are no expressions that take use-conditional content as an argument.

This prohibition against CI arguments (3.8) prohibits expressions that map use-conditional content to use-conditional content. That means that $\mathcal{L}_{CI}$ predicts that there are no expressions that may be called *use-conditional modifiers*.[17] That is, according to (3.8), there should be no expressions that somehow modify or alter use-conditional content, for example by strengthening it.

As already argued by Geurts (2007), I think that this claim is not warranted by the empirical data. *Prima facie*, the expressive adjective *fucking* in (3.54a) modifies the expressive epithet *bastard*, and *holy* modifies the expressive noun *shit* in (3.54b). Furthermore, *fucking* itself is modified by *really* in (3.54c).

(3.54) *Use-conditional modifiers*
   a. That **fucking** bastard Burns got promoted!
   b. **Holy** shit, my bike tire is flat again!
   c. I feel **really** fucking brilliant.

[17] I suggested the term *expressive modifiers* in Gutzmann (2011a), from which much of the following discussion is drawn.

The intuitive semantic structure for a sentence like *fucking bastard Burns* is one in which *fucking* modifies *bastard*.

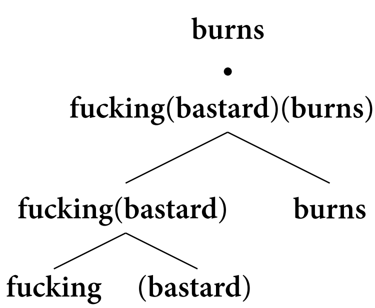
(3.55) *Intuitive structure* (cf. Geurts 2007)
That (fucking(bastard))(Burns) got promoted!

However, such a structure is not possible in $\mathcal{L}_{\text{CI}}$, since *fucking* cannot modify *bastard* directly, because in order to do so, it would have to have a CI type in its domain which is not defined in the type system of $\mathcal{L}_{\text{CI}}$ in the first place. Therefore, Potts (2007a,b) suggests a workaround to solve the problem raised by cases like these for his type definition. Instead of assigning an intuitive structure like (3.55) to (3.54a), Potts in (2007a,b) presents an analysis along the lines of (3.56), where each expressive item applies to *Burns* one after the other.

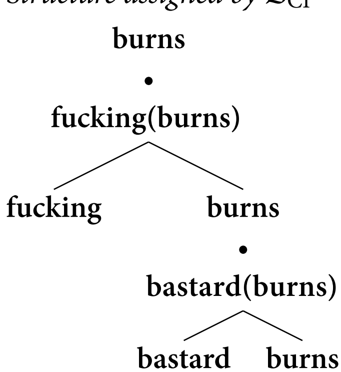
(3.56) *Structure assigned by* $\mathcal{L}_{\text{CI}}$
That fucking(Burns) • bastard(Burns) got promoted!

That is, they are treated like non-restrictive modifiers on the same argument instead of one (complex) expressive that is derived from an expression modifying an expressive item.

(3.57) *Intuitive structure*



(3.58) *Structure assigned by* $\mathcal{L}_{\text{CI}}$



Potts (2007b) then defines the meaning of expressive items in such a way that it somehow models the superficial observation that *fucking* intensifies the expressive meaning of *bastard*.[18] However, there are some problems with this way of handling use-conditional modifiers. First, Potts has to resort to purely syntactic arguments to explain why the linearization in (3.59) is not possible.

(3.59) *That bastard fucking Burns got promoted!

This is of course not such a big problem. More problematic are cases like (3.54b) in which a treatment along the lines of (3.58) seems highly implausible. In the case of *fucking bastard Burns*, each expressive could be dropped, so it could at least be argued that, in the semantics, both expressives are modifying **burns**. However, this does not hold for *holy shit* because only *holy* may be dropped but not *shit*.

(3.60) a. Shit, my bike tire is flat again!
b. *Holy, my bike tire is flat again!

Even if it is clear from a syntactic point of view why *holy* cannot modify a sentence—it is an adjective, not a sentence adverb—according to an analysis within $\mathcal{L}_{\text{CI}}$, it still needs a propositional argument in the semantics and therefore should be expected to be possible in (3.60b).

Further examples of this kind are provided in constructions that include intensifiers like *totally* or German *voll* 'totally' (Gutzmann and Turgay 2012, 2015; McCready and Schwager 2009) that obviously modify the expressive itself and, crucially, not the noun that in turn is modified by the expressive:

(3.61) a. That **total** bastard Burns got promoted!
b. *That **total** Burns got promoted!

(3.62) a. Dieser **voll** bescheuerte Peter ist zu spät!
this totally daft Peter is too late
'That totally daft Peter is too late!'

b. *Dieser **voll** Peter ist zu spät!
that totally Peter is too late

A further argument for a structure like (3.57), in which the use-conditional modifiers are modifying the expressive, is provided by overt case marking in languages like German:

[18] See the discussion of Potts (2007b) in Gutzmann (2012: §3.3.1).

(3.63) a. Verdammt-**e** Scheiße, mein Fahrrad hat einen Platten!
damn-FEM *shit*.FEM *my bike has a flat*
'Damn shit, my bike tire is flat!'

b. Verdammt-**er** Mist, mein Fahrrad hat einen Platten!
damn-MASC *crap*.MASC *my bike has a flat*
'Damn shit, my bike tire is flat!'

c. Verdammt-Ø, mein Fahrrad hat einen Platten!
damn my bike has a flat
'Damn, my bike tire is flat!'

Depending on the gender of the expressive that is modified, the expressive adjective *verdammt* 'damn' shows different inflection, since German shows gender agreement within the NP. Accordingly, *verdammt* is inflected differently when combined with the female *Scheiße* 'shit' than when it modifies the masculine *Mist* 'crap'. This could not be easily explained in a structure in which *verdammt* 'damn' also modified the proposition that the speaker's bike tire is flat instead of the expressive. Furthermore, if *verdammt* really applied to the proposition, it should appear as an uninflected adverb, as in (3.63c) where it is used without any other expressive and comments on the proposition itself.

A third argument based on inflectional data is provided by the following example. If *verdammt* 'damn' were a modifier of *Peter*, it should show masculine gender marking. However, it agrees with the neuter *Arschloch* 'asshole'.

(3.64) a. Das verdammt-**e** Arschloch Peter hat mich abgezockt!
the damn-NEUT *asshole*.NEUT *Peter*.MASC *has me off-ripped*
'That damn asshole Peter ripped me off!'

b. *Das verdammt-**er** Arschloch Peter hat mich abgezockt!
the damn-MASC *asshole*.NEUT *Peter*.MASC *has me off-ripped*

It is hard to see how the $\mathcal{L}_{CI}$ analysis can account for these data without stipulating a disconnection between their syntax and semantics. Such a move would, however, not be well-supported, since the syntactic data are completely regular if one assumes that the expressions in question are treated as use-conditional modifiers. Therefore, I take the existence of use-conditional modifiers to be empirically well supported.

3.3.3 Abstraction problem

Beside the types of UCIs that cannot be analysed adequately by $\mathcal{L}_{\text{CI}}$, there is an additional problem in $\mathcal{L}_{\text{CI}}$ that has its origin in the isolating character of CI application. Even if $\mathcal{L}_{\text{CI}}$ allows lambda-abstraction from variables in CI expressions, this abstraction cannot actually be used during a semantic derivation when CI expressions are involved. But sometimes, one needs to apply an argument to a function only to abstract from it later.[19] This is, however, impossible to do in $\mathcal{L}_{\text{CI}}$. Suppose that we want to have something like the following structure:

(3.65) $[\lambda x\, [\mathbf{damn}\ x]]$

If we draw the actual parsetree for such a structure, we arrive at a configuration in which the variable fed into the CI function expressed by *damn* cannot be bound by the higher lambda-operator; only the variable that is returned after the application gets bound, so the at-issue expression at the top node becomes an identity function:

(3.66)

$$\lambda x.x : \langle e, e\rangle$$

$$\lambda x \qquad x$$

$$\bullet$$

$$\mathbf{damn}(x) : t^c$$

$$\mathbf{damn} : \langle e, t^c\rangle \qquad x$$

This is, of course, not what we are after. It is hard to come up with concrete examples in which such a configuration would be needed. However, this is only the case for functional expletives. With functional mixed UCIs, it is relatively easy to find instances in which you want to abstract from a variable that has been fed into the CI function. I will discuss such cases later, when I am evaluating McCready's (2010) logic in §3.5.3, because in contrast to $\mathcal{L}_{\text{CI}}$, mixed UCIs are allowed in his system.

[19] Quantifiers raising or some instance of overt movement are cases where a combination of application and abstraction may be needed (Heim and Kratzer 1998).

3.3.4 Summary of the assessment of $\mathcal{L}_{CI}$

Even if $\mathcal{L}_{\mathrm{CI}}$ offers adequate tools to deal with a huge range of phenomena, I have pointed out various gaps in its scope in this assessment. Besides the fact that $\mathcal{L}_{\mathrm{CI}}$ cannot deal with all kinds of UCIs—see Table 3.2 on page 72 for an overview—the foregoing discussion has revealed further problems for $\mathcal{L}_{\mathrm{CI}}$. The majority of these restrictions of $\mathcal{L}_{\mathrm{CI}}$'s reach are built into the core of the logic. It is either the asymmetric type definition that does not allow for CI arguments, or the fact that the combination of CI content with descriptive material is always isolating with respect to the CI content and non-resource-sensitive with regards to the descriptive content that precludes the discussed phenomena from being analysed adequately by $\mathcal{L}_{\mathrm{CI}}$. Therefore, I will now turn to McCready's (2010) modification of Potts's logic to show how he extends it in order to approach the phenomena that proved problematic for the original version of $\mathcal{L}_{\mathrm{CI}}$.

3.4 $\mathcal{L}^{+}_{\mathrm{CI}}$—Accounting for mixed content

In an innovative paper, Eric McCready (2010) provides an extension of $\mathcal{L}_{\mathrm{CI}}$ that is capable of dealing with those 'varieties of conventional implicature' and use-conditional content which cannot be addressed properly by $\mathcal{L}_{\mathrm{CI}}$. The logic $\mathcal{L}^{+}_{\mathrm{CI}}$, as McCready labels the extension of Potts's (2005) logic, is a conservative modification of $\mathcal{L}_{\mathrm{CI}}$, as it extends it only by adding new types and corresponding derivation rules, accompanied by a slight modification of the mechanism of parsetree interpretation that adapts it to the new types. The core ideas of $\mathcal{L}_{\mathrm{CI}}$—namely, isolating composition rules for use-conditional content as well as parsetree interpretation—are left intact and $\mathcal{L}^{+}_{\mathrm{CI}}$ can therefore be viewed as a more liberal variant of $\mathcal{L}_{\mathrm{CI}}$. In the following, I will first outline $\mathcal{L}^{+}_{\mathrm{CI}}$, before testing whether it can fill in the gaps we found in $\mathcal{L}_{\mathrm{CI}}$.

3.4.1 From trees to proofs

Before I present McCready's (2010) logic $\mathcal{L}^{+}_{\mathrm{CI}}$ and illustrate how it can deal with the phenomena discussed in the last section, I will briefly introduce the format that McCready uses for $\mathcal{L}^{+}_{\mathrm{CI}}$. In contrast to the tree notation employed in Potts (2005) and my discussion of it, McCready employs a proof-style notation. This notation is primarily used in various sorts of categorial and type-logical grammar, since such frameworks are often built around the idea that the derivation of grammatical sentences in a language can be represented by the deduction rules of a logical system ("parsing as deduction").[20] While semantic trees and proofs conceptually and philosophically do not always amount to the same, I follow McCready (2010) here and assume they are just notational variants. The basic idea is that you have an expression (the "conclusion") to be proved at the bottom and, on top of it, the expressions from which the expression can be deduced (the "premises", which can sometimes be empty). This resembles a logical deduction, like, for instance, *modus ponens*:

(3.67) $$\frac{p \rightarrow q \qquad p}{q} \qquad\qquad \frac{\text{If the sun shines, Peter is happy.} \qquad \text{The sun shines.}}{\text{Peter is happy.}}$$

Applying this to linguistic expressions, we can for instance derive that **run**(**peter**) is a grammatical expression of type t on the basis of the premises that **peter** : e and **run** : $\langle e, t\rangle$ are grammatical expressions. This is, of course, the common derivation rule for functional application.[21]

(3.68) $$\frac{\mathbf{run} : \langle e, t\rangle \qquad \mathbf{peter} : e}{\mathbf{run}(\mathbf{peter}) : t}\,\mathrm{Fa}$$

Given this way of representing the combinatoric system, McCready recasts Potts's original tree-admissibility conditions as inference rules in a proof system, as presented in Figure 3.1 (overleaf). While McCready (2010: 13) simply numbers his rules of proof from (R1) to (R6), I prefer to give them more descriptive labels. Since, in some minor respects, McCready's (2010) representation goes beyond being a notational variant of $\mathcal{L}_{\mathrm{CI}}$, and since my re-representation in turn deviates slightly from his, a few remarks are in order.

The axiom (Lx)—which is surprisingly missing in McCready 2010—is a rule for lexical insertion and corresponds to Potts's (2005: 222) tree-admissibility condition "(A.13)", which I mentioned briefly in footnote 11 above. It licenses the introduction of a lexical expression into a derivation from an empty set of premises. This is crucial since only

[20] For various overviews and expositions, see e.g. Carpenter (1997); Moortgat (1997); Morrill (2011); Steedman (2000). The first chapter of Jäger (2005) provides a concise introduction to type-logical grammars.

[21] There is a deep connection between proofs and the typed lambda-calculus, the so-called Curry–Howard isomorphism. For instance, functional types $\langle\sigma, \tau\rangle$ correspond to logical implication $\sigma \rightarrow \tau$, and, accordingly, functional application as in (3.68) is connected with implication elimination (*modus ponens*) as in (3.67). See e.g. van Benthem 1986.

(Lx) $\dfrac{}{\alpha : \sigma}$ Lex

(α is a lexical expression)

(Fs) $\dfrac{\alpha : \sigma}{\beta(\alpha) : \tau}$ Fs

(β is a *feature term* of type $\langle \sigma, \tau \rangle$)

(Id) $\dfrac{\alpha : \sigma}{\alpha : \sigma}$ Id

($\mathcal{E}$a) $\dfrac{\alpha : \langle \sigma^a, \tau^c \rangle \qquad \beta : \sigma^a}{\beta : \sigma^a \bullet \alpha(\beta) : \tau^c}$ $\mathcal{E}$a

(Fa) $\dfrac{\alpha : \langle \sigma^a, \tau^a \rangle \qquad \beta : \sigma^a}{\alpha(\beta) : \tau^a}$ Fa

(Iε) $\dfrac{\beta : \tau^a \qquad \alpha : t^c}{\beta : \tau^a \bullet \alpha : t^c}$ Iε

(Co) $\dfrac{\alpha : \langle \sigma^a, \tau^a \rangle \qquad \beta : \langle \sigma^a, \tau^a \rangle}{\lambda X.\alpha(X) \wedge \beta(X) : \langle \sigma^a, \tau^a \rangle}$ Co

($\mathcal{E}$e) $\dfrac{\beta : \tau^a \bullet \alpha : t^c}{\beta : \tau^a}$ $\mathcal{E}$e

FIGURE 3.1 Rules of proof in $\mathcal{L}_{\text{CI}}$

expressions that can be derived from no premises count as licensed by the logic. However, I will often write the natural language expression for which an $\mathcal{L}_{\text{CI}}$ expression is the translation above the line (instead of an empty premise set) to better illustrate which expression is to be derived. For instance, if **paul** is the translation of *Paul* and $\lambda p.\neg p$ is the translation of the sentential negation, I will write the following:

(3.69) a. $\dfrac{\textit{Paul}}{\textbf{paul} : e}$ Lx b. $\dfrac{\textit{not}}{\lambda p.\neg p : \langle t, t \rangle}$ Lx

(Id) is just an identity or reflexion axiom which says that you can derive every expression from itself. The next axiom, (Fa), is ordinary functional application, but restricted to at-issue content, like the tree-admissibility condition (3.14) on page 51. The coordination schema (Co) will not be of much interest in the following and corresponds to the tree-admissibility condition reproduced in footnote 10. An axiom (Fs) recasts the tree-admissibility condition for feature semantics (3.25) and allows the introduction of a suitable feature expression during the derivation without having it as an explicit premise. ($\mathcal{E}$a) and (Iε)—for expressive application and isolated expressives respectively—correspond to the two crucial tree-admissibility conditions for CI application and isolated CIs as given in (3.17) and (3.21). The rule for isolated expressive content is actually missing in McCready's reconstruction of $\mathcal{L}_{\text{CI}}$. I have added it here for completeness and better comparison. The last axiom—which I have labeled ($\mathcal{E}$e) for *expressive elimination*—is specific to McCready's (2010) reformulation. Its function is to eliminate CIs that have reached propositional status from the premise set. This helps to keep the other proof rules simpler than a direct transfer of Potts's tree-admissibility conditions would do. For instance, a more faithful reconstruction of condition (3.17) for CI application would involve an optional premise that does not play any role in the deduction of the conclusion:

(3.70)
$$\frac{\alpha : \langle \sigma^a, \tau^c \rangle \qquad \beta : \sigma^a \boxed{\bullet\, \delta : \phi^c}}{\beta : \sigma^a \bullet \alpha(\beta) : \tau^c}$$

Axiom ($\mathcal{E}$e) allows us to bypass the need for such CI material that is ignored for the deduction of the conclusion (cf. McCready 2010: fn. 20). Instead, we can arrive at the same conclusion if we strip away the unneeded CI content in the premise set by using ($\mathcal{E}$e) first:

(3.71)
$$\dfrac{\alpha : \langle \sigma^a, \tau^c \rangle \qquad \dfrac{\beta : \sigma^a \bullet \delta : \phi^c}{\beta : \sigma^a}\,\mathcal{E}\mathrm{e}}{\beta : \sigma^a \bullet \alpha(\beta) : \tau^c}\,\mathcal{E}\mathrm{a}$$

Together, these rules can basically derive all structures that constitute well-formed parsetrees in Potts's original formulation of $\mathcal{L}_{\mathrm{CI}}$. The following example shows a complete sample derivation to illustrate the proof-style notation of $\mathcal{L}_{\mathrm{CI}}$:

(3.72)
$$\dfrac{\dfrac{\dfrac{\dfrac{\textit{Ames}}{\textbf{ames} : e}\,\mathrm{Lx} \qquad \dfrac{\dfrac{\textit{a spy}}{\textbf{spy} : \langle e, t \rangle}\,\mathrm{Lx}}{\textbf{comma}(\textbf{spy}) : \langle e, t^c \rangle}\,\mathrm{Fs}}{\textbf{ames} : e \bullet \textbf{comma}(\textbf{spy})(\textbf{ames}) : t^c}\,\mathcal{E}\mathrm{a}}{\textbf{ames} : e}\,\mathcal{E}\mathrm{e} \qquad \dfrac{\textit{is behind bars}}{\textbf{behind-bars} : \langle e, t \rangle}\,\mathrm{Lx}}{\textbf{behind-bars}(\textbf{ames}) : t}\,\mathrm{Fa}$$

3.4.2 New types in $\mathcal{L}_{CI}^{+}$

As shown in the last section, what causes the problems with $\mathcal{L}_{\mathrm{CI}}$ is that it is too strict when it comes to the combinatorics of UCIs, since there is no way around the isolating and non-resource-sensitive composition of expressive application ($\mathcal{E}$a). The solution which McCready (2010) proposes is to introduce a non-isolating and resource-sensitive derivation rule for UCIs, that works just like ordinary functional application. However, just adding such an axiom to $\mathcal{L}_{\mathrm{CI}}$ does not suffice, since the system then can never know which rule applies if a UCI and a descriptive item have to be combined. Therefore McCready (2010) first introduces new designated types that indicate that an expression does not behave like the known expressive items of type σ^c.

(3.73) *Basic types for $\mathcal{L}^+_{CI}$* (cf. McCready 2010: 52–3)
a. e^a, t^a, and s^a are basic at-issue types.
b. e^c, t^c, and s^c are basic CI types.
c. e^s, t^s, and s^s are basic shunting types.
d. Nothing else is a basic type for $\mathcal{L}^+_{\mathrm{CI}}$.

McCready (2010: fn. 52) follows the practice of $\mathcal{L}_{\mathrm{CI}}$ of mirroring not only the basic type t in all three variants, but also types e and s, even though only types t^c and t^s are actually used.

Given these basic types for $\mathcal{L}^+_{\mathrm{CI}}$, the complete recursive type definition for $\mathcal{L}^+_{\mathrm{CI}}$ is given as follows:[22]

(3.74) *Types for $\mathcal{L}^+_{CI}$* (cf. McCready 2010: 52–3)
a. If σ is a basic type for $\mathcal{L}^+_{\mathrm{CI}}$, then σ is a type for $\mathcal{L}^+_{\mathrm{CI}}$.
b. If σ and τ are at-issue types for $\mathcal{L}^+_{\mathrm{CI}}$, then $\langle\sigma,\tau\rangle$ is an at-issue type for $\mathcal{L}^+_{\mathrm{CI}}$.
c. If σ is an at-issue type for $\mathcal{L}^+_{\mathrm{CI}}$ and τ is a CI type for $\mathcal{L}_{\mathrm{CI}}$, then $\langle\sigma,\tau\rangle$ is a CI type for $\mathcal{L}^+_{\mathrm{CI}}$.
d. If σ is an at-issue or shunting type for $\mathcal{L}^+_{\mathrm{CI}}$ and τ is a shunting type for $\mathcal{L}_{\mathrm{CI}}$, then $\langle\sigma,\tau\rangle$ is a shunting type for $\mathcal{L}^+_{\mathrm{CI}}$.
e. If σ is an at-issue type for $\mathcal{L}^+_{\mathrm{CI}}$ and τ is a shunting type for $\mathcal{L}^+_{\mathrm{CI}}$, then $\sigma\times\tau$ is a mixed type.
f. The entire set of types for $\mathcal{L}^+_{\mathrm{CI}}$ is the union of the at-issue, the CI types, the shunting types, and the mixed types.

Clauses of (3.74a)–(3.74c) are just transferred from the type definition of $\mathcal{L}_{\mathrm{CI}}$, as given in (3.4) on page 47. What is new in this definition are the clauses (3.74d) and (3.74e). The first defines how complex types can be built with the new shunting types. As is the case with CI types, the building of complex shunting types allows for functional types from

[22] I should note that the definition in the main text deviates slightly from McCready's (2010: 52–3) definition regarding shunting and mixed types. His original definition reads as given at (3.75) below. The simpler definition given in the main text instead defines essentially the same type space though.

(3.75) a. If σ is an at-issue type for $\mathcal{L}^+_{\mathrm{CI}}$ and τ is a shunting type for $\mathcal{L}_{\mathrm{CI}}$, then $\langle\sigma,\tau\rangle$ is a shunting type for $\mathcal{L}^+_{\mathrm{CI}}$.
b. If σ is a shunting type for $\mathcal{L}^+_{\mathrm{CI}}$ and τ is a shunting type for $\mathcal{L}_{\mathrm{CI}}$, then $\langle\sigma,\tau\rangle$ is a shunting type for $\mathcal{L}^+_{\mathrm{CI}}$.
c. If σ and τ are at-issue types for $\mathcal{L}^+_{\mathrm{CI}}$, and ζ and υ are shunting types for $\mathcal{L}^+_{\mathrm{CI}}$, then $\sigma\times\zeta$, $\langle\sigma,\tau\rangle\times\zeta$, $\sigma\times\langle\tau,\zeta\rangle$, and $\sigma\times\langle\zeta,\upsilon\rangle$ are mixed types for $\mathcal{L}_{\mathrm{CI}}$.
d. If σ,τ and ζ are at-issue types for $\mathcal{L}^+_{\mathrm{CI}}$ and υ is a shunting type for $\mathcal{L}^+_{\mathrm{CI}}$, then $\langle\sigma,\tau\rangle\times\langle\zeta,\upsilon\rangle$ is a mixed type for $\mathcal{L}^+_{\mathrm{CI}}$.

$$(\mathcal{S}\text{a}) \quad \frac{\alpha : \langle \sigma^{x}, \tau^{s} \rangle \qquad \beta : \sigma^{x}}{\alpha(\beta) : \tau^{s}}\, \mathcal{S}\text{a} \quad \text{where } x \in \{a, s\}$$

$$(\mathcal{M}\text{a}) \quad \frac{\alpha \blacklozenge \beta : \langle \sigma^{a}, \tau^{a} \rangle \times \langle \sigma^{a}, \upsilon^{s} \rangle \qquad \gamma : \sigma^{a}}{\alpha(\gamma) \blacklozenge \beta(\gamma) : \tau^{a} \times \upsilon^{s}}\, \mathcal{M}\text{a} \qquad (\mathcal{S}\text{e}) \quad \frac{\alpha \blacklozenge \beta : \sigma^{a} \times t^{s}}{\alpha : \sigma^{a} \bullet \beta : t^{c}}\, \mathcal{S}\text{e}$$

FIGURE 3.2 Additional rules of proof for $\mathcal{L}_{\mathrm{CI}}^{+}$

at-issue into shunting types but not vice versa. In contrast to CI types, however, complex shunting types that map shunting types onto shunting types are licensed by the definition. As we will see, shunting types are used to enable the resource-sensitive combination of expressive content with its arguments. The second innovation in (3.74) is given by (3.74e), defining mixed types, which are basically Cartesian-product types. Mixed types are always built from at-issue and shunting types.

3.4.3 New rules of proof in $\mathcal{L}_{CI}^{+}$

We can now define new rules of proof for $\mathcal{L}_{\mathrm{CI}}^{+}$ that make use of the newly available types in order to account for the phenomena that came out as problematic for $\mathcal{L}_{\mathrm{CI}}$. The full set of axiomatic rules of proof for $\mathcal{L}_{\mathrm{CI}}^{+}$ includes the set of rules for $\mathcal{L}_{\mathrm{CI}}$ as displayed in Figure 3.1 on page 80 as well as the three additional ones in Figure 3.2 above that make use of the $\mathcal{L}_{\mathrm{CI}}^{+}$-specific types.

Axiom ($\mathcal{S}$a)—which I call *shunting application*—is standard functional application defined for the application of a shunting expression to an argument. This is the rule alluded to above. Since shunting types are used for use-conditional content like CI types, the distinction between these two types makes it possible to have two modes of composition for use-conditional content. While CI-type UCIs compose non-resource-sensitively with their arguments, and are isolated according to ($\mathcal{E}$a), their shunting relatives compose in a more conservative, that is, non-isolating and resource-sensitive manner. And since this difference is dictated by the types, it boils down to a lexical distinction whether a UCI is resource-sensitive or not. As will become clear, the distinction between the *c*- and the *s*-types accounts for the differences between functional expletive UCIs and functional shunting UCIs.

Since ($\mathcal{S}$a) allows use-conditional content to consume its argument, it allows sentences that totally lack at-issue content at the conclusion of the derivation and instead have only a shunting expression as their main content. The following schematic configuration illustrates this (McCready 2010: 31):

(3.76)
$$\dfrac{\dfrac{}{\beta : \tau^{a}}\,\text{Lx} \qquad \dfrac{\dfrac{}{\alpha : \sigma^{a}}\,\text{Lx} \qquad \dfrac{}{\gamma : \langle \sigma^{a}, \langle \tau^{a}, \upsilon^{s}\rangle\rangle}\,\text{Lx}}{\gamma(\alpha) : \langle \tau, \upsilon^{s}\rangle}\,\mathcal{S}\text{a}}{\gamma(\alpha)(\beta) : \upsilon^{s}}\,\mathcal{S}\text{a}$$

As an example of such a constellation, McCready (2010: 36) discusses cases in which sentence-final *man* enforces the expressive speech act conveyed by an interjection like *ouch*.

(3.77) Ouch, man! (McCready 2010: 35)

If we assume that *ouch* directly expresses propositional use-conditional content and that this is of type t^s, we can assign a functional shunting type to *man* in order to derive the sentence.[23]

(3.78)
$$\dfrac{\dfrac{\textit{Ouch}}{\textbf{ouch} : t^{s}}\,\text{Lx} \qquad \dfrac{\textit{man}}{\textbf{man} : \langle t^{s}, t^{s}\rangle}\,\text{Lx}}{\textbf{man}(\textbf{ouch}) : t^{s}}\,\mathcal{S}\text{a}$$

The second new axiom is the one for what I call *mixed application* ($\mathcal{M}$a) and which establishes the combinatorics for mixed-type objects. When you have an at-issue expression α and a shunting expression β, these can be mixed to a new expression by means of the diamond "$\blacklozenge$" (cf. (3.74e) on page 82). The type of this mixed object is then the mixed type consisting of the at-issue type of α and the shunting type of β. If both parts take the same type of at-issue argument, ($\mathcal{M}$a) licenses the distributed application of the two functions to the same argument. For illustration, consider the Japanese honorific predicate *irassharu* again. Instead of translating it as a bullet expression as in (3.52) on page 71, McCready (2010: 23) translates it into a diamond expression:

(3.79) $\textit{irassharu} \rightsquigarrow \lambda x.\textbf{come}(x) \blacklozenge \lambda x.\textbf{honor}(x)(c_S) : \langle e, t\rangle \times \langle e, t^{s}\rangle$

Employing the rule for mixed application, this lexical entry can be used to derive the desired semantics in which both dimensions of meaning of *irassharu* apply to its argument:

[23] In order for this to work, I had to change ($\mathcal{S}$a) a little bit, since in McCready's (2010: 18) definition—his (R7)—it is only defined for at-issue arguments. However, since he suggests that *man* could be analysed as an expression of type $\langle t^s, t^s\rangle$ later in his paper (McCready 2010: 36), I assume that this change suits what he had in mind.

(3.80)
$$\dfrac{\dfrac{\dfrac{\dfrac{\textit{senseiga}}{\iota x.\mathbf{teacher}(x) : e}\text{Lx} \quad \dfrac{\textit{irasshaimasita}}{\lambda x.\mathbf{come}(x) \blacklozenge \lambda x.\mathbf{honor}(x)(c_S) : \langle e,t\rangle \times \langle e,t^s\rangle}\text{Lx}}{\mathbf{come}(\iota x.\mathbf{teacher}(x)) \blacklozenge \mathbf{honor}(\iota x.\mathbf{teacher}(x))(c_S) : t \times t^s}\mathcal{M}\text{a}}{\mathbf{come}(\iota x.\mathbf{teacher}(x)) : t \bullet \mathbf{honor}(\iota x.\mathbf{teacher}(x))(c_S) : t^c}\mathcal{S}\text{e}}{\mathbf{come}(\iota x.\mathbf{teacher}(x)) : t}\mathcal{E}\text{e}$$

This example also shows how the rules for the mixing diamond interact with the rules for the isolating bullet. Mixed application can be used to drag the additional use-conditional meaning component along until propositional level is reached. Then the new rule for shunting elimination ($\mathcal{S}$e) kicks in and changes the diamond into a bullet, so that the truth-conditional and use-conditional meanings are no longer mixed, but isolated from each other. I should note that I changed the rule as compared to McCready's (2010: 20) original (R9), since ($\mathcal{S}$e) not only substitutes the diamond with the bullet but also changes the type of the expressive dimension from t^s to t^c to reflect the switch from mixed to isolated content. Besides the fact that I think it is more coherent from a conceptual point of view, this has two advantages. First, the conclusion of ($\mathcal{S}$e) now conforms to the premise of the rule for expressive elimination ($\mathcal{E}$e) and, therefore, the latter can be used to strip the use-conditional content away in order to obtain a one-dimensional expression at the root. This is done as the last step in the proof in (3.80). The second advantage is that since every shunting-type proposition is finally changed into a CI-type proposition, the same mechanism of parsetree interpretation that has been used in $\mathcal{L}_{\mathrm{CI}}$ can be used for $\mathcal{L}^{+}_{\mathrm{CI}}$ as well. In his version of "proof tree interpretation", McCready (2010: 32) has to refer to t^c and t^s objects, since both can be hanging around in the proof tree. With the adapted ($\mathcal{S}$e), such an extension of the interpretation rule becomes unnecessary.

Another modification McCready (2010: 32) makes to Potts's (2005) original interpretative mechanism is to add a second clause that takes care of proofs that do not contain any descriptive content on their root node. Recall that the new proof rule ($\mathcal{S}$a) for shunting application is resource-sensitive. That is, the argument of a shunting-type function is used up by the application. As illustrated in (3.76), nodes without any descriptive content are possible in $\mathcal{L}^{+}_{\mathrm{CI}}$, in contrast to $\mathcal{L}_{\mathrm{CI}}$. McCready (2010: 32) solves these issues by defining that in such cases, the descriptive dimension consists of a tautology T that is always true (cf. McCready 2010: 32).

(3.81) **No descriptive content**
Let $\mathcal{T}$ be a proof tree with the shunting term $\alpha : \langle s, t^s \rangle$ on its root node, and distinct terms $\beta_1 : \langle s^a, t^c \rangle, \ldots, \beta_n : \langle s^a, t^c \rangle$ on nodes in it. Then the interpretation of $\mathcal{T}$ is

$$\left\langle T, \left\{ [\![\alpha : \left\langle s, t^s \right\rangle]\!]^{\mathcal{M}_i, g}, [\![\beta_1 : \left\langle s^a, t^c \right\rangle]\!]^{\mathcal{M}_i, g}, \ldots, [\![\beta_n : \left\langle s^a, t^c \right\rangle]\!]^{\mathcal{M}_i, g} \right\} \right\rangle$$

In this case, however, the interpretation rule has to specifically mention shunting types since only they are capable of showing up at the root node alone.

3.4.4 Omitting mixed types from $\mathcal{L}_{CI}^{+}$

In the previous sections, I already suggested some modifications of $\mathcal{L}_{\mathrm{CI}}^{+}$ to simplify its definitions. Before I go on to the assessment of McCready's extension of $\mathcal{L}_{\mathrm{CI}}$, I would like to suggest a further modification that allows for a more substantial simplification of the type system. The starting point is the different role that the diamond and the bullet play in $\mathcal{L}_{\mathrm{CI}}^{+}$. Consider the following two nodes that can typically appear during a derivation:

(3.82) a. $$\frac{\vdots \quad \vdots}{\gamma(\beta) \blacklozenge \alpha(\beta) : \sigma \times \tau^s}$$ b. $$\frac{\vdots \quad \vdots}{\beta : \sigma \bullet \alpha(\beta) : \tau^c}$$

The difference is that while the formula in (3.82a) is conceived as one expression with a single (product) type, the formula in (3.82b) is understood as consisting of independent expressions, each with its own type. Of course, there is a difference between the two expressions. The diamond allows the use-conditional component to move along with its truth-conditional counterpart, while the expressive content behind the bullet is destined to be left behind when further inference rules apply. However, I take this to be only a difference in how the use-conditional content composes with further expressions and not as a conceptual difference between having one or two expressions. The use-conditional (shunting) part of a mixed expressive does belong to a distinct dimension and it will finally end up being isolated by the bullet as well. For this reason, I suggest changing the rule for mixed application ($\mathcal{M}$a) and shunting elimination ($\mathcal{S}$e) to bring it closer to the rule for expressive application ($\mathcal{E}$a):

(3.83) $$\frac{\alpha : \langle \sigma^a, \tau^a \rangle \blacklozenge \beta : \langle \sigma^a, \upsilon^s \rangle \qquad \gamma : \sigma^a}{\alpha(\gamma) : \tau^a \blacklozenge \beta(\gamma) : \upsilon^s} \mathcal{M}\mathrm{a}$$

(3.84) $$\frac{\alpha : \sigma^{a} \blacklozenge \beta : t^{s}}{\alpha : \sigma^{a} \bullet \beta : t^{c}}\ \mathcal{S}\text{e}$$

If these rules are recast in this way, the expressions containing a diamond are understood as having two distinct contents, each with their own type. I take this to be conceptually slightly more appealing, and it has the huge advantage that the type definition of $\mathcal{L}_{\text{CI}}^{+}$ can be greatly simplified. Note that the rules as given in (3.83) and (3.84) do not mention mixed types. Therefore, the clause for building mixed types in (3.74e) on page 82 can be omitted entirely.

3.5 Assessment of $\mathcal{L}_{\text{CI}}^{+}$

Having presented and slightly modified $\mathcal{L}_{\text{CI}}^{+}$, McCready's (2010) extension of $\mathcal{L}_{\text{CI}}$, I will carry out a detailed assessment of the new logic, in order to highlight the improvements it provides when compared with its predecessor, while also pointing out loose ends that $\mathcal{L}_{\text{CI}}^{+}$ still exhibits. This will hint at the problems I will address when I develop a multidimensional semantics for use-conditional content in the next chapter. I will start with the same categories as in the assessment of Potts's (2005) original logic in §3.3.

3.5.1 Types of UCIs in $\mathcal{L}_{\text{CI}}^{+}$

Being a conservative extension of $\mathcal{L}_{\text{CI}}$, $\mathcal{L}_{\text{CI}}^{+}$ can deal with all the types of UCIs that Potts's (2005) original formulation was capable of dealing with. That is, isolated expletive and functional expletive UCIs are analysed in $\mathcal{L}_{\text{CI}}^{+}$ as they are in $\mathcal{L}_{\text{CI}}$. For explicit comparison, I give the $\mathcal{L}_{\text{CI}}^{+}$ derivations of two examples that correspond to the $\mathcal{L}_{\text{CI}}$ parsetrees in (3.35) and (3.39) pages 64 and 66 respectively.

(3.85) $$\cfrac{\cfrac{\cfrac{\textit{Ouch}}{\textbf{ouch} : t^{c}}\ \text{Lx} \quad \cfrac{\textit{I got bit}}{\textbf{got-bit}(c_{S}) : t}\ \text{Lx}}{\textbf{ouch} : t^{c} \bullet \textbf{got-bit}(c_{S}) : t}\ \text{I}\varepsilon}{\textbf{got-bit}(c_{S}) : t}\ \mathcal{E}\text{e}$$

(3.86) $$\cfrac{\cfrac{\cfrac{\textit{Webster schläf}}{\textbf{sleeps}(\textbf{webster}) : \langle s, t\rangle}\ \text{Lx} \quad \cfrac{\textit{ja}}{\textbf{ja} : \langle\langle s, t\rangle , \langle s, t^{c}\rangle\rangle}\ \text{Lx}}{\textbf{sleeps}(\textbf{webster}) : \langle s, t\rangle \bullet \textbf{ja}(\textbf{sleeps}(\textbf{webster})) : \langle s, t^{c}\rangle}\ \mathcal{E}\text{a}}{\textbf{sleeps}(\textbf{webster}) : \langle s, t\rangle}\ \mathcal{E}\text{e}$$

Comparing these two proofs with the corresponding parsetree notations shows that the tree-admissibility conditions for CI application (3.17) and isolated CIs (3.21) of $\mathcal{L}_{\text{CI}}$ are each decomposed into two derivational steps in $\mathcal{L}^{+}_{\text{CI}}$. The first step involves the inferences for isolated expressives (Iε) and expressive application ($\mathcal{E}$a) respectively, while the second step in both derivations consists of stripping out the saturated use-conditional content by means of expressive elimination ($\mathcal{E}$e).

3.5.1.1 Isolated mixed UCIs in $\mathcal{L}^{+}_{\text{CI}}$ The extended reach of $\mathcal{L}^{+}_{\text{CI}}$ can be attested when looking at mixed expressives. I start with the simpler case of isolated mixed expressives, as they can be dealt with in a way that resembles the $\mathcal{L}_{\text{CI}}$ solution which I discussed on pages 68–71. In contrast to the way this would be done in $\mathcal{L}_{\text{CI}}$, McCready (2010: 21–2) suggests that the isolated propositional content of pejoratives is introduced as a mixed-type UCI together with the descriptive content associated with it. That is, instead of (3.47), *Kraut* receives the following translation in $\mathcal{L}^{+}_{\text{CI}}$ (cf. McCready 2010: 22). This lexical entry licenses the derivation in (3.88).

(3.87) *Kraut* $\rightsquigarrow \lambda x.\mathbf{german}(x) : \langle e, t\rangle \blacklozenge \mathbf{bad}({}^{\cap}\mathbf{german}) : t^{s}$

(3.88)
$$\dfrac{\dfrac{\textit{Piet}}{\mathbf{piet} : e}\,\text{Lx} \qquad \dfrac{\dfrac{\dfrac{\textit{is a Kraut}}{\lambda x.\mathbf{german}(x) : \langle e, t\rangle \blacklozenge \mathbf{bad}({}^{\cap}\mathbf{german}) : t^{s}}\,\text{Lx}}{\lambda x.\mathbf{german}(x) : \langle e, t\rangle \bullet \mathbf{bad}({}^{\cap}\mathbf{german}) : t^{c}}\,\mathcal{S}\text{e}}{\lambda x.\mathbf{german}(x) : \langle e, t\rangle}\,\mathcal{E}\text{e}}{\mathbf{german}(\mathbf{piet}) : t}\,\text{Fa}$$

Note that this derivation actually involves one step more (namely, the first), than it would if the isolated content were introduced as an expression of t^{c} instead of a shunting expression of type t^{s}. Conceptually, this approach seems however to be more appealing, since it brings the lexical entries of isolated mixed expressives closer to those of functional mixed expressives, and the derivational rules used are also the same (though the order may differ).

3.5.1.2 Functional mixed UCIs in $\mathcal{L}^{+}_{\text{CI}}$ The strength of $\mathcal{L}^{+}_{\text{CI}}$ and its superiority over Potts's (2005) logic is best witnessed when it comes to functional mixed UCIs. In contrast to their isolated peers, which could, at least in principle, receive a similar treatment in $\mathcal{L}_{\text{CI}}$ as in McCready's elaboration, functional mixed UCIs cannot be dealt with by the tools of $\mathcal{L}_{\text{CI}}$. This was illustrated in detail on pages 71–3. The introduction of mixed types, or rather, the inference pattern for mixed application ($\mathcal{M}$a), allows us to deal with expressions that come with functional content in both dimensions of meaning. The crucial aspect is that in order to construe functional mixed UCIs in $\mathcal{L}_{\mathrm{CI}}^{+}$, shunting-type expressions are employed to represent the use-conditional content of an expression. That is, repeating example (3.79) from earlier, the honorific verb *irassharu* can be translated in $\mathcal{L}_{\mathrm{CI}}^{+}$ as follows (cf. McCready 2010: 23):

(3.79) $\textit{irassharu} \rightsquigarrow \lambda x.\mathbf{come}(x) : \langle e,t\rangle \blacklozenge \lambda x.\mathbf{honor}(x)(c_S) : \langle e,t^s\rangle$

Equipped with this lexical entry and the corresponding rules of proof, the correct proof for sentence (3.50) can be derived, as illustrated in (3.80) on page 85, which is also repeated here. First, both functional dimensions of the mixed UCI apply to the descriptive argument *sensei* 'teacher'. By doing so, the use-conditional dimension reaches propositional status, i.e., it is now of type t^s. Therefore, the proof rule for shunting elimination ($\mathcal{S}$e) can be applied, turning the mixed expression into an ordinary descriptive and CI element. The latter, familiar from $\mathcal{L}_{\mathrm{CI}}$, can then be removed from the derivation via the inference rule for expressive elimination ($\mathcal{E}$e).

(3.80)
$$\cfrac{\cfrac{\cfrac{\cfrac{\textit{senseiga}}{\iota x.\mathbf{teacher}(x) : e}\,\mathrm{Lx} \qquad \cfrac{\textit{irasshaimasita}}{\lambda x.\mathbf{come}(x) \blacklozenge \lambda x.\mathbf{honor}(x)(c_S) : \langle e,t\rangle \times \langle e,t^s\rangle}\,\mathrm{Lx}}{\mathbf{come}(\iota x.\mathbf{teacher}(x)) \blacklozenge \mathbf{honor}(\iota x.\mathbf{teacher}(x))(c_S) : t \times t^s}\,\mathcal{M}\mathrm{a}}{\mathbf{come}(\iota x.\mathbf{teacher}(x)) : t \bullet \mathbf{honor}(\iota x.\mathbf{teacher}(x))(c_S) : t^c}\,\mathcal{S}\mathrm{e}}{\mathbf{come}(\iota x.\mathbf{teacher}(x)) : t}\,\mathcal{E}\mathrm{e}$$

The mechanism of proof tree interpretation is then used to extract the use-conditional content from the proof tree in order to deliver the entire interpretation of (3.80):

(3.89) $\langle [\![\mathbf{come}(\iota x.\mathbf{teacher}(x)) : t]\!], [\![\mathbf{honor}(\iota x.\mathbf{teacher}(x))(c_S) : t^c]\!]\rangle$

The use of a shunting expression in the use-conditional dimension of (3.80) is crucial here, since it allows the expression to apply to its argument in a resource-sensitive way. As already shown by (3.53), introducing the expressive dimension as a CI expression would not do the trick, as there is no rule of proof that could combine it with its argument.

Another important function of shunting types becomes apparent when we consider functional mixed UCIs that need more than one argument. For the sake of illustration, let us assume that a "colored" transitive verb like German *begaffen* 'to gawk at' has a use-conditional component in addition to its descriptive meaning. Like its neutral counterpart *to look at* it needs a subject and an object. If those are supplied, it expresses—in addition to the truth-conditional proposition that the subject looks at the object—that the speaker is annoyed that (or by the way) the subject looks at the object. In $\mathcal{L}^{+}_{\mathrm{CI}}$, such an expression is analysed as a mixed expression that combines a descriptive meaning with a use-conditional component that has a shunting type:

(3.90) $$\textit{begaffen} \rightsquigarrow \begin{array}[t]{l} \lambda x \lambda y.\mathbf{look\text{-}at}(x)(y) : \langle e, \langle e, t\rangle\rangle \\ \blacklozenge\ \lambda x \lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(x)(y)) : \langle e, \langle e, t^s\rangle\rangle \end{array}$$

Since a shunting expression is used for the use-conditional dimension, it can apply to its argument without returning it and can therefore be applied to further argument. An example derivation can be given as follows:

(3.91) $$\cfrac{\cfrac{\cfrac{\cfrac{\textit{Jonas}}{\mathbf{j} : e}\,\mathrm{Lx} \qquad \cfrac{\cfrac{\textit{begafft}}{\begin{array}{c}\lambda x \lambda y.\mathbf{look\text{-}at}(x)(y) : \langle e, \langle e, t\rangle\rangle \\ \blacklozenge\ \lambda x \lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(x)(y)) : \langle e, \langle e, t^s\rangle\rangle\end{array}}\,\mathrm{Lx} \quad \cfrac{\textit{Thomas}}{\mathbf{t} : e}\,\mathrm{Lx}}{\begin{array}{c}\lambda y.\mathbf{look\text{-}at}(\mathbf{t})(y) : \langle e, t\rangle \\ \blacklozenge\ \lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(\mathbf{t})(y)) : \langle e, t^s\rangle\end{array}}\,\mathcal{M}\mathrm{a}}{\mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j}) : t \blacklozenge \mathbf{bad}(\mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j})) : t^s}\,\mathcal{M}\mathrm{a}}{\mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j}) : t \bullet \mathbf{bad}(\mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j})) : t^c}\,\mathcal{S}\mathrm{e}}{\mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j}) : t}\,\mathcal{E}\mathrm{e}$$

What shunting types are good for in such cases is that they function as a kind of logging system that keeps track of use-conditional side material and drags it along during the derivation until it is fully saturated and reaches (use-conditional) propositional status. This way of thinking about the function of shunting types will play a major role when I recast McCready's (2010) logic in the next chapter.

3.5.1.3 Functional shunting UCIs The introduction of shunting types in $\mathcal{L}^{+}_{\mathrm{CI}}$ not only plays an important role in the treatment of functional expletives, but also enables a straightforward analysis of shunting UCIs. The crucial thing about this subtype of functional UCIs is that they respect resource-sensitivity and "shunt" their truth-conditional argument to the use-conditional dimension without replicating it at the truth-conditional layer. The proof in (3.78) on page 84 illustrates how the rule of proof for ($\mathcal{S}$e) provides the desired result. This is a further respect in which $\mathcal{L}^{+}_{\mathrm{CI}}$ fixes a problem that existed in $\mathcal{L}_{\mathrm{CI}}$.

Table 3.3 summarizes the discussion so far. In contrast to $\mathcal{L}_{\mathrm{CI}}$, which misses at least shunting UCIs and functional mixed expressives, and, officially, isolated mixed UCIs as well, $\mathcal{L}^{+}_{\mathrm{CI}}$ can analyse all five types of UCIs.

TABLE 3.3 Types of UCIs accounted for by $\mathcal{L}_{CI}^{+}$

isolated expletive UCIs	✓
isolated mixed UCIs	✓
functional UCIs, expletive	✓
shunting	✓
functional mixed UCIs	✓

Of course, this does not imply that $\mathcal{L}_{CI}^{+}$ overcomes all the flaws of $\mathcal{L}_{CI}$. As the following discussion will show, some problems still arise in McCready's (2010) extension.

3.5.2 Use-conditional modifiers

As the previous discussion has shown, the main advantage of McCready's (2010) extension of $\mathcal{L}_{CI}^{+}$ is that—in contrast to its predecessor—it can deal with various kinds of mixed content. However, a glance at the expanded type definitions, given in (3.74), reveals that there are still no types licensed in $\mathcal{L}_{CI}^{+}$ that would allow for the modification of UCIs. That is, there are no use-conditional modifiers. As in the original $\mathcal{L}_{CI}$, type construction rules like the following are absent in $\mathcal{L}_{CI}^{+}$:

(3.92) *Gaps in the type system of* $\mathcal{L}_{CI}^{+}$
a. If σ is a CI type and τ is an at-issue type, then $\langle\sigma,\tau\rangle$ …
b. If σ and τ are CI types, then $\langle\sigma,\tau\rangle$ …

I think that the first gap is desirable, as a rule like (3.92a) would allow mapping information from the use-conditional dimension to the truth-conditional one, which we want to exclude. However, as argued in detail in §3.3.2, excluding a rule like (3.92b) seems too strong as there is evidence that there are expressions mapping use-conditional content to use-conditional content. Since Potts's (2005) prohibition against use-conditional arguments is still present in $\mathcal{L}_{CI}^{+}$, it suffers from the same inadequacy.

As already noted in footnote 23 on page 84, however, McCready (2010: 35–7) discusses cases in which a UCI seemingly modifies another UCI. Examples he presents include the particle *man*, which, he assumes, can indeed modify the expressive content of an interjection like *ouch*; see example (3.77). The intensifier *totally* shows similar behavior.

(3.93) a. Totally ouch(, dude). (McCready 2010: 36)

I have already given the derivation for *Ouch, man!* in (3.78), which I repeat here for convenience. A derivation for (3.93a) would look analogous.

(3.78)
$$\dfrac{\dfrac{\mathit{Ouch}}{\mathbf{ouch} : t^s}\,\mathrm{Lx} \qquad \dfrac{\mathit{man}}{\mathbf{man} : \langle t^s, t^s \rangle}\,\mathrm{Lx}}{\mathbf{man}(\mathbf{ouch}) : t^s}\,\mathcal{S}\mathrm{a}$$

The crucial thing is that *man* gets assigned type $\langle t^s, t^s \rangle$, that is, a modifier on (shunting) use-conditional propositions. If we modify McCready's (2010: 18) rule for shunting application (his R7), as I have already done in ($\mathcal{S}$a), such expressions are allowed to combine with a (shunting) UCI to yield a modified (shunting) UCI. The clause that licenses such expressions that map shunting-type expressions onto shunting-type expressions is (3.74d), which corresponds to McCready's (2010: 52) clause (B1i.i). That is, modification of UCIs is partially possible in $\mathcal{L}_{\mathrm{CI}}^{+}$.

(3.94) *Closing the gap in* $\mathcal{L}_{CI}^{+}$ *(but only partially)*
If σ and τ are shunting types, $\langle \sigma, \tau \rangle$ is a shunting type.

This, however, does not completely close the gap in the empirical coverage of $\mathcal{L}_{\mathrm{CI}}^{+}$, since it just enables the derivation of the modification of shunting UCIs. The modification of functional expletive UCIs is still not possible in $\mathcal{L}_{\mathrm{CI}}^{+}$. Even if we assumed that in examples like (3.54a), repeated here, the UCIs were shunting expressions, $\mathcal{L}_{\mathrm{CI}}^{+}$ could not derive the desired interpretation.

(3.54a) That fucking bastard Burns got promoted.

(3.95)
$$\dfrac{\dfrac{\dfrac{\dfrac{\mathit{fucking}}{\mathbf{fucking} : \langle\langle e, t^s\rangle, \langle e, t^s\rangle\rangle}\,\mathrm{Lx} \qquad \dfrac{\mathit{bastard}}{\mathbf{bastard} : \langle e, t^s\rangle}\,\mathrm{Lx}}{\mathbf{fucking}(\mathbf{bastard}) : \langle e, t^s\rangle}\,\mathcal{S}\mathrm{a} \qquad \dfrac{\mathit{Burns}}{\mathbf{burns} : e}\,\mathrm{Lx}}{\mathbf{fucking}(\mathbf{bastard})(\mathbf{burns}) : t^s}\,\mathcal{S}\mathrm{a} \qquad \dfrac{\mathit{got\ promoted}}{\mathbf{got\text{-}promoted} : \langle e, t\rangle}\,\mathrm{Lx}}{\lightning}\,\text{✗}$$

The problem in such cases is that the UCI that is produced by means of shunting application in the first step of the derivation is itself a shunting UCI. Therefore, it has to combine with its argument by shunting application as well. This combination, as shown in the second step of the derivation, is, however, resource-sensitive and the argument of the application is not returned, but consumed by the application. Due to this, the main descriptive predicate *got promoted* cannot find a suitable argument, and the derivation crashes.

From this, I conclude that the inclusion of the modification of shunting UCIs into $\mathcal{L}_{\mathrm{CI}}^{+}$ is a correct first step, but it does not suffice to account for the whole range of use-conditional modifiers that can be found in natural language.

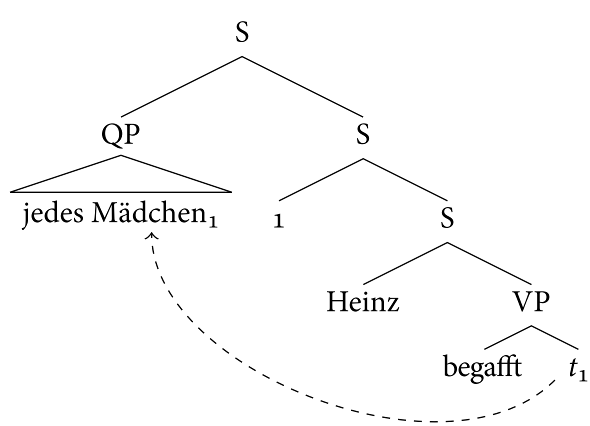
3.5.3 Abstraction problems in $\mathcal{L}_{CI}^{+}$

As discussed in §3.3.3 on page 77, it is not feasible in $\mathcal{L}_{\mathrm{CI}}$ to feed a variable as an argument to a CI function in order to abstract from it later on. The reason for this is not that such expressions are not well-formed—they are—but that the tree-admissibility conditions make such a strategy work out incorrectly. However, for the expressions that $\mathcal{L}_{\mathrm{CI}}$ can deal with, I could not come up with an actual example, which is why I formulated the problem with an abstract constellation. In $\mathcal{L}_{\mathrm{CI}}^{+}$, this problem can, however, be fleshed out with real data, since functional mixed UCIs interact more with the surrounding linguistic material. Consider (3.96), in which the object of *begafft* 'is gawking' is a quantifier phrase.

(3.96) Heinz begafft jedes Mädchen.
Heinz gawks-at every girl
'Hans is gawking at every girl.'

The problem of quantifiers in object position is that, under standard typing and surface constituency, the expressions cannot be combined, as *begafft* 'is gawking at' is of type $\langle e, \langle e, t\rangle\rangle$ and therefore needs a type e direct object, while *jedes Mädchen* 'every girl' is a quantifier of type $\langle\langle e, t\rangle, t\rangle$. A common solution to this mismatch is the assumption of quantifier raising (QR) at LF (Heim and Kratzer 1998). The direct object moves to take scope over the entire sentence, leaving an indexed trace behind, which is bound by a corresponding index that is adjoined to the sentence at the position below the landing position of the quantifier. This gives us the following LF structure for (3.96):

(3.97)



When this LF is interpreted by the semantics, the trace is interpreted as variable. Crucially, the binding index is understood as a lambda abstractor binding that variable. However, when we now substitute the semantic representations for the expressions in (3.96) and compose the complex expressions in accordance with the proof rules of $\mathcal{L}^{+}_{\text{CI}}$, we arrive at the following parsetree:

(3.98)

- $\forall x.[\mathbf{girl}(x) \rightarrow \mathbf{look\text{-}at}(x)(\mathbf{h})] : t$
  - $\lambda P.\forall x.[\mathbf{girl}(x) \rightarrow P(x)] : \langle\langle e,t\rangle , t\rangle$
  - $\lambda z.\mathbf{look\text{-}at}(z)(\mathbf{h}) : \langle e, t\rangle$
    - λz
    - $\mathbf{look\text{-}at}(z)(\mathbf{h}) : t$ $\bullet$ $\mathbf{bad}(\mathbf{look\text{-}at}(z)(\mathbf{h})) : t^s$
      - $\mathbf{h} : e$
      - $\lambda y.\mathbf{look\text{-}at}(z)(y) : \langle e, t\rangle$ $\blacklozenge$ $\lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(z)(y)) : \langle\langle e,t^s\rangle$
        - $\lambda x\lambda y.\mathbf{look\text{-}at}(x)(y) : \langle e, \langle e, t\rangle\rangle$ $\blacklozenge$ $\lambda x\lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(x)(y)) : \langle e, \langle e, t^s\rangle\rangle$
        - $z : e$

The problem is again that, while for the at-issue part of *begafft* the combination of a provisional introduction of the object argument and its later abstraction works as needed, the variable introduced by the trace remains unbound by the λ-operator in the CI dimension, because it is isolated by CI application. This predicts that, in the CI dimension, (3.98) expresses a negative attitude regarding Heinz's looking at $g(z)$, i.e., whatever referent is assigned to the variable z by the assignment function g. This is, of course, not the use-conditional content expressed by (3.96).

3.5.4 Quantification problems in $\mathcal{L}^{+}_{CI}$

Given the possibilities of $\mathcal{L}^{+}_{\text{CI}}$, the abstraction problem just discussed makes an analysis of quantifiers in object positions impossible (or, more precisely, the intended reading cannot be derived). However, the problem with quantification is not just based on the abstraction problem—I merely used quantification as an example whose analysis often involves abstraction—but goes deeper. To see why, consider the following innocuous-looking example, which has the quantifier in subject position.

(3.99) Alle begaffen Sandy.
everybody gawks-at Sandy
'Everybody is gawking at Sandy.'

At first glance, this example seems simple to analyse. Combine the verb with its object, and the VP then becomes the argument of the quantifier. However, when we actually try this, we face a problem.

(3.100)

$$\dfrac{\dfrac{\textit{Alle}}{\mathbf{everybody} : \langle\langle e,t\rangle ,t\rangle}\,\text{Lx} \qquad \dfrac{\dfrac{\textit{begaffen}}{\begin{array}{c}\lambda x\lambda y.\mathbf{look\text{-}at}(x)(y) : \langle e,\langle e,t\rangle\rangle \ \blacklozenge \\ \lambda x\lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(x)(y)) : \langle e,\langle e,t^{s}\rangle\rangle\end{array}}\,\text{Lx} \quad \dfrac{\textit{Sandy}}{\mathbf{s} : e}\,\text{Lx}}{\begin{array}{c}\lambda y.\mathbf{look\text{-}at}(\mathbf{s})(y) : \langle e,t\rangle \ \blacklozenge \\ \lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(\mathbf{s})(y)) : \langle e,t^{s}\rangle\end{array}}\,\mathcal{M}\text{a}}{\lightning}\,\text{✗}$$

The step which applies the mixed predicate to its object is easily accomplished by the proof rule for mixed application, but the final step of applying the subject quantifier to the VP is not covered by any application rule offered by $\mathcal{L}_{\mathrm{CI}}^{+}$: the proof rules only cover one direction. Mixed application allows the application of the two functional dimensions of a mixed expression to a one-dimensional argument. But there is no rule that would license the separate application of a one-dimensional function to the two dimensions of a mixed argument, as would be needed to derive the correct reading of (3.99). On an intuitive level, what must be done is clear. We need a type shifter that lifts the one-dimensional quantifier into a two-dimensional one, which quantifies over both meaning dimensions. That is, something along the following lines:

(3.101) $\mathbf{everybody} : \langle e,\langle e,t\rangle\rangle \Rightarrow \mathbf{everybody} : \langle e,\langle e,t\rangle\rangle \blacklozenge \mathbf{everybody} : \langle\langle e,t^{s}\rangle ,t^{s}\rangle$

However, even if such a type shift captures the intuition about what kind of expression is needed in order to derive the correct reading for (3.99), its introduction alone is not sufficient, because there is still no proof rule for $\mathcal{L}_{\mathrm{CI}}^{+}$ that could license the application of such a two-dimensional quantifier to a two-dimensional VP, even if we can easily imagine how such a rule should look. I will come back to these issues when I set up the new logic in the next chapter. For now, let us conclude that, in its current state, $\mathcal{L}_{\mathrm{CI}}^{+}$ cannot deal with simple quantificational sentences like (3.99).

TABLE 3.4 Further cases in $\mathcal{L}_{\mathrm{CI}}^{+}$

2-place UCIs	✓
use-conditional modifiers	✗
quantification	✗
abstraction	✗

3.5.5 *Summary of the assessment of $\mathcal{L}_{CI}^{+}$*

While Potts's (2005) logic of conventional implicatures $\mathcal{L}_{\mathrm{CI}}$ was a big leap in our understanding of how use-conditional meaning composes with other linguistic material, and provided a rich toolbox to model such interactions, the discussion in §3.3 highlighted that it cannot deal with all the varieties of UCI that can be attested in natural languages. In his careful extension and modification of $\mathcal{L}_{\mathrm{CI}}$, McCready (2010) closes many of those gaps by extending the type system and introducing new composition rules, thereby broadening the reach of the formal system. As the foregoing discussion has shown, this extended logic $\mathcal{L}_{\mathrm{CI}}^{+}$ can deal with many of those instances of UCIs that have proven to be problematic for $\mathcal{L}_{\mathrm{CI}}$. Thanks to the inclusion of shunting types, not only pure use-conditional sentences without any (meaningful) truth-conditional content can be derived in $\mathcal{L}_{\mathrm{CI}}^{+}$, but functional mixed UCIs, the biggest problem for the original $\mathcal{L}_{\mathrm{CI}}$, can be dealt with as well. Table 3.3 on page 91 illustrates how well $\mathcal{L}_{\mathrm{CI}}^{+}$ scores in this respect. Then again, use-conditional modifiers still pose a problem for the extended system, and cannot be properly analysed in it, as shown in Table 3.4 above. The same holds for the other problematic cases of abstraction and quantification.

Before I develop my own extension of the basic insights of the two multidimensional frameworks to deal with use-conditional content in the next chapter, I will first address a worry about the way the two meaning dimensions are kept separate in the two systems. This worry regards compositionality.

3.6 Compositionality issues with $\mathcal{L}_{\mathrm{CI}}^{*}$

One of the few but most prominent constraints that most semantic theories put on the meaning of complex expressions is the *Principle of Com-*

positionality.[24] It can be formulated in various ways (T.E. Zimmermann 2012): regarding extension, intensions, or even characters (Westerståhl 2012). The most general principle just refers to the "meaning" of complex expressions (T.E. Zimmermann 2012: 82).

(PoC) *Ordinary Principle of Compositionality*
The meaning of a complex expression functionally depends on the meaning of its immediate parts and the way in which they are combined.

Even if there may be some disagreement regarding the question of whether compositionality has the status of an empirical hypothesis or, rather, of a methodological principle (cf., e.g., Dowty 2007), developing a semantic theory that does not adhere to some form of (PoC) is deemed undesirable by the majority of semanticists.

What is crucial for the following discussion is that (PoC) does not merely refer to the parts of a complex expression (and the way they are combined), but to its *immediate* parts. Consider the following example (borrowed from T.E. Zimmermann 2012b: 83):

(3.102) **john loves mary**

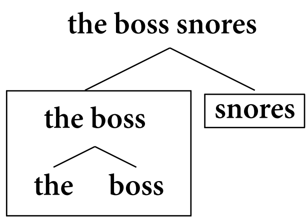
$\boxed{\textbf{john}}$ $\boxed{\textbf{loves mary} \; (\textbf{loves} \;\; \textbf{mary})}$

The complex expression **john loves mary** consists of four proper parts; the subject **john**, the VP **loves mary**, the predicate **loves** and the object **mary**. However, in order to comply to (PoC), the meaning of the entire sentence must be given by a function of the meaning of its immediate subparts (and the way in which they are combined), as indicated by the boxes. In particular, what matters for the composition is the meaning of **john** and **loves mary**. Thus the meaning of the terminals **loves** and **mary** must not play a (direct) role in determining the meaning of (3.102), in order to respect (PoC). Compositionality is, so to speak, blind to the structure that goes deeper than the immediate constituents of the complex expression under consideration. It can look only one level down.

[24] For an extensive overview on various topics related to the notion of compositionality, cf. the contributions in *The Oxford Handbook of Compositionality*, edited by Werning, Hinzen, and Machery (2012).

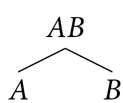
To be sure, the meaning of the expressions inside the right box of (3.102) matters for the entire sentence, but only indirectly, insofar as they determine the meaning of the expression **loves mary.** Once the meaning of **loves mary** is determined (again, in a compositional manner), the way in which that meaning was reached is forgotten and does not matter anymore. For instance, if **loves mary** and **snores** have the same extension and **the boss** and **john** have the same extension, we can substitute them for **loves mary** and **john** respectively and the resulting expression must have the same meaning as **john loves mary** (T.E. Zimmermann 2012b: 83).

(3.103)



The requirement that only the immediate and not the intermediate constituents be taken into account for the determination of the meaning of a complex expression is therefore stronger than an alternative formulation in which the meaning of arbitrary parts is allowed to matter. Both requirements may not even generate the same results. T.E. Zimmermann (2012b: 83–4, fn. 4) proves this by an artificial example. Suppose the "meaning" of expressions consists of numerical values that are assigned by a function *f*. For every binary branching structure of the form

(3.104)



the function f assigns the values as given in (3.105), where $|T|$ denotes the number of nodes of a tree T.

(3.105) $$f(AB) = \begin{cases} f(A) + f(B), & \text{if } |A| > |B| \\ f(A) \cdot f(B), & \text{otherwise} \end{cases}$$

The function f does not adhere to (PoC), because, even if it determines the "meaning" of a complex expression on the basis of the meaning of (all of) its parts, it refers not only to the immediate constituents, but counts deeper embedded ones as well. Suppose, we have the following lexical meanings for the terminal expressions of (3.102) and (3.103):

(3.106) a. $f(\textbf{the}) = f(\textbf{loves}) = 1$
b. $f(\textbf{boss}) = f(\textbf{john}) = 2$
c. $f(\textbf{mary}) = f(\textbf{snores}) = 3$

Plugging these lexical entres into the two trees and calculating the non-terminal nodes according to (3.105), we arrive at the following two interpretations:

(3.107)

- $f(\textbf{john loves mary}) = 2 \times 3 = 6$
  - $f(\textbf{john}) = 2$
  - $f(\textbf{loves mary}) = 1 \times 3 = 3$
    - $f(\textbf{loves}) = 1$
    - $f(\textbf{mary}) = 3$

(3.108)

- $f(\textbf{the boss snores}) = 2 + 3 = 5$
  - $f(\textbf{theboss}) = 1 \times 2 = 2$
    - $f(\textbf{the}) = 1$
    - $f(\textbf{boss}) = 2$
  - $f(\textbf{snores}) = 3$

Crucially, the meanings of the entire sentences differ (5 vs 6), while the meaning of their immediate subparts is the same (2 and 3, respectively). However, the interpretation function in (3.105) is defined such that it not only looks at the meaning of the immediate constituents, but counts the number of nodes they include in order to determine how exactly the meaning of the complex expression is computed. Therefore, the function f in (3.105) is not compositional in the strong sense that is required by (PoC), even if f provides a non-arbitrary and deterministic procedure to derive the meaning of a complex expression.

One may reject T.E. Zimmermann's (2012) argument on the basis of the artificiality of the example he chooses for illustration. His point, however, is more general. And we need not look too far to find a semantics that resembles his example in this respect and which has actually been proposed. It turns out, unsurprisingly, that the interpretation in Potts's (2005) and McCready's (2010) framework, which I will collectively refer to as "$\mathcal{L}^{\star}_{\mathrm{CI}}$" henceforth, constitutes such an example. It behaves rather like T.E. Zimmermann's function in (3.105) and does not fulfill the ordinary principle of compositionality as formulated in (PoC). To see why this is the case, consider the following parsetree (Potts 2005: 117).

(3.109) Sheila believes that Chuck, a psychopath, is fit to watch the kids.

- $\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(\mathbf{sheila}) : t$
  - $\mathbf{sheila} : e$
  - $\lambda x.\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(x) : \langle e, t\rangle$
    - $\lambda p \lambda x.\mathbf{believe}(p)(x) : \langle\langle s, t\rangle, \langle e, t\rangle\rangle$
    - $\mathbf{fit}(\mathbf{chuck}) : \langle s, t\rangle$
      - $\mathbf{chuck} : e$ • $\mathbf{psychopath}(\mathbf{chuck}) : t^c$
        - $\mathbf{chuck} : e$
        - $\mathbf{psychopath} : \langle e, t^c\rangle$
      - $\mathbf{fit} : \langle e, \langle s, t\rangle\rangle$

In $\mathcal{L}^{\star}_{\mathrm{CI}}$, the interpretation of the entire sentence is composed by the mechanism of parsetree interpretation (3.32), which—and this is crucial for the current discussion—interprets the entire parsetree instead of merely the root node. We then arrive at the following interpretation:

(3.110) $[\![(3.109)]\!] =$
$\langle [\![\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(\mathbf{sheila}) : t]\!], [\![\mathbf{psychopath}(\mathbf{chuck}) : t^c]\!]\rangle$

Even if parsetree interpretation may be an elegant solution for the problem of how the CI content dangling inside the parsetree gets finally interpreted, it leads to non-compositionality, as noted, for instance, by Barker, Bernardi, and Shan (2010):

Though formally precise, this method is not compositional. The reason is that the computation of the side-issue content draws information from deeply embedded expressions (the supplement phrases), rather than only from the denotation of the sentence's immediate subconstituents. (Barker, Bernardi and Shan 2010: 113).

To make this more explicit, consider the following parsetree, which is a minimal variant of (3.109), missing just the supplement.

(3.111) $\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(\mathbf{sheila}) : t$

- $\mathbf{sheila} : e$
- $\lambda x.\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(x) : \langle e, t\rangle$
  - $\lambda p \lambda x.\mathbf{believe}(p)(x) : \langle\langle s, t\rangle, \langle e, t\rangle\rangle$
  - $\mathbf{fit}(\mathbf{chuck}) : \langle s, t\rangle$
    - $\mathbf{chuck} : e$
    - $\mathbf{fit} : \langle e, \langle s, t\rangle\rangle$

Comparing this parsetree with the variant in (3.109) shows that in both cases, the immediate constituents of the sentence are the same, namely the subject and the predicate consisting of the attitude verb with its sentential complement. That is, what matters for (PoC) is in both cases the following structure:

(3.112) $\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(\mathbf{sheila}) : t$

- $\mathbf{sheila} : e$
- $\lambda x.\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(x) : \langle e, t\rangle$

However, even if both sentences consist of the same immediate constituents, the interpretation assigned to (3.109) by parsetree interpretation is as in (3.110), while the interpretation of (3.111) consists just of a single (descriptive) dimension.

(3.113) $[\![(3.111)]\!] = [\![\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(\mathbf{sheila}) : t]\!]$

For this reason, it can be concluded, that $\mathcal{L}^{*}_{\mathrm{CI}}$ constitutes an interpretive system that is not compositional in the way that is required by the ordinary principle of compositionality (PoC). Instead, it is akin to T.E. Zimmermann's (2012) artificial interpretation function given in (3.105), insofar as it takes information into account that is embedded deeper than the immediate parts of the sentence that is interpreted.

An additional problem of parsetree interpretation is that it is not a recursive meaning definition. Consider again (3.110). The denotations on the left-hand side of the equation are not the same as the ones on the right-hand side. While on the left-hand side, it is the entire parsetree that gets interpreted, what is interpreted on the right-hand side are single expressions. This must be the case, because if we had interpreted trees on the right-hand side as well, we would have ended up with undesired results:

(3.114) $^{*}[\![(3.109)]\!] = \langle\langle[\![\mathbf{believe}(\mathbf{fit}(\mathbf{chuck}))(\mathbf{sheila}) : t]\!], [\![\mathbf{psychopath}(\mathbf{chuck}) : t^{c}]\!]\rangle, [\![\mathbf{psychopath}(\mathbf{chuck}) : t^{c}]\!]\rangle$

Of course, if we want to compute, say, $[\![\mathbf{psychopath}(\mathbf{chuck})]\!]$ by applying the function to the argument, i.e., $[\![\mathbf{psychopath}]\!]([\![\mathbf{chuck}]\!])$, we are not dealing with trees either. Therefore, it is crucial that only the interpretation of the topmost node of a tree is given by parsetree interpretation, whereas at every other node, the interpretation function works as usual. Now the problem is that in order to know that, we must know that the derivation is complete. Since a complete derivation is not designed by a special type in $\mathcal{L}_{\mathrm{CI}}$, the interpretation function must "look ahead" to see whether a tree is complete or not.

Motivated by these challenges, as well as the other problems of Potts's (2005) and McCready's (2010) logics which the assessments in this chapter have revealed, I will develop a new view upon the basic insights of $\mathcal{L}^{\star}_{\mathrm{CI}}$ and develop a new logic to implement multidimensionality in a more general fashion than $\mathcal{L}^{\star}_{\mathrm{CI}}$ does. While doing so, I will aim for a system which (i) takes the basic insights of $\mathcal{L}^{\star}_{\mathrm{CI}}$ as a starting point, but (ii) closes the empirical gaps exhibited by $\mathcal{L}_{\mathrm{CI}}$ and, to a lesser degree, $\mathcal{L}^{+}_{\mathrm{CI}}$, and (iii) in contrast to $\mathcal{L}^{\star}_{\mathrm{CI}}$, is compositional in the sense of (PoC).

4

A multidimensional logic for hybrid semantics

4.1 Introduction

Starting with the tools provided by Potts's (2005) $\mathcal{L}_{\mathrm{CI}}$ and McCready's (2010) $\mathcal{L}^{+}_{\mathrm{CI}}$, I will develop my own formal version of a multidimensional semantics in this chapter. While trying to keep the spirit of $\mathcal{L}^{\star}_{\mathrm{CI}}$ alive, I will deviate in many ways from the path prepared by Potts and McCready, mostly for reasons detailed in the discussion of their systems in the previous chapter. These deviations will mainly regard three programmatic aspects:

(i) interpretation of the second dimension of meaning
(ii) compositionality
(iii) type system

Re (i): While $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$ are multidimensional semantics in the sense that they dispense with what Bach (1999) calls the "one sentence one proposition" assumption—they can associate the meaning of a sentence with more than one proposition—they are, however, no hybrid semantics in the sense I established in Chapter 2. The second dimension in $\mathcal{L}^{+}_{\mathrm{CI}}$ still receives a truth-conditional interpretation. While this may be perfectly fine for appositives, it is not suitable to deal with UCIs. Based on the basic insights of Kaplan (1999), the second dimension will receive a use-conditional interpretation in the new logic.

Re (ii): The specific way in which use-conditional content is separated from the descriptive meaning and kept so in $\mathcal{L}^{\star}_{\mathrm{CI}}$ renders the logic non-compositional, as argued in more detail at the end of the previous chapter. The new logic will overcome this methodological problem and be in compliance with the ordinary principle of compositionality, according to which only the meaning of the immediate constituents of a complex expression (and the way in which they are combined) matter for calculating the meaning of that expression. In order to achieve this, we will need another way to separate descriptive and use-conditional meaning which, at the same time, allows for a way to keep track of the second dimension at each node of the derivation.

Re (iii): As the assessment of the two logics has revealed, there are empirical blind spots for both of them. That is, there are special UCIs that cannot be dealt with in those frameworks, as well as certain constructions that cannot be analysed even if the UCIs involved fall under their scope. The reasons for this are the gaps in the type system detected in the last chapter and the way the composition works in $\mathcal{L}_{\mathrm{CI}}^{\star}$. I will try to close these gaps in the new system by allowing for more compositions than even McCready's (2010) more liberal logic $\mathcal{L}_{\mathrm{CI}}^{+}$.

In developing the new logic—which I will call $\mathcal{L}_{\mathrm{TU}}$—I will address these three issues one at a time. First, I will follow the lead of Chapter 2 and assign a new kind of denotation to use-conditional expressions and provide a systematic way in which such meanings can be built. In doing so, I will try to keep the way use-conditional meaning is conceptualized as parallel as possible to the truth-conditional aspects of meaning. Secondly, I will address the compositionality problems of $\mathcal{L}_{\mathrm{CI}}^{\star}$ and develop a new formalization of its key ideas to solve those problems. As I will show, there is a simple way to retain compositionality, while simultaneously addressing the third issue by allowing more combinatorics, namely by making use of a truly multidimensional system, which not only involves what can be called *interpretational* multidimensionality, as is the case for $\mathcal{L}_{\mathrm{CI}}^{\star}$, but also *compositional* multidimensionality, by which I mean that each expression in itself, as well as their combinations, involves multiple dimensions.

4.2 Use-conditional types

In Chapter 2, I discussed Kaplan's (1999) suggestion as to how the very idea of use-conditional meaning can be given a formal implementation. This led to the notion of what I have called hybrid semantics, that is, a semantic framework in which both truth and use conditions together capture the meaning of natural language expressions. The basic idea of introducing use conditions into an otherwise rather standard semantic framework is to make use of contexts, not in their familiar role of determining the intension of expressions, but to allow for a new kind of proposition. Whereas ordinary truth-conditional propositions are conceived as sets of worlds, use-conditional propositions are sets of contexts. Using an expressive adjective as an example, we have, informally, the following two meaning dimensions.

$$\text{(4.1)}\quad \text{That damn Kaplan got promoted} = \frac{\{c : c_S \text{ has a negative attitude towards Kaplan in } c_W\}}{\{w : \text{Kaplan got promoted in } w\}}$$

I call these new kinds of propositions "*u*-propositions", in contrast to the traditional variant of propositions, which I call analogously "*t*-propositions". On the technical level, both *t*-propositions and the new *u*-propositions are based on the notion of truth values, as both sets are given by characteristic functions from worlds and contexts respectively into truth values. However, only *t*-propositions are actually meant to model truth values of natural language sentences. That is, for 4.2 we get the following informal truth conditions:

(4.2) "That damn Kaplan got promoted" is true in world w',
if $w' \in \{w : \text{Kaplan got promoted in } w\}$.

In contrast, *u*-propositions—though ultimately being functions from contexts into truth values—capture the use or felicity conditions of a sentence:[1]

(4.3) "That damn Kaplan got promoted" is felicitously used in a context c',
if $c' \in \{c : c_S \text{ has a negative attitude towards Kaplan in } c_W\}$.

However, it would do the project pursued in this book no favors if contexts were treated completely in parallel with worlds, especially if they became proper parts of the logic. This would open the door to various monstrous operators that could shift the interpretation from the current context such that other "possible contexts" also had to be considered for the evaluation of the felicity of an utterance, where as the displaceability of use-conditional content and its bondage to the actual utterance context are crucial features of the behavior of UCIs (Potts 2007b), and such shifts should therefore be excluded. This is achieved by rendering it opaque that *u*-propositions are actually sets of contexts and treating them, at the the level of the logic, as basic objects. That is, instead of giving *u*-propositions the transparent type $\langle c, t\rangle$, they are assigned a

[1] In Gutzmann (2008), I hardwired use conditions directly into the logic and the model by introducing two new binary "use values"—✓ and ↯ respectively—to parallel the two truth values. I now consider the present approach to be more appealing, as it does not introduce anything new into the logic besides contexts, and highlights the different nature of truth- and use-conditional content, while at the same time rendering them more parallel.

new type u, which functions as the basic use-conditional type of the logic. It will be only at the level of interpretation that type u expressions are understood as sets of contexts.

(4.4) $D_u = \wp(C)$ is the domain of type u, where C is a set of contexts.

Crucially, the logic has no knowledge that type u would actually be interpreted as if it were of type $\langle c, t\rangle$. I will come back to this point in §4.4.4, where I flesh out the details of the new logic $\mathcal{L}_{\mathrm{TU}}$.

So far, I have just directly stated the complete use conditions for various examples. In the end, however, we want to be equipped with a system in which we can arrive at the use conditions in a compositional manner. In order to enable this, we need to assign meanings to sub-u-propositional use-conditional content. This can be done, as usual, by setting up a recursive type definition that has access to the new type u as a building block, such that we can compose not only complex truth-conditional types, but complex use-conditional ones as well. For the time being, I will present a type definition that just reformulates the Pottsian at-issue and CI types in the new parlance of truth- and use-conditional types.

(4.5) a. e, t are basic truth-conditional types.
b. u is the basic use-conditional type.
c. If σ and τ are truth-conditional types, then $\langle\sigma, \tau\rangle$ is a truth-conditional type.
d. If σ is a truth-conditional type and τ is a use-conditional type, then $\langle\sigma, \tau\rangle$ is a use-conditional type.

The type definition will be extended into a more complete type space in §4.4.1, where I will present the new system that goes beyond the types covered by $\mathcal{L}_{\mathrm{CI}}$ and McCready's (2010) $\mathcal{L}^{+}_{\mathrm{CI}}$. For the moment, it suffices to bring the new denotations for use-conditional content to $\mathcal{L}_{\mathrm{CI}}$ without changing anything in the composition (which will be done in the remainder of this chapter). Comparing this definition with the type definition for $\mathcal{L}_{\mathrm{CI}}$ given in (3.4) on page 47 reveals that it is basically the same, except that t^c has been swapped for u. For instance, the expressive adjective in 4.2, which has been of type $\langle e, t^c\rangle$ in $\mathcal{L}_{\mathrm{CI}}$, becomes an expression of type $\langle e, u\rangle$ in the new system. The denotation, however, differs. According to $\mathcal{L}_{\mathrm{CI}}$, the domain for type t^c objects is still the set of truth values, or, if we want to speak intensionally, it will be of type $\langle s, t^c\rangle$ and therefore denote a set of worlds, just as every ordinary *t*-proposition does. This contrasts with the present approach according to which *u*-propositions receive genuinely different denotations from *t*-propositions. Since, as argued in Chapter 2, it is undesirable to assign the same denotation to both kinds of content, this seems to be conceptually preferable to providing an ordinary *t*-propositional interpretation for use-conditional content.

4.3 Towards true multidimensionality

In §3.6, we saw that, stricly speaking, $\mathcal{L}_{\mathrm{CI}}^{\star}$ is not compositional. The main reason that, as I conceive it, leads to these compositionality issues as well as to other problems discussed in §§3.5.3 and 3.5.4, is that $\mathcal{L}_{\mathrm{CI}}^{\star}$ is merely pseudo-multidimensional. No expression by itself is multidimensional in $\mathcal{L}_{\mathrm{CI}}$, and in $\mathcal{L}_{\mathrm{CI}}^{+}$; only mixed expressives exhibit two dimensions. It is only when the entire parsetree (or proof) gets interpreted that the expressive content which has been isolated during the derivation is distributed into a second dimension of meaning, such that the interpretation of the entire tree becomes a tuple. For this reason, I call this kind of multidimensionality *interpretational multidimensionality.* However, as I will show in the following, what enables us to overcome the compositionality issues and further problems is a kind of true multidimensionality, which I would like to call *compositional multidimensionality*. By this, I mean that every expression is multidimensional and has content in all dimensions. As we will see, this leads to straightforward solutions to the aforementioned problems. I will first reformulate $\mathcal{L}_{\mathrm{CI}}$ in §4.3.1 and $\mathcal{L}_{\mathrm{CI}}^{+}$ in §4.3.2 in a compositional way, without increasing their power and without going into too many details, before setting up the new logic in §4.4.

4.3.1 Compositional $\mathcal{L}_{CI}$

The second step towards $\mathcal{L}_{\mathrm{TU}}$—besides the new use-conditional types—is to transfer Potts's (2005) logic $\mathcal{L}_{\mathrm{CI}}$ into a compositional variant. The intermediate system that I am aiming at first covers basically the same range of data as $\mathcal{L}_{\mathrm{CI}}$, but does this compositionally, that is, it does not evoke mechanisms like parsetree interpretation in order to (re)collect material that is dangling somewhere inside the tree. If this can be done, the resulting $\mathcal{L}_{\mathrm{CI}}$ derivate will be compositional in the strict sense that is required by the ordinary principle of compositionality, which I repeat here from page 97:

(PoC) *Ordinary principle of compositionality*
The meaning of a complex expression functionally depends on the meaning of its immediate parts and the way in which they are combined.

Fortunately, to come up with such a system, I do not have to start from scratch, as there exists a first step towards a compositional $\mathcal{L}_{\mathrm{CI}}$-variant sketched by Portner (2007) in an article on various use-conditional expressions.[2] The basic idea of his reformulation of $\mathcal{L}_{\mathrm{CI}}$ is to not have the composition and non-composition of descriptive and use-conditional expressions regulated by the type system and composition schemata, but to have separate interpretation functions for the two dimensions of meaning (Portner 2007: 413), similar to the parallel calculation of focus values in alternative focus semantics (Rooth 1985). That is, we have two interpretation functions, $[\![\cdot]\!]^t$ for the descriptive, truth-conditional content, and $[\![\cdot]\!]^u$ for the expressive, use-conditional content.[3] The crucial aspect—and this will be a major point in all that follows—is that every expression can be interpreted by both functions, not just the ones that bear use-conditional content. This is an important step towards compositionality. To see why, recall that the problem for compositionality in $\mathcal{L}_{\mathrm{CI}}$ was that use-conditional content, once applied to its argument, is stopped from percolating up the tree and hence is not present at dominating nodes of which the expressions that contributed the use-conditional content are proper constituents. In contrast, if every expression exhibits both dimensions, we can compose them at every node and therefore recast the $\mathcal{L}_{\mathrm{CI}}$ derivation in a compositional way.

After these introductory remarks, let us have a look at Portner's (2007) proposal. Like in $\mathcal{L}_{\mathrm{CI}}$, Portner (2007) distinguishes two kinds of application schema, one for ordinary functional application and one for expressive application, corresponding to the $\mathcal{L}_{\mathrm{CI}}$ tree-admissibility conditions (3.15) and (3.17) (pp. 52–3). However, since we are now dealing with two distinct interpretation functions, we do not have to worry about distinguishing between at-issue and CI-types, as long as

[2] Curiously, this is often overlooked in the literature that discusses Potts's (2005) $\mathcal{L}_{\mathrm{CI}}$ and subsequent work on expressive meaning. The reason may be that Portner does not devote much discussion to this issue. I am guilty of this neglect as well, as I was not aware of the article when writing Gutzmann (2008), which is a pity, especially given that in it Portner suggests use-conditional approach to sentence mood, one of the main points of Gutzmann (2008). I will give Portner (2007) a proper treatment here and especially later in Chapter 5, when I pick up sentence mood again as well.

[3] I deviate slightly from Portner's (2007) notation in order to bring it more in line with the parlance of this book. This is however only terminological.

the combination of the expression in each dimension is properly typed.[4] Portner (2007: 413) provides the following definitions.[5]

(4.6) *Ordinary functional application*
For all nodes $\alpha\beta$, if $[\![\beta]\!]^t$ is in the domain of $[\![\alpha]\!]^t$, then
a. $[\![\alpha\beta]\!]^t = [\![\alpha]\!]^t([\![\beta]\!]^t)$
b. $[\![\alpha\beta]\!]^u = [\![\alpha]\!]^u \cup [\![\beta]\!]^u$

(4.7) *Expressive functional application*
For all nodes $\alpha\beta$, if $[\![\beta]\!]^t$ is in the domain of $[\![\alpha]\!]^u$, then
a. $[\![\alpha\beta]\!]^t = [\![\beta]\!]^t$
b. $[\![\alpha\beta]\!]^u = \{[\![\alpha]\!]^u([\![\beta]\!]^t)\} \cup [\![\beta]\!]^u$

The first clauses of (4.6) and (4.7) are relatively straightforward and akin to what happens in $\mathcal{L}_{\mathrm{CI}}$, because they define truth-conditional composition. For ordinary functional application, the truth-conditional dimension is calculated by just that, functional application. For expressive application, the truth-conditional meaning is just the meaning of the argument β, that is, an expressive function returns its truth-conditional argument unmodified to the truth-conditional dimension. This corresponds to what happens in $\mathcal{L}_{\mathrm{CI}}$, when the argument is passed along the proof after the CI content has been isolated by the bullet. For easy reference, the rule for CI application of $\mathcal{L}_{\mathrm{CI}}$ is repeated here:

(3.17) *CI application*

$$
\begin{array}{c}
\beta : \sigma \\
\bullet \\
\alpha(\beta) : \tau^c \\
\alpha : \langle \sigma^a , \tau^c \rangle \qquad \begin{array}{c} \beta : \sigma^a \\ \bullet \\ \boxed{\delta : \phi^c} \end{array}
\end{array}
$$

So far, the definitions correspond quite closely to what the tree-admissibility conditions in $\mathcal{L}_{\mathrm{CI}}$ do. The differences becomes clear, however, when we consider what happens in the use-conditional meaning component. While in $\mathcal{L}_{\mathrm{CI}}$, use-conditional content is removed and not passed up the derivation, Portner's (2007) system makes it available at higher nodes. First, this is achieved by (4.6). While in the truth-

[4] Once the complete new system is in place, I will make use of type distinctions again, employing the new type *u* for use-conditional content, introduced in (4.5) on p. 106.

[5] Portner (2007: 413) uses different variables from my own in the definitions. Furthermore, in the published version, the definition for expressive application contains an error. A missed superscript renders the condition for expressive application the same as the one for ordinary functional application. Since this error is not present in Portner's manuscript version of that article, it seems that it sneaked in during the typesetting process.

conditional dimension (4.6a), functional application is used to calculate the complex meaning, (4.6b) collects the use-conditional content of the two daughters by building their union, thereby making it available at the mother as well. Similar things happen in the use-conditional dimension in the case of expressive application. However, in this case, we build the union of the use-conditional content that results when the expressive functor is applied to its (truth-conditional) argument and the use-conditional content that comes with the argument. That is, when comparing this to rule (3.17), this dimension corresponds to what is located below the bullet intersected with the CI content that may optionally be located below β as well.

Let us now see how Portner's (2007) reformulation of $\mathcal{L}_{\text{CI}}$ provides a compositional interpretation for the following example, which is similar to (3.109) on page 100, that illustrated the non-compositionality of $\mathcal{L}_{\text{CI}}$. For convenience and better comparison with $\mathcal{L}_{\text{CI}}$, which uses an indirect interpretation in contrast with Portner's direct interpretation, I will directly write both meaning dimensions as distinct logical expressions at the same node. To bring it even more in line with Potts's (2005) mode of presentation, I will separate the truth-conditional from the use-conditional content below it by the bullet. In addition, I will use the new type u for use-conditional propositions.[6]

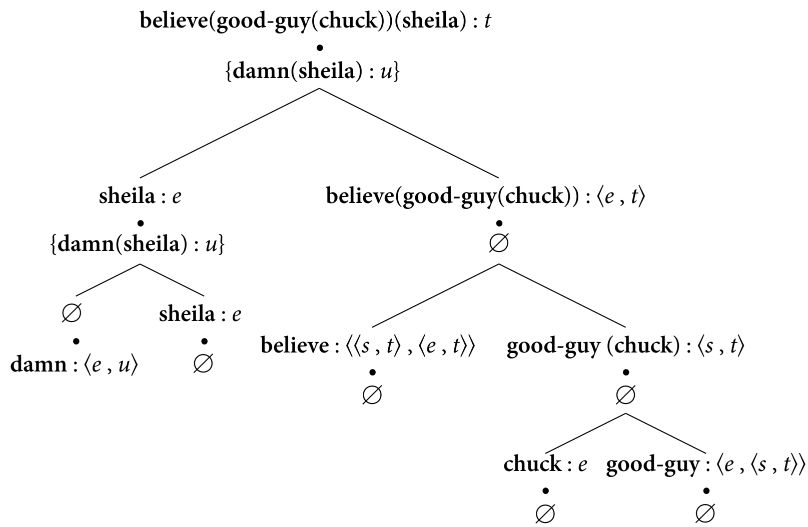
(4.8) That damn Sheila believes that that bastard Chuck is a good guy.

- **believe(good-guy(chuck))(sheila)** : t • { **damn(sheila)** : u, **bastard(chuck)** : u }
  - **sheila** : e • { **damn(sheila)** : u }
    - $\varnothing$ • **damn** : $\langle e, t\rangle$
    - **sheila** : e • $\varnothing$
  - **believe(good-guy(chuck))** : $\langle e, t\rangle$ • {**bastard(chuck)** : u }
    - **believe** : $\langle\langle s, t\rangle, \langle e, t\rangle\rangle$ • $\varnothing$
    - **good-guy (chuck)** : $\langle s, t\rangle$ • {**bastard(chuck)** : u}
      - **chuck** : e • {**bastard(chuck)** : u}
        - $\varnothing$ • **bastard** : $\langle e, u\rangle$
        - **chuck** : e • $\varnothing$
      - **good-guy** : $\langle e, \langle s, t\rangle\rangle$ • $\varnothing$

[6] Note that, since $M \cup \varnothing = M$ for every set M, what happens in the use-conditional domain is often trivial and I do not write it explicitly in the derivation.

Now compare this to a minimal variant in which the expressive inside the embedded clause is omitted. While in $\mathcal{L}_{\mathrm{CI}}$ this does not change anything for the immediate constituents of the clause, it does so in the new system.

(4.9) That damn Sheila believes that Chuck is a good guy.



That is, not only does the entire clause receive a different interpretation, but its right immediate constituent has different content as well, in contrast to what happens in $\mathcal{L}_{\mathrm{CI}}$. This is in accordance with compositionality, since a change in meaning of the complex expression is caused by a change in the meaning of (at least) one of its immediate parts.

It is important to note that, except for the fact that use-conditional content is dragged along during the derivation in Portner's (2007) system, it has all the restriction that $\mathcal{L}_{\mathrm{CI}}$ comes with. First, there is no rule that allows the use-conditional component of an expression to become the argument of anything, thereby implementing the prohibition against CI arguments (cf. (3.8) on p. 48). That is, use-conditional modifiers are excluded. There can also be no mixed expressives in Portner's variant of $\mathcal{L}_{\mathrm{CI}}$, as there is no rule that applies both dimensions of a functional expression to an argument. This is because in the case of expressive application (4.7a), the first dimension is ensured to be identical to its argument. Therefore, as a next step, I will transfer Portner's (2007) suggestion for a compositional version of $\mathcal{L}_{\mathrm{CI}}$ to McCready's (2010) $\mathcal{L}_{\mathrm{CI}}^{+}$.

Before proceeding with the reformulation of $\mathcal{L}^{+}_{\mathrm{CI}}$ in a compositional fashion, however, a digression is in order regarding the manner of presentation that I will use. First, since I will stick to an indirect interpretation, I will keep on representing both dimensions of meaning explicitly at each node of the derivation. Officially, every natural language expression will be translated into the intermediate logical language as an ordered pair, where the first projection of that pair corresponds to the expression's truth-conditional content and the second projection represents its use-conditional content. I will call these dimensions t-*dimension* and u-*dimension*, respectively. For instance, an expression like *Sheila*, which does not have use-conditional content (at least, let us assume that), is taken to the logic by the translation function as follows:

(4.10) *Sheila* $\rightsquigarrow \langle \mathbf{sheila} : e, \emptyset \rangle$

Recall that in the original version of $\mathcal{L}_{\mathrm{CI}}$, there are no expressions that have both truth- and use-conditional content. Accordingly, the *u*-dimension of a descriptive item like *Sheila* can be considered empty, as in (4.10). Likewise, a UCI does not have a contentful *t*-dimension. This way of representing the content of "non-active" dimensions in the logic will be revised in the next section, but for the moment, let us follow Portner's (2007) system and assume truth-conditional expressions have an empty *u*-dimension and UCIs have an empty *t*-dimension. An expressive like *damn* therefore translates into the following two-dimensional representation.

(4.11) *damn* $\rightsquigarrow \langle \emptyset, \mathbf{damn} : \langle e, u \rangle \rangle$

We can now reformulate Portner's (2007: 413) application schemata (4.6) and (4.7) so that they directly apply to such two-dimensional expressions, instead of having two interpretation functions:

(4.12) *Ordinary functional application*
If $\Gamma_1 : \langle \sigma, \tau \rangle$ and $\Delta_1 : \sigma$, then $\Gamma(\Delta) = \langle \Gamma_1(\Delta_1), \Gamma_2 \odot \Delta_2 \rangle$

(4.13) *Expressive functional application*
If $\Gamma_2 : \langle \sigma, \tau \rangle$ and $\Delta_1 : \sigma$, then $\Gamma(\Delta) = \langle \Delta_1, \Gamma_2(\Delta_1) \odot \Delta_2 \rangle$

In these definitions, the capital Greek letters Γ and Δ range over entire two-dimensional expressions of the logical language, and I use subscripts when just a single dimension is referred to.[7] Furthermore, since we are now dealing with an indirect interpretation, we cannot directly unite the objects in the second dimension, since they are still expressions (of the intermediate logical language) and not sets of denotations. For this, I use an operator "$\odot$" that merges those expressions.[8]

As an alternative form of presentation, these two rules can be given in a proof-style notation as follows, where the lower Greek letters now range over one-dimensional expressions of the logic. For ordinary functional application, we have the following rule of proof:

(4.16) $$\frac{\langle \alpha : \langle \sigma, \tau \rangle, \gamma \rangle \qquad \langle \beta : \sigma, \delta \rangle}{\langle \alpha(\beta) : \tau, \gamma \odot \delta \rangle}$$

For expressive application, we have to make a choice. Note that the definition in (4.13) does not put any constraints on the first projection of Γ. In principle, we could have anything there, because the outcome of expressive application does not include this component at all. As can be seen in the following rule, the first dimension of the function does not show up anymore after expressive application.

(4.17) $$\frac{\langle \gamma, \alpha : \langle \sigma, \tau \rangle \rangle \qquad \langle \beta : \sigma, \delta \rangle}{\langle \beta : \sigma, \alpha(\beta) : \tau \odot \delta \rangle}$$

For now, let us assume that expressive application only applies to cases in which the functional expression has an empty truth-conditional dimension.

[7] More formally, the subscripts are used according to the abbreviation schema $\pi_n(\Gamma) \leftrightsquigarrow \Gamma_n$, where π_n is the projection function that takes a tuple as its argument and returns the n*th* member of that tuple. For instance:

(4.14) a. $\pi_1 \langle 25, 9, \{20, 12\} \rangle = 25$
b. $\pi_3 \langle 5, 2, \{20, 14\} \rangle = \{20, 14\}$

Thanks to the projection function, we can obtain Portner's (2007) two interpretation functions as follows:

(4.15) a. $[\![\Gamma]\!]^t = [\![\pi_1(\Gamma)]\!]$
b. $[\![\Gamma]\!]^u = [\![\pi_2(\Gamma)]\!]$

[8] In the final version of the logic, the interpretation of "$\odot$" will however be officially defined as intersection and not as union as in Portner (2007), because I conceive u-propositions as sets of contexts. For the moment this does not matter though, so "$\odot$" can simply be understood as an operator that connects u-propositions.

$$(4.18)\quad \frac{\langle \varnothing, \alpha : \langle \sigma, \tau \rangle \rangle \qquad \langle \beta : \sigma, \delta \rangle}{\langle \beta : \sigma, \alpha(\beta) : \tau \odot \delta \rangle}$$

For expository purposes, I will employ the following abbreviation convention to reduce the number of brackets in the proofs and bring the appearance closer to $\mathcal{L}_{\mathrm{CI}}^{+}$.

$$(4.19)\quad \langle \alpha, \beta \rangle \leftrightsquigarrow \alpha \bullet \beta$$

Substituting this abbreviation into the two proof rules, we arrive at the following rules, which should look familiar to those who have read the previous chapter.

$$(4.20)\quad \frac{\alpha : \langle \sigma, \tau \rangle \bullet \gamma \qquad \beta : \sigma \bullet \delta}{\alpha(\beta) : \tau \bullet \gamma \odot \delta}\,\mathrm{Fa}$$

$$(4.21)\quad \frac{\varnothing \bullet \alpha : \langle \sigma, \tau \rangle \qquad \beta : \sigma \bullet \delta}{\beta : \sigma \bullet \alpha(\beta) : \sigma \odot \delta}\,\mathcal{E}\mathrm{a}$$

However, the similarity of this to McCready's (2010) rules of proof for $\mathcal{L}_{\mathrm{CI}}^{+}$ should not belie the crucial contrast. First, we are officially still dealing with two-dimensional expressions; that is, the two expressions connected with the bullet are actually the first and second projection of an ordered pair that serves as the translation for a single expression with two dimensions of meaning. Secondly, in contrast to $\mathcal{L}_{\mathrm{CI}}^{+}$, the flow of information (i.e., the fact that only use-conditional meaning can apply to descriptive content to produce use-conditional content, but not vice versa) is solely regulated by the composition rules and depends on the dimension an expression occurs in, instead of being encoded as a distinction in the semantic type system. For this purpose, there is, at the moment, no need for additional types beyond the usual ones. However, we can introduce a pseudo type distinction that allows us to bring the definition in (4.21) even more in line with the formulation in $\mathcal{L}_{\mathrm{CI}}^{+}$ by means of the following additional abbreviation schema:

$$(4.22)\quad \langle \varnothing, \alpha : \langle \sigma, \tau \rangle \rangle \leftrightsquigarrow \varnothing \bullet \alpha : \langle \sigma, \tau \rangle \leftrightsquigarrow \alpha : \langle \sigma, \tau \rangle^{c}$$

This abbreviation schema can now be plugged into (4.21), so that we end up with the following abbreviated proof rule for expressive application:

(4.23) $$\frac{\alpha : \langle \sigma, \tau \rangle^c \qquad \beta : \sigma \bullet \delta}{\beta : \sigma \bullet \alpha(\beta) : \tau \odot \delta}\,\mathcal{E}\mathrm{a}$$

Except for the additional use-conditional material that could be brought into the derivation by the argument expression (and which is carried over to the conclusion as well), this new rule looks a lot like McCready's (2010) proof-style notion of expressive application, which I repeat here for comparison:[9]

(4.25) $$\frac{\alpha : \langle \sigma^a, \tau^c \rangle \qquad \beta : \sigma^a}{\beta : \sigma^a \bullet \alpha(\beta) : \tau^c}\,\mathcal{E}\mathrm{a}$$

Before presenting an actual proof in this system, let me introduce a further abbreviation convention that helps to greatly reduce spurious use-conditional content that does not play any crucial role in the derivation.

(4.26) $\langle \alpha : \sigma, \emptyset \rangle \leftrightsquigarrow \alpha : \sigma \bullet \emptyset \leftrightsquigarrow \alpha : \sigma^a$

This convention allows us to employ the superscripted *a*, which is used in $\mathcal{L}_{\mathrm{CI}}$ to mark all at-issue types, to write expressions whose use-conditional content is empty as a single expression, instead of specifying the empty set each time. With these conventions and proof rules, we can now convert the parsetree of Portner's (2007) system in (4.8) into a proof-style notation: see page 116.

[9] Transforming (4.23) into a tree-style presentation helps to highlight the similarity to CI application in Potts's (2005) $\mathcal{L}_{\mathrm{CI}}$.

(4.24)
$$\begin{array}{c}
\beta : \sigma \\
\bullet \\
\alpha(\beta) : \sigma \odot \delta \\
\alpha : \langle \sigma, \tau \rangle^c \qquad \begin{array}{c} \beta : \sigma \\ \bullet \\ \delta \end{array}
\end{array}$$

However, officially the expressions in this parsetree are all full-fledged two-dimensional expressions, each with a truth-conditional and use-conditional component, such that the entire derivation is kept compositional.

(4.27)

$$
\begin{prooftree}
\AxiomC{\textit{That damn}}
\RightLabel{Lx}
\UnaryInfC{$\mathbf{damn} : \langle e, u\rangle^{c}$}
\AxiomC{\textit{Sheila}}
\RightLabel{Lx}
\UnaryInfC{$\mathbf{sheila} : e^{a}$}
\RightLabel{$\mathcal{E}$a}
\BinaryInfC{$\mathbf{sheila} : e \bullet \mathbf{damn}(\mathbf{sheila}) : u$}
\AxiomC{\textit{believes}}
\RightLabel{Lx}
\UnaryInfC{$\mathbf{believe} : \langle \langle s, t\rangle , \langle e, t\rangle \rangle^{a}$}
\AxiomC{\textit{that bastard}}
\RightLabel{Lx}
\UnaryInfC{$\mathbf{bastard} : \langle e, u\rangle^{c}$}
\AxiomC{\textit{Chuck}}
\RightLabel{Lx}
\UnaryInfC{$\mathbf{chuck} : e^{a}$}
\RightLabel{$\mathcal{E}$a}
\BinaryInfC{$\mathbf{chuck} : e \bullet \mathbf{bastard}(\mathbf{chuck}) : u$}
\AxiomC{\textit{is a good guy}}
\RightLabel{Lx}
\UnaryInfC{$\mathbf{good\text{-}guy} : \langle e, \langle s, t\rangle \rangle^{a}$}
\RightLabel{Fa}
\BinaryInfC{$\mathbf{good\text{-}guy}(\mathbf{chuck}) : \langle s, t\rangle \bullet \mathbf{bastard}(\mathbf{chuck}) : u$}
\RightLabel{Fa}
\BinaryInfC{$\mathbf{believe}(\mathbf{good\text{-}guy}(\mathbf{chuck})) : \langle e, t\rangle \bullet \mathbf{bastard}(\mathbf{chuck}) : u$}
\RightLabel{Fa}
\BinaryInfC{$\mathbf{believe}(\mathbf{good\text{-}guy}(\mathbf{chuck}))(\mathbf{sheila}) : t \bullet \mathbf{bastard}(\mathbf{chuck}) : u \odot \mathbf{damn}(\mathbf{sheila}) : u$}
\end{prooftree}
$$

In contrast to the original $\mathcal{L}_{\mathrm{CI}}$, this reformulation keeps track of both truth- and use-conditional content at each point of the derivation, thereby adhering to the principle of compositionality (PoC).

4.3.2 Compositional $\mathcal{L}^{+}_{CI}$

In the following, I will extend the compositional variant of $\mathcal{L}_{\mathrm{CI}}$ developed in the last section to McCready's (2010) $\mathcal{L}^{+}_{\mathrm{CI}}$. To this end, I will again employ a system of true multidimensionality in which every expression is thoroughly multidimensional.

As we have seen in the previous chapter, the main advantage of $\mathcal{L}^{+}_{\mathrm{CI}}$ over $\mathcal{L}_{\mathrm{CI}}$ is the use of shunting and mixed types in order to deal with mixed content. Moreover, one other important function of the shunting dimension is that it serves as a kind of book-keeping device, as it allows the use-conditional content of mixed UCIs to be kept active in the derivation as long as it still has open argument positions. It is only after it reaches (use-conditional) propositional status that the use-conditional dimension of mixed UCIs is removed from the derivation. This elegantly resolves a potential conflict of two important points. First, the use-conditional content of a mixed UCI must be kept around until all its arguments are saturated. Secondly, it is necessary to isolate UCIs as soon as they are propositional in order to adhere to the principle of non-interaction (cf. Barker, Bernardi, and Shan 2010: 111).

(4.28) *Principle of non-interaction* (PONI)
Once launched, use-conditional content does not interact with truth-conditional content.

Just as I used two different dimensions for the two different types employed in $\mathcal{L}_{\mathrm{CI}}$, I will use three distinct dimensions in order to transfer the three types of $\mathcal{L}^{+}_{\mathrm{CI}}$ into a compositional variant of the logic. This additional *s*-dimension, as I call it, will serve mainly as a place to store content that is still *u*-active, by which I mean that is active for the calculation for use-conditional content. This is a kind of generalization of the function played by shunting types for mixed UCIs in McCready's $\mathcal{L}^{+}_{\mathrm{CI}}$.[10]

[10] Note that I use the term *shunting* only for historical reasons. Think of *s*, rather, as standing for *storing* than *shunting*, since the main function of the new dimension is to store unsaturated use-conditional content. Pure shunting expressions, as employed by McCready (2010), are implemented differently in the new system. See the discussion on pp. 123–5.

(4.29) $$\{\ \underbrace{t\text{-dimension}}_{t\text{-content}},\ \underbrace{s\text{-dimension}}_{u\text{-active content}},\ \underbrace{u\text{-dimension}}_{\text{saturated } u\text{-content}}\ \}$$

The first and third dimension are the same as the two dimensions used in the compositional variant of Potts's (2005) logic, while the second is the new *s*-dimension. Roughly speaking, these three dimensions correspond to the at-issue, shunting, and CI types respectively, as used in $\mathcal{L}^{+}_{\mathrm{CI}}$.

The proof rules of ordinary functional application, expressive application, and mixed application from $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$, as depicted in Figure 3.1 on page 80 and Figure 3.2 on page 83, can be straightforwardly transferred into such a truly three-dimensional system:

(4.30) *Ordinary functional application*

$$\frac{\left\langle \alpha_1 : \langle \sigma, \tau \rangle, \varnothing, \alpha_3 \right\rangle \qquad \left\langle \beta_1 : \sigma, \varnothing, \beta_3 \right\rangle}{\left\langle \alpha_1(\beta_1) : \tau, \varnothing, \alpha_3 \odot \beta_3 \right\rangle}$$

(4.31) *Expressive application*

$$\frac{\left\langle \varnothing, \alpha_2 : \langle \sigma, \nu \rangle, \alpha_3 \right\rangle \qquad \left\langle \beta_1 : \sigma, \varnothing, \beta_3 \right\rangle}{\left\langle \beta_1 : \sigma, \alpha_2(\beta_1) : \nu, \alpha_3 \odot \beta_3 \right\rangle}$$

(4.32) *Mixed application*

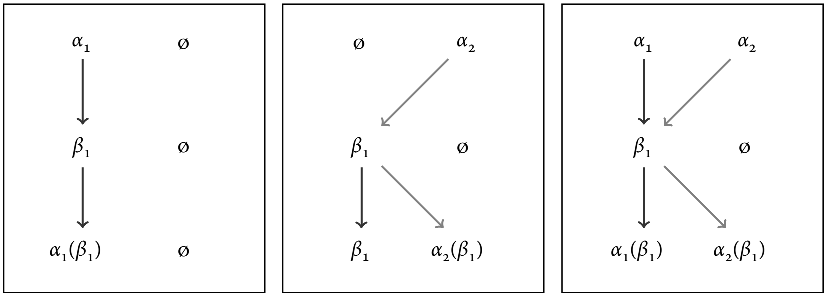
$$\frac{\left\langle \alpha_1 : \langle \sigma, \tau \rangle, \alpha_2 : \langle \sigma, \nu \rangle, \alpha_3 \right\rangle \qquad \left\langle \beta_1 : \sigma, \varnothing, \beta_3 \right\rangle}{\left\langle \alpha_1(\beta_1) : \tau, \alpha_2(\beta_1) : \nu, \alpha_3 \odot \beta_3 \right\rangle}$$

The rule for shunting elimination ($\mathcal{S}$e) of $\mathcal{L}^{+}_{\mathrm{CI}}$, which switches shunting to CI content and the diamond to the bullet, can be reformulated by the following rule that shifts an expression from the second to the third dimension when it has reached the status of a completed *u*-proposition, thereby emptying the *s*-dimension:

(4.33) *Shunting elimination*

$$\frac{\left\langle \alpha_1, \alpha_2 : u, \alpha_3 \right\rangle}{\left\langle \alpha_1, \varnothing, \alpha_3 \odot \alpha_2 \right\rangle}$$

This would work just fine. However, the fact that we now have all three dimensions of meaning available for every expression in the derivation opens some possibilities to simplify the system by reducing the number of composition rules. In order to do this, it helps to think about how content composes in each dimension. Since in all the application rules in



(a) Functional application (b) Expresssive application (c) Mixed application

FIGURE 4.1 Composition of the first and second meaning dimensions in three-dimensional $\mathcal{L}^{+}_{\text{CI}}$

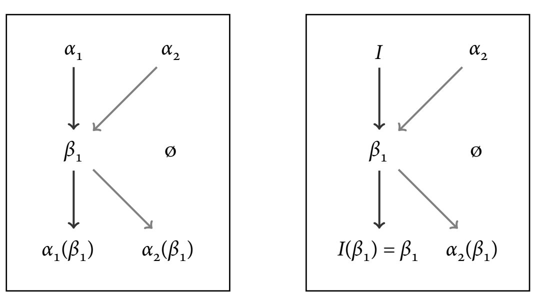
(4.30)–(4.32) the third dimension is always composed in the same way, let us concentrate on the first two dimensions for the moment. Figure 4.1 visualizes how these two dimensions compose with each other in the three application rules. The first line presents the t-dimension and s-dimension of the functional expression and the second line does the same for the argument expression. The third line then is the outcome of the application. The arrows between the first two lines are hence to be read as "applies to", while the lower arrows mean "yields". Note that the arrows do not connect anything with an empty set. This suggests that these dimensions are the place where we should look for modifications, as they currently play no crucial role in the composition.

A first possibility for reducing the number of composition rules lies in the relation between expressive application and mixed application. In a truly multidimensional system, the two rules can be unified, given some additional assumptions. A comparsion of Figures 4.1(b) and 4.1(c) reveals that the sole difference between expressive application and mixed application is that in the former, the argument is passed to the truth-conditional dimension unmodified, whereas in the case of mixed application, it serves as an argument to the truth-conditional component of the mixed UCI. If we now assume that the t-dimension of functional expletive UCIs is not the empty set, but rather an identity function (on the type of the argument expression's t-dimension), the two cases can be unified. An identity function I_σ on type σ is a function that maps every expression of type σ onto itself:

(4.34) $I_\sigma = \lambda x_\sigma . x : \langle \sigma, \sigma \rangle$

Now, if we have $\alpha_1 = I$ in the schema for mixed application in Figure 4.1(c), then the outcome of applying α_1 to β_1 gives us β_1 again, since $I(\beta_1) = \beta_1$ which is what expressive application would have delivered as well. Hence, expletive expressive application becomes a special variant of the more general mixed application, namely one in which the *t*-dimension of the function is the identity function. That is, the difference between functional expletive UCIs and functional mixed UCIs comes down not to a difference in how the meaning dimensions compose (as is the case in $\mathcal{L}^+_{\mathrm{CI}}$), but to a difference in what content they have in their *t*-dimension. If it is something contentful, we have a mixed UCI; if it is an identity function, we have an expletive UCI. The schematic presentation in Figure 4.2 illustrates how expletive expressive application is just a special instance of the more general rule of mixed application.

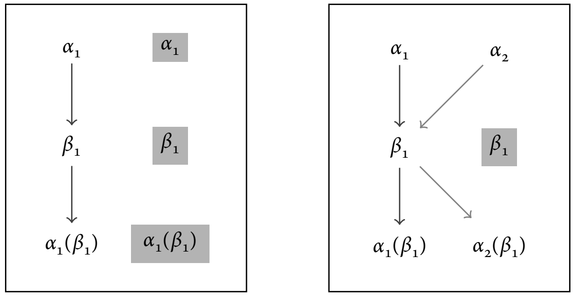
But I think we can do better, and reduce the composition rules even more by unifying ordinary functional application with general expressive application, so that we end up with just a single generalized rule for multidimensional application. The key to achieve this lies in the second dimension of the argument expression. Looking back at the schematic visualization of ordinary functional application in Figure 4.1(a) on the previous page and both application rules in Figure 4.2 below, we see that the argument's *s*-dimension does not play a role in either of the two applications.[11] Furthermore, it is always the *t*-dimension of the argument to which both dimensions of the functional expression apply. Now let me employ the following trick. Instead of using the empty set for representing "empty" use-conditional content in the *s*-dimension of an



(a) Mixed application (b) Expletive expressive application

FIGURE 4.2 Expletive expressive application as an instance of mixed application

[11] That is not to say that it is irrelevant for the application rules. Quite the contrary. It constrains the use of the application to just those cases in which the *s*-dimension of the argument is empty.



(a) Functional application (b) General expressive application

FIGURE 4.3 Composition of the first two meaning dimensions with non-empty dimensions

expression, I instead use a copy of the first dimension. I do this for every empty *s*-dimension. In the case of ordinary functional application, the entire application is therefore replicated in the second dimension. For the moment, I leave the arrows untouched. For illustration, I put the copied material in gray boxes. We thus end up with the two schemata in Figure 4.3.

Note that merely copying the truth-conditional content to the *s*-dimension does not affect the composition in any meaningful way, because the places to which I have copied material do not play any role in the application schemata. No gray box is connected to anything else.

Comparing the two schemata resulting from the copying trick reveals how this enables the unification of the two rules. What happens in the *t*-dimension is the same as before the copying trick. Now, in the *s*-dimension, we see that the sole difference is that the function's *s*-dimension may differ from the *t*-dimension in the case of expressive application, while it has to be the same in functional application. This is also true of the outcome of the application. Now, if the function's *s*-dimension in expressive application happens to be the same as its *t*-dimension (i.e. $\alpha_2 = \alpha_1$), then the schema for expressive application reads the same as the one for ordinary functional application. That is, functional application can be understood as a special case of general expressive application, namely one in which the function's *s*-dimension is a copy of its *t*-dimension. This maneuver then opens up an additional possibility for simplification. Note that if we were to employ general expressive application as in Figure 4.3(b) as the most general rule, the *s*-dimension of the argument would still remain unused. However, since it happens to be a copy of the *t*-dimension, we can equally

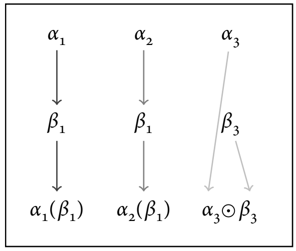


FIGURE 4.4 Generalized functional application

assume that the function's *s*-dimension applies to the *s*-dimension of the argument, instead of the *t*-dimension. That is, we can have an entirely *intra*-dimensional application, instead of the *trans*-dimensional application that so far has been the hallmark of the second dimension, since Potts's $\mathcal{L}_{\text{CI}}$. Of course, this is currently nothing more than an aesthetic advantage. However, as I will show later, this move allows us to extend the general application schema to subsume use-conditional modification too once the corresponding types are licensed, merely by a minor modification of the rule, instead of introducing a dedicated composition rule for such cases.

The new visual illustration for the resulting single, generalized application schema is given here in Figure 4.4. For completeness, I have also added the composition of the third dimension, which was put aside during the present reformulation.

If it is the case that $\alpha_2 = \alpha_1$, this general rule becomes the special case of ordinary functional application. If $\alpha_1 = I$, then it becomes the special case of expletive functional application. For other assignments, it equals mixed application.

Coming back from the schematic illustrations to actual rules of proof, the new proof rule for general functional application can be given as follows:

(4.35) *Generalized functional application*

$$\frac{\left\langle \alpha_1 : \langle \sigma, \tau \rangle, \alpha_2 : \langle \sigma, \nu \rangle, \alpha_3 \right\rangle \qquad \left\langle \beta_1 : \sigma, \beta_1 : \sigma, \beta_3 \right\rangle}{\left\langle \alpha_1(\beta_1) : \tau, \alpha_2(\beta_1) : \nu, \alpha_3 \odot \beta_3 \right\rangle}$$

Note that the function's *t*- and *s*-dimensions do not have to be equal, but of course may be, as is the case with ordinary functional application. Therefore, we have α_1 and α_2. In contrast, the second dimension of the argument must be the same as its first dimension, just as the second dimension had to be empty in (4.30) and (4.31). This will be revised in §4.4.1, when I extend the system of $\mathcal{L}^{+}_{\mathrm{CI}}$ to allow for use-conditional modifiers as well. Furthermore, since we have now done away with the empty sets as the means of representing non-existent or trivial content in the first two dimensions, we should look for a way to do this in the third dimension as well. In anticipation of the final interpretation of the use-conditional connective "$\odot$"—to be set up in §4.4.4—as intersection of sets (of contexts), let me introduce an expression U that serves this role. Its interpretation will later be defined such that it serves as a neutral element with respect to such context set intersection. That is, it will hold that $[\![\alpha \odot U]\!] = [\![\alpha]\!]$. This element will represent the u-dimension of expressions that do not come with completed use-conditional content. That is, a simple truth-conditional expression like *Jonas* will receive the following three-dimensional representation:

(4.36) $\quad$ *Jonas* $\rightsquigarrow \langle \mathbf{jonas} : e, \mathbf{jonas} : e, U \rangle$

With the modification of the application rule, we now have to adjust the proof rule for shunting elimination as well. Recall that by means of (4.33), the s-dimension gets emptied when the use-conditional proposition is shifted from the second to the third dimension. In order to be in harmony with the new general application schema, the new rule for shunting elimination copies the content of the t-dimension to the s-dimension. This brings it in accordance with the general strategy that, if an expression has no active, that is, functional use-conditional content, its truth-conditional content is present both in its t- and its s-dimension, where it is accessible for the second dimension of other expressions. The revised proof rule for shunting elimination therefore looks as follows:

(4.37) $\quad$ *Shunting elimination, revised*

$$\frac{\langle \alpha_1, \alpha_2 : u, \alpha_3 \rangle}{\langle \alpha_1, \alpha_1, \alpha_3 \odot \alpha_2 \rangle}$$

An example derivation in the new system is given in (4.39). As I did for $\mathcal{L}_{\mathrm{CI}}$, I adopt the separators of $\mathcal{L}^{+}_{\mathrm{CI}}$ to reduce brackets by means of the following abbreviation convention:

(4.38) $\quad \langle \alpha, \beta, \gamma \rangle \leftrightsquigarrow \alpha \blacklozenge \beta \bullet \gamma$

To save more horizontal space, I write the dimensions above each other, with the t-dimension at the bottom and the u-dimension on top in order to mirror the informal tower notation used in earlier chapters.[12]

(4.39)

$$
\dfrac{
\dfrac{
\dfrac{
\dfrac{\textit{Der verdammte}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \mathbf{damn} : \langle e,u\rangle\\ I_e\end{array}}\,\mathrm{Lx}
\quad
\dfrac{\textit{Jonas}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \mathbf{j} : e\\ \mathbf{j} : e\end{array}}\,\mathrm{Lx}
}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \mathbf{bad}(\mathbf{j}) : u\\ \mathbf{j} : e\end{array}}
}{\begin{array}{c}\bullet\, \mathbf{bad}(\mathbf{j}) : u\\ \blacklozenge\ \mathbf{j} : e\\ \mathbf{j} : e\end{array}}
\quad
\dfrac{
\dfrac{\textit{begafft}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \lambda x\lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(x)(y)) :\\ \langle e,\langle e,u\rangle\rangle\\ \mathbf{look\text{-}at} : \langle e,\langle e,t\rangle\rangle\end{array}}\,\mathrm{Lx}
\quad
\dfrac{\textit{Thomas}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \mathbf{t} : e\\ \mathbf{t} : e\end{array}}\,\mathrm{Lx}
}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \lambda y.\mathbf{bad}(\mathbf{look\text{-}at}(\mathbf{t})(y)) : \langle e,u\rangle\\ \mathbf{look\text{-}at}(\mathbf{t}) : \langle e,t\rangle\end{array}}
}{
\dfrac{\begin{array}{c}\bullet\, \mathbf{damn}(\mathbf{j}) : u\\ \blacklozenge\ \mathbf{bad}(\mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j})) : u\\ \mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j}) : t\end{array}}{\begin{array}{c}\bullet\, \mathbf{bad}(\mathbf{j}) : u \odot \mathbf{bad}(\mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j})) : u\\ \blacklozenge\ \mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j}) : t\\ \mathbf{look\text{-}at}(\mathbf{t})(\mathbf{j}) : t\end{array}}
}
$$

Checking each step of the proof shows that the entire derivation is compositional. At each inference, only the immediate parts matter for determining the meaning of the newly formed complex expression.

Comparing the rules of proof I have used in the compositional variant of $\mathcal{L}^+_{\mathrm{CI}}$ with those of the original reveals some differences. First, as I have already mentioned, I have reduced McCready's (2010) three rules for ordinary, expressive, and mixed application to a single generalized application rule. With this generalization, the differences between the original application rules come down to the question of which dimensions contain informative content and which do not. A further difference between the compositional variant of $\mathcal{L}^+_{\mathrm{CI}}$ and the original is that McCready's fourth application rule—the one for shunting application ($\mathcal{S}$a)—is notably missing from my compositional reformulation. The reason for this "lack" is, again, that shunting application is subsumed by the new generalized proof rule. Recall that in $\mathcal{L}^+_{\mathrm{CI}}$, shunting UCIs are functional UCIs that, when combined with a truth-conditional argument, yield use-conditional content, but which—and this is what distinguishes them from expletive functional UCIs—do not return their

[12] I employ again the generic **bad** for the negative attitude.

argument. In the new system, this can be achieved by giving shunting expressions a truth-conditional component that maps every input onto trivial truth-conditional content. The resulting application then looks as follows:[13]

(4.40) $$\frac{\langle \lambda x_\sigma.T : \langle \sigma, t\rangle, \alpha : \langle \sigma, \tau\rangle, \gamma\rangle \qquad \langle \beta : \sigma, \beta : \sigma, \delta\rangle}{\langle T, \alpha(\beta) : \tau, \gamma \odot \delta\rangle}$$

Note that this application rule, however, has no independent status in the present reformulation. It is an instance of the generalized application. That is, shunting application is just the special case in which the functional expression has a truth-conditional trivialization function in its t-dimension.

Having developed compositional variants of $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$, I can now turn to the final deviation from, and extension of, $\mathcal{L}^{*}_{\mathrm{CI}}$ that I mentioned in the introduction to this chapter, namely the extension of the type system. While I have provided new rules of proof in this and the previous section, these are mere compositional reformulations, and quite faithful to the original versions of $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$ regarding their empirical scope. The empirical gaps diagnosed in the previous chapter still prevail in these new versions. I will now deal with them.

4.4 The new logic $\mathcal{L}_{\mathrm{TU}}$

In this section, I will build on the compositional reformulations of $\mathcal{L}^{+}_{\mathrm{CI}}$ developed in the previous section in order to formulate a new hybrid logic, called $\mathcal{L}_{\mathrm{TU}}$, that unites truth- and use-conditional meaning in a multidimensional framework and exhibits compositional multidimensionality. As I will show, the step towards a truly multidimensional system—I have already alluded to this in the reformulation of $\mathcal{L}^{+}_{\mathrm{CI}}$—enables us to generalize the combinatoric rules of the logic, so that the number of composition rules can be reduced greatly, while simultaneously allowing us to deal with expressions and constructions that were beyond the scope of $\mathcal{L}^{*}_{\mathrm{CI}}$. As I did in the last section, I will first proceed in a rather intuitive fashion when setting up the compositional system of $\mathcal{L}_{\mathrm{TU}}$ and its restrictions in §4.4.1 and §4.4.2, before finally giving proper

[13] This mirrors the interpretation that McCready (2010: 32) assigns to sentences that lack descriptive content. However, he does this by invoking the mechanism of proof tree interpretation (see discussion on p. 86). The T is the truth-conditional equivalent of the trivial use-conditional expression U.

definitions in §4.4.4. I will also present some conventions in §4.4.3 that will help to abbreviate the complex proofs and increase their legibility.

4.4.1 Extension and generalization

In §3.3.2, I argued that one of Potts's (2005) empirical claims, namely his prohibition against CI arguments, is too strong. While I agree with its first part—that truth-conditional content does not apply to use-conditional content—its second part rules out what I have called *expressive modifiers* (Gutzmann 2011a): expressions that apply to a UCI to yield a modified UCI. In the following, I will call them *use-conditional modifiers*, to use a more general term. For more data in support of the existence of such expressions, see the discussion in §3.3.2, but here are the two illustrative examples.

(4.41) a. That [fucking [bastard]] Burns got promoted!
b. I feel [really [fucking]] brilliant.

In order to cover this data, I need to extend the system developed in previous sections. In Gutzmann (2011a: 135–6), I proposed to achieve this by extending the type definition of $\mathcal{L}_{\mathrm{CI}}$, such that it includes the following type-construction rules:

(4.42) a. If σ is a descriptive type and τ is a (hybrid or pure) expressive type, then $\langle \sigma, \tau \rangle$ is a hybrid expressive type.
b. If σ and τ are (hybrid or pure) expressive types, then $\langle \sigma, \tau \rangle$ is a pure expressive type.

The first clause of (4.42) is just a slight modification of Potts's (2005: 55) clause to build expressive/CI types that characterizes the combination of a descriptive type and an expressive type as a hybrid expressive type. The second clause, (4.42b), is the new one, as it introduces the possibility of having functional expressions that map UCIs onto UCIs. Expressions of this type are called *pure expressives* in Gutzmann (2011a). The two labels *hybrid* and *pure* are used because I defined different modes of composition for each of them. While hybrid expressives are combined by Potts's CI application—cf. (3.17)—pure expressives are combined by the specifically introduced tree-admissibility condition of pure expressive application (cf. Gutzmann 2011a: 135). In the proof-style format of McCready (2010), this rule can be stated as follows:

(4.43) $$\frac{\alpha : \langle \sigma^c, \tau^c \rangle \qquad \beta : \sigma^c}{\alpha(\beta) : \tau^c}$$

The use of the superscript c in this proof rule indicates that the type in question must be a (hybrid or pure) expressive type. Adding the new type definition in (4.42b) to $\mathcal{L}^{\star}_{\mathrm{CI}}$ together with the combination rule (4.43) already allows us to analyse expressive modifiers in a non-compositional extension of $\mathcal{L}^{+}_{\mathrm{CI}}$:

(4.44)

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\textit{fucking}}{\textbf{fucking} : \langle\langle e,t^c\rangle,\langle e,t^c\rangle\rangle}\,\text{Lx} \quad \dfrac{\textit{bastard}}{\textbf{bastard} : \langle e,t^c\rangle}\,\text{Lx}}{\textbf{fucking(bastard)} : \langle e,t^c\rangle} \quad \dfrac{\textit{Burns}}{\textbf{burns} : e}\,\text{Lx}}{\textbf{burns} : e \bullet \textbf{fucking(bastard)(burns)} : t^c}\,\mathcal{E}\text{a}}{\textbf{burns} : e}\,\mathcal{E}\text{e} \quad \dfrac{\textit{got promoted}}{\textbf{got-promoted} : \langle e,t\rangle}\,\text{Lx}}{\textbf{got-promoted(burns)} : t}\,\text{Fa}$$

Let us now see how a similar result can be achieved for the compositional variant of $\mathcal{L}^{+}_{\mathrm{CI}}$ that I developed in the last section. To be sure, we could just do the same and add a new proof rule for expressive modification to the system and, taken together with the suitable extension of the types, we would be done. However, in the spirit of the last section, I will again aim at a most general application rule instead of adding a new one dedicated to expressive modification. In §4.2, I started with a type system that keeps the basic restrictions of $\mathcal{L}_{\mathrm{CI}}$. This type definition will be the starting point for our extension, as an extension of it will be needed in any case. Once this is in place, we can further investigate how it helps to come up with a general application rule and where further modifications are necessary. Hence, I start by modifying the type definition from (4.5), achieving an effect similar to that of the new definition in (4.42), but more in line with the types intended for the new hybrid logic.

(4.45) *Types for $\mathcal{L}_{TU}$*

a. e, t are basic truth-conditional types for $\mathcal{L}_{\mathrm{TU}}$.
b. u is a basic use-conditional type for $\mathcal{L}_{\mathrm{TU}}$.
c. If τ is a truth-conditional type for $\mathcal{L}_{\mathrm{TU}}$, then $\langle s, \tau\rangle$ is a truth-conditional type for $\mathcal{L}_{\mathrm{TU}}$.
d. If σ and τ are truth-conditional types for $\mathcal{L}_{\mathrm{TU}}$, then $\langle \sigma, \tau\rangle$ is a truth-conditional type for $\mathcal{L}_{\mathrm{TU}}$.
e. If σ is a type for $\mathcal{L}_{\mathrm{TU}}$ and τ is a use-conditional type for $\mathcal{L}_{\mathrm{TU}}$, then $\langle \sigma, \tau\rangle$ is a use-conditional type for $\mathcal{L}_{\mathrm{TU}}$.
f. The set of all types for $\mathcal{L}_{\mathrm{TU}}$ is the union of all truth-conditional and use-conditional types.

The only difference to the first version of the type definition in (4.5) on page 106 is in the conditional part of (4.45e), highlighted by shading. In contrast to (4.5d), which only licenses the combination of a truth-conditional type in the domain and a use-conditional type in the range, clause (4.45e) does not specify the input type and therefore allows for both truth-conditional and use-conditional types in the domain. This enables us to build expressions that map use-conditional content onto use-conditional content, which is the first step needed to account for expressive modification.

Now, let us go back to the generalized proof rule for functional application defined in (4.35) on page 122 and schematically depicted in Figure 4.4. As it stands, it cannot be used for expressive modification. The reason is that it is only defined for cases in which the argument is a truth-conditional expression which has the same content in the first two dimensions. However, every UCI has a contentful use-conditional expression in the second dimension that differs from the content of the first dimension. Fortunately, the rule for general functional application can easily be adjusted to allow expressive modification as well. We just have to relax the requirement that the first two dimensions of the argument expression are copies of each other. What we end up with is the most general rule for what I like to call *multidimensional application*, which is defined as in (4.46) and illustrated in Figure 4.5.

(4.46) *Multidimensional application*

$$\frac{\left\langle \alpha_1 : \langle \sigma, \tau \rangle, \alpha_2 : \langle \rho, \nu \rangle, \alpha_3 \right\rangle \qquad \left\langle \beta_1 : \sigma, \beta_2 : \rho, \beta_3 \right\rangle}{\left\langle \alpha_1(\beta_1) : \tau, \alpha_2(\beta_2) : \nu, \alpha_3 \odot \beta_3 \right\rangle}$$

With this new application rule, expressive modification can be accounted for. Recall that expletive UCIs like *bastard* have an identity function in their *t*-dimension which operates on the type of the argument needed in the *s*-dimension. In case of *bastard*, which takes

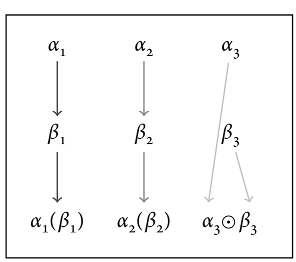


FIGURE 4.5 Composition of meaning dimensions with multidimensional application

an argument of type e in the s-dimension, the t-dimension is therefore the identity function on type e, mapping every argument of type e onto itself. Accordingly, a modifier on expletive UCIs must have an identity function on identity functions on expressions of the type of the s-dimension's argument. An expressive modifier on *bastard*, like *fucking*, therefore receives the following multidimensional translation:

(4.47) $\left\langle I_{\langle e,e\rangle}, \textbf{fucking} : \langle\langle e,u\rangle, \langle e,u\rangle\rangle, U : u \right\rangle$

Given this lexical entry, the $\mathcal{L}^{\star}_{\text{CI}}$-style proof from (4.44) can be transferred into the compositional system as in (4.48), again writing $\alpha \blacklozenge \beta \bullet \gamma$ from bottom to top for $\langle \alpha, \beta, \gamma \rangle$.

(4.48)

$$
\dfrac{
\dfrac{
\dfrac{
\dfrac{
\dfrac{\textit{fucking}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \textbf{fucking} : \langle\langle e,u\rangle, \langle e,u\rangle\rangle\\ I_{\langle e,e\rangle}\end{array}}\,\mathrm{Lx}
\quad
\dfrac{\textit{bastard}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \textbf{bastard} : \langle e,u\rangle\\ I_{e}\end{array}}\,\mathrm{Lx}
}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \textbf{fucking(bastard)} : \langle e,u\rangle\\ I_{e}\end{array}}
\quad
\dfrac{\textit{Burns}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \textbf{burns} : e\\ \textbf{burns} : e\end{array}}\,\mathrm{Lx}
}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \textbf{fucking(bastard)(burns)} : u\\ \textbf{burns} : e\end{array}}
}{\begin{array}{c}\bullet\ \textbf{fucking(bastard)(burns)} : u\\ \blacklozenge\ \textbf{burns} : e\\ \textbf{burns} : e\end{array}}
\quad
\dfrac{\textit{got promoted}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \textbf{got-promoted} : \langle e,t\rangle\\ \textbf{got-promoted} : \langle e,t\rangle\end{array}}\,\mathrm{Lx}
}{\begin{array}{c}\bullet\ \textbf{fucking(bastard)(burns)} : u\\ \blacklozenge\ \textbf{got-promoted(burns)} : t\\ \textbf{got-promoted(burns)} : t\end{array}}
}{}
$$

As the system is set up so far, however, the introduction of multidimensional application does allow some compositions that we do not want to be licensed. Recall that an important generalization about the compositional properties of UCIs made in the literature is the principle of non-interaction mentioned in (4.28) on page 117, according to which complete use-conditional content is not able to become the argument of further modification or operations. According to Barker, Bernardi, and Shan (2010), the principle of non-interaction captures the observation that there are, for instance, no expressions that negate just the use-conditional content while leaving the truth-conditional dimension untouched. As this would be the mirror image of ordinary truth-functional negation, Barker, Bernardi, and Shan (2010: 111) call such an imaginary operator **negex**, which would work as follows:

(4.49) That **negex** damn Kaplan got promoted

$$= \frac{\text{The speaker } \textbf{does not} \text{ bear a negative attitude towards Kaplan}}{\text{Kaplan got promoted}}$$

In the parlance of the system at hand, **negex** would be an expressive modifier. Since there are no restrictions yet on how to combine one-dimensional logical expressions into multidimensional representation, **negex** could be given a lexical entry along the following lines:

(4.50) $I_e \blacklozenge \textbf{negex} : \langle u, u \rangle \bullet U$

With such a lexical entry, the system developed so far allows for the proof in (4.51) which derives the (un)desired result that the use-conditional dimension is negated while nothing happens in the truth-conditional dimension:

(4.51)

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\textit{negex}}{I_e \blacklozenge \textbf{negex} : \langle u,u \rangle \bullet U}\,\text{Lx} \qquad \dfrac{\dfrac{\textit{damn}}{I_e \bullet \textbf{damn} : \langle e,u \rangle \blacklozenge U}\,\text{Lx} \quad \dfrac{\textit{Kaplan}}{\textbf{k} : e \blacklozenge \textbf{k} : e \bullet U}\,\text{Lx}}{\textbf{k} : e \blacklozenge \textbf{damn}(\textbf{k}) : u \bullet U}}{\textbf{k} : e \blacklozenge \textbf{negex}(\textbf{damn}(\textbf{k})) : u \bullet U}}{\textbf{k} : e \bullet \textbf{negex}(\textbf{damn}(\textbf{k})) : u} \qquad \dfrac{\textit{got promoted}}{\textbf{got-prom} : \langle e,t \rangle \blacklozenge \textbf{got-prom} : \langle e,u \rangle \bullet U}\,\text{Lx}}{\begin{array}{c} \bullet\ \textbf{negex}(\textbf{damn}(\textbf{k})) : u \\ \blacklozenge\ \textbf{got-prom}(\textbf{k}) : t \\ \textbf{got-prom}(\textbf{k}) : t \end{array}}$$

The reason why such an undesired derivation is possible is that the use-conditional content expressed by *that damn Kaplan* is still available even if it has already been "launched", to use Barker, Bernardi, and Shans' (2010) metaphor. Therefore, it remains accessible for expressive modification. The question now is whether there are ways to exclude such unwarranted modification without excluding expressive modification entirely. I think that there are, at least, basically four places where different restrictions against this could be introduced into the logical system: (i) the type system, (ii) the definition of well-formed expressions, (iii) the composition rules, and (iv) the lexicon. I will briefly discuss these options.[14]

[14] Note that there is, at least, a fifth option, namely excluding an expression from having the meaning of a use-conditional negation (that is, not allowing for the construction of complementary sets of contexts). However, as long as one cannot come up with a suitable

The standard place to impose combinatoric restrictions is the type system. Following its predecessors, $\mathcal{L}_{\mathrm{TU}}$ uses the type system to exclude expressions that map from use-conditional to truth-conditional content by simply not allowing complex types that would correspond to such functions. However, the type system is not a suitable location to exclude an expression like (4.50). The reason is that, in contrast to McCready's (2010) original logic, $\mathcal{L}_{\mathrm{TU}}$ does not make any reference to the types of multidimensional expressions. While in the official version of $\mathcal{L}_{\mathrm{CI}}^{+}$, a mixed UCI has a complex mixed type, each dimension of a multidimensional expression in $\mathcal{L}_{\mathrm{TU}}$ consists of an independent expression, each of which has its own type. That is, instead of, say, $\alpha \blacklozenge \beta : \langle \sigma, \tau \rangle \times \langle \sigma, \nu \rangle$, we have something along the lines of $\alpha : \langle \sigma, \tau \rangle \blacklozenge \beta : \langle \sigma, \nu \rangle$ in $\mathcal{L}_{\mathrm{TU}}$. That is, the type definition is blind to the fact that we are dealing with multidimensional objects; it just defines the types of the lower-dimensional objects that are used to construct multidimensional expressions. Accordingly, there is no simple way to exclude undesired type combinations across dimensions.[15] There is, however, a different way to nevertheless exclude (4.50) at the level of the type definition, namely simply to forbid the complex type $\langle u, u \rangle$. The type definition could easily be reformulated in a way that excludes just this combination but allows for all other complex types that are licensed by (4.45); but this seems to be a rather ad hoc maneuver to get the restriction right. Of course, this is justified if it is the only possibility of implementing the restriction, which seems, after all, to be motivated by the empirical facts known so far. However, if there are options that are more principled, these would be conceptually more satisfying.[16]

The second place where the desired restriction could be implemented is the definition of well-formed expressions for $\mathcal{L}_{\mathrm{TU}}$. I have not given these definitions yet, but they must define at least two things, namely (i) what the well-formed one-dimensional objects are, and (ii) how the two- or three-dimensional objects are built from them. So, there are two

rational explanation for such a prohibition, such a move would be the most ad hoc and therefore I will not consider it as a viable option outside of this note.

[15] Of course, this could easily be done, but I think we would lose a lot of conceptual appeal by such a move.

[16] There is also a theory-internal argument against such an approach. In order to prohibit other use-conditional connectives like, say, "exor" or "exif", we would have to introduce restrictions against $\langle u, \langle u, u \rangle\rangle$ as well. However, this is the type of the use-conditional connective "$\odot$" needed for merging u-propositions. Thus we should look for an alternative way to exclude such connectives as lexical expressions without prohibiting the corresponding types.

possibilities to exclude operators like **negex**. First, one could say that expressions of type $\langle u, u\rangle$ are not well-formed expressions. However, this would disturb the parallelism between the recursive type definition and the definition of well-formed expressions, because it would no longer hold that every well-typed expression is a well-formed expression, which is undesirable. Moreover, such a move would be even more ad hoc than introducing the corresponding restriction in the type definition. The second possibility would put the restrictions into the definition of the two- or three-dimensional objects, such that expressions like **negex** cannot be composed, even if each of their parts were well-formed. Since we want to have some restriction for the three dimensions anyway—like having no use-conditional expressions in the first, and only expressions of type u in the third—this would not be as unmotivated as all the other possibilities mentioned so far. The cost is that it somewhat complicates how multidimensional expressions are built, as the restrictions would not be as general as they otherwise could be.

Another place to exclude certain expressions or derivations is in the way the composition rules for $\mathcal{L}_{\mathrm{TU}}$ are set up. If there are no rules according to which an expression could be combined with **negex**, then the mere possibility of defining such an expression becomes innocuous, because even if there were such an expression, it could not take part in any derivation and therefore would never end up negating anything. This seems to be conceptually more appealing, as it does not add complexity to the type definitions and captures the intuition that once use-conditional content becomes propositional, it becomes "inactive" and inaccessible to further modifications; an intuition which seemed to be the main motivation for Potts's (2005) original definition of CI application and which is also expressed in Barker, Bernardi, and Shans' (2010) PONI, as stated in (4.28) on page 117. This intuition can easily be implemented in the new system. It just needs to be ensured that use-conditional content in the s-dimension, once it reaches type u, does not stay there, but instead is immediately stored in the third dimension, where it is safe from becoming the argument of any functional expression. Such a rule, which I call *binary use-conditional elimination*, resembles McCready's (2010) rule for shunting elimination that shifts an active shunting expression into an inactive CI expression. It can be stated as follows:

(4.52) *Binary use-conditional elimination*

$$\frac{\left\langle \alpha_1 : \langle \sigma, \tau\rangle, \alpha_2 : \langle \rho, u\rangle, \alpha_3\right\rangle \qquad \left\langle \beta_1 : \sigma, \beta_2 : \rho, \beta_3\right\rangle}{\left\langle \alpha_1(\beta_1) : \tau, \alpha_1(\beta_1) : \tau, \alpha_3 \odot \beta_3 \odot \alpha_2(\beta_2) : u\right\rangle}$$

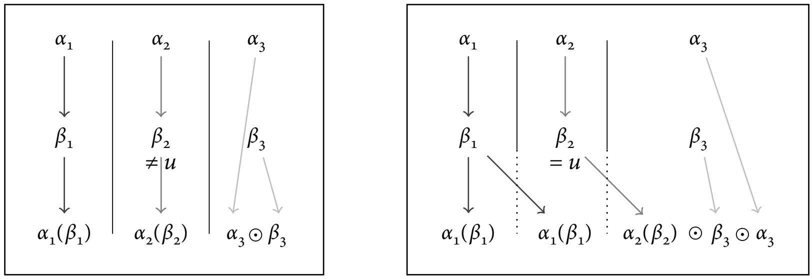
What is important about this rule is that it not only "empties" the *s*-dimension by moving its content into the third dimension immediately after the application, but also copies the first dimension into the second one. This must be so because, as I have set up the system, expressions that have no active use-conditional content have their truth-conditional content present in the *s*-dimension as well, where it can become the target of functional UCIs (or other truth-conditional functions) by multidimensional application. In the presence of this binary use-conditional elimination, the composition schema for multidimensional application must be restricted to cases in which the outcome of the application in the *s*-dimension is not type *u*, such that there is no overlap between the input of the two rules. The restricted version of multidimensional application can therefore be given just as in (4.46), but with an additional side condition:

(4.53) *Restricted multidimensional application*

$$\frac{\left\langle \alpha_1 : \langle \sigma, \tau \rangle, \alpha_2 : \langle \rho, \nu \rangle, \alpha_3 \right\rangle \qquad \left\langle \beta_1 : \sigma, \beta_2 : \rho, \beta_3 \right\rangle}{\left\langle \alpha_1(\beta_1) : \tau, \alpha_2(\beta_2) : \nu, \alpha_3 \odot \beta_3 \right\rangle} \quad \text{for } \nu \neq u$$

Similarly to the shunting types of McCready's $\mathcal{L}_{\mathrm{CI}}^{+}$, the *s*-dimension in $\mathcal{L}_{\mathrm{TU}}$ plays the role of a kind of logging system. It contains the information that is active in the calculation of use-conditional content. If it is completed, its status shifts and so it is moved to the *u*-dimension. Whereas in $\mathcal{L}_{\mathrm{CI}}^{\star}$, UCIs have direct access to truth-conditional expressions, these relations are resembled in $\mathcal{L}_{\mathrm{TU}}$ by the fact that the *s*-dimension can be a copy of an expression's *t*-dimension, such that its *t*-content becomes available for functional use-conditional content in the *s*-dimension. As already stated, this means that there is no transdimensional application in $\mathcal{L}_{\mathrm{TU}}$, as the rule for multidimensional application involves only intradimensional combinations. The only exchange between the dimensions is the shifting and copying that is done by binary use-conditional elimination. The two rules are schematically illustrated in Figure 4.6 (overleaf). The flow of information between the dimensions is indicated by the (dotted) lines.

This restricted version of multidimensional application, together with the elimination rule, directly captures the PONI, and renders an expression like **negex** in (4.50) on page 130 obsolete, because even if it existed it would be harmless, since it could never be combined with another expression, Use-conditional elimination ensures that there are no multidimensional objects with a type *u* expression in their *s*-dimension.



(a) Restricted multidimensional application (b) Binary use-conditional elimination

FIGURE 4.6 Composition with restricted multidimensional application and binary elimination

However, even if the restricted version of multidimensional application together with binary use-conditional elimination provides a conceptually appealing way to implement the PONI and the restriction against propositional use-conditional modifiers, there are reasons why we may not want to adopt them wholesale. Doing it this way really renders the non-interaction constraint a core part of the framework. Of course, this may turn out to be an advantage, but it could just as well turn out to be disadvantageous. The problem is that we do not know how general a principle the PONI really is, if we take a more universal, cross-linguistic perspective. Even if it seems to hold for English and German, the empirical data upon which the PONI is based do not seem to be rich enough to support a constraint embedded as deeply into the logic as is achieved by (4.52). That is, if there are languages that differ from English or German in this respect and allow for the modification of u-propositions, the entire logic would have to be changed for these languages. This would deprive $\mathcal{L}_{\mathrm{TU}}$ of a lot of its conceptual appeal as a *general* framework for the interaction between use- and truth-conditional content. In the end, it comes down to the empirical question of how universal the PONI is. If it turns out to be a universally valid principle, I would happily adopt the restricted version of multidimensional application and the binary version of use-conditional elimination. Until then, however, I think it is better to look for an alternative implementation of PONI that can be dropped or softened for languages in which expressions like **negex** exist without changing the combinatorics of the underlying logic.

In addition to this empirical question, there are theory-internal, technical considerations against an implementation of PONI along these lines. Recall from the discussion in §§3.5.3 and 3.5.4, that the main reason why $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$ cannot properly deal with constructions that involve abstraction or quantification across dimensions is that the use-conditional content is inevitably isolated after it reaches u-propositional status, so that a variable in the now isolated expression cannot be bound afterwards. If I were to use the binary version of use-conditional elimination (4.52) together with the restricted application rule (4.53), $\mathcal{L}_{\mathrm{TU}}$ would inherit a similar problem from the original systems. Even if this could in principle be solved from a technical point of view, this would very much complicate the system and would not be in line with the conception of the u-dimension as a "point of no return".

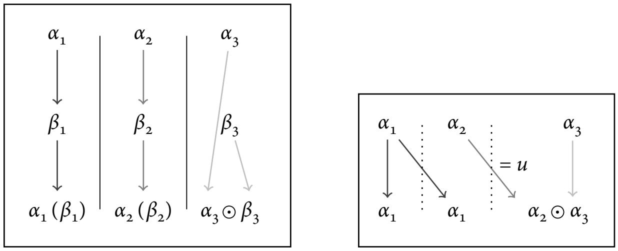
For these two reasons, I will stick to the unrestricted rule for multidimensional application in (4.46). However, we then need another way to send completed use-conditional content from the second to the third dimension. Since we do not want this new elimination rule to apply obligatorily like the binary version, we set it up as a unary rule:

(4.54) *Unary use-conditional elimination*

$$\frac{\langle \alpha_1, \alpha_2 : u, \alpha_3 \rangle}{\langle \alpha_1, \alpha_1, \alpha_3 \odot \alpha_2 \rangle}$$

In this unary version, use-conditional elimination is just the revised version of shunting elimination. The unrestricted version of multidimensional application now combines any expression, regardless of what the outcome in the second dimension is. If type u is reached in the second dimension, we may apply (4.54) in order to empty the second dimension so that the result becomes suitable for further compositions. But this does not need to happen. *If* there were expressions like **negex**, they could apply to the outcome of multidimensional application before (4.54) changes the status of the use-conditional content. On an intuitive level, the combinatorics of $\mathcal{L}_{\mathrm{TU}}$ are similar to the derivations in $\mathcal{L}^{+}_{\mathrm{CI}}$, but thanks to implementation of true multidimensionality $\mathcal{L}_{\mathrm{TU}}$ just needs two characteristic rules, whereas $\mathcal{L}^{+}_{\mathrm{CI}}$ needs a total of six characteristic rules.[17] The way meaning is composed in the different dimension for this final set of rules is illustrated schematically in Figure 4.7 (overleaf).

[17] With multidimensional application and unary use-conditional elimination, we have one application and one elimination rule in $\mathcal{L}_{\mathrm{TU}}$. In $\mathcal{L}^{+}_{\mathrm{CI}}$, we have four application rules with what can be called ordinary functional application, expressive application, shunting application, and mixed application. In addition, there are the two elimination rules for expressive elimination and mixed elimination. And this even without the ability to account for expressive modifiers.



(a) Multidimensional application (b) Unary use-conditional elimination

FIGURE 4.7 Composition with multidimensional application and unary elimination

However, since have I argued that we should not adopt the system in which the emptying of the second dimension is obligatory, while we do not as yet have enough empirical evidence to treat PONI as a universal principle, we nevertheless need a way to implement something like the PONI for languages like English or German, for which it seems to hold, but in a way that is flexible enough to enable such compositions if they are possible in other languages. The place that allows for such a flexible implementation is the fourth and remaining possibility I have mentioned above: the lexicon. Since the lexicon varies from language to language anyway, it would be a good place to keep the possibility of negex-like expression open, while excluding it for languages in which PONI is a valid generalization. Of course, this too would be an ad hoc solution if I simply imposed on the lexicon the restriction that there are no expressions which have a type $\langle u, u\rangle$ in their *s*-dimension. There is however a more systematic way in which such a restriction can be stated. Furthermore, I will suggest that a solution to the PONI problem along these lines can be motivated independently by the desirability of keeping the lexicon as simple as possible.

Before going on, let me briefly mention another possibile way to implement the PONI while staying flexible, namely imposing a kind of meta-proof rule for derivation for particular languages. For English and German, we could set up the rule that unary use-conditional elimination must always apply if possible, such that type *u* content in the *s*-dimension will always be removed before any other expression could apply to it. In other languages, this constraint would not hold, and therefore *u*-propositional modification would be possible. However, since we need the rules introduced in the next section anyway, I do not think that such a meta-rule is really necessary.

4.4.2 Lexical extension rules

Given that all application rules for $\mathcal{L}_{\mathrm{TU}}$ apply only to expressions that are fully specified for all three meaning dimensions, I have to address the question of what the lexicon for $\mathcal{L}_{\mathrm{TU}}$ actually looks like. There are basically two options. Either the expressions that are part of the lexicon for $\mathcal{L}_{\mathrm{TU}}$ are fully specified for each dimension, or they just contain the information that cannot be inferred from what is specified. I think that if the second option can be applied it is preferable, as it seems more parsimonious. Otherwise, the lexical entries would contain a lot of redundant information. However, this is certainly just conceptual thinking and does not provide *a priori* a better account of the empirical data.

Besides keeping the lexical entries simpler, the additional and even more important advantage of such an approach to the lexicon of the logic is that it allows us to implement restrictions on what are possible multidimensional expressions, which, given the discussion in the last section, is precisely what we are after. If the rules that derive material that is not lexically given cannot yield undesired expressions like **negex**, the logic itself is freed from the task of excluding them.

The basic idea is this. Lexical expressions of $\mathcal{L}_{\mathrm{TU}}$ are only specified for those dimensions that cannot be inferred from what is given. From the point of view of the composition rules, which only act on three-dimensional objects, one- or two-dimensional expressions in the lexicon are incomplete, because they lack meaning dimensions that are needed for the proper composition. However, it is possible to state general rules according to which the missing pieces can be added to the lexical entries in a principled way, which would allow the objects to be inserted into the proof trees. I call these rules *lexical extension rules* (LERs). They not only make the lexical entries simpler, but also allow for possible linguistic variation (if it turns out that there is any), because the set of lexical extension rules may differ from language to language. In the following, let us see how LERs can be defined for the various types of UCI that I presented in Chapter 2.

The majority of expressions in the lexicon for $\mathcal{L}_{\mathrm{TU}}$ are plain truth-conditional expressions which are not associated with any use-conditional content. As I have set up the composition rule in (4.46), plain truth-conditional expressions must have their truth-conditional content duplicated in the second dimension, while having the neutral use-conditional object U in the u-dimension. That is, a simple truth-conditional expression can be extended according to the following rule, where $\mathbf{Con}_\sigma$ is the set of constants (i.e. atomic lexical expressions, but not variables) of type σ for $\mathcal{L}_{\mathrm{TU}}$:

(4.55) *LER for pure truth-conditional expressions*
$\alpha \Rightarrow \langle \alpha, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_\sigma$, where σ is a truth-conditional type.

In a similar vein, we have seen that functional expletive UCIs always have an identity function in their descriptive dimension which returns the t-dimension of the argument unmodified. They do not have any isolated use-conditional content. Therefore, if we have a one-dimensional expression that maps from truth-conditional to use-conditional content, we can infer the other two dimensions according to the following LER:[18]

(4.56) *LER for functional expletive UCIs*
$\alpha \Rightarrow \langle I_\sigma, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle}$, where σ is a truth-conditional type and τ is a use-conditional type.

In contrast to functional expletives, isolated expletive UCIs do not have any active use-conditional content, but come as full-fledged use-conditional propositions, that is, expressions of type u. If we want to extend them into proper three-dimensional objects, we can model the fact that they neither have meaningful truth-conditional content nor really interact with other expressions by the insertion of the trivial truth-conditional element T into the first and second dimensions:

(4.57) *LER for isolated expletive UCIs*
$\alpha \Rightarrow \langle T, T, \alpha \rangle$, if $\alpha \in \mathbf{Con}_u$.

Isolated mixed expressives are similar to isolated expletive UCIs insofar as they express complete use conditions without the need for any argument. However, in contrast to isolated expletives, which lack any truth-conditional content, isolated mixed UCIs do have meaningful truth-conditional content. That is, in contrast to the UCIs dealt with so far, they must have a two-dimensional lexical entry. This is, of course, not surprising, as it is the characteristic property of mixed UCIs that they conventionally contribute content to two dimensions. And since the concrete content of a mixed UCI cannot be inferred, it must be

[18] This LER will later be subsumed under a more general LER for use-conditional modification. See (4.67) on p. 142.

part of our lexical knowledge, and therefore we have to encode both dimensions. The two dimensions given for an isolated mixed UCI can then be extended into a three-dimensional representation by copying the first dimension:

(4.58) *LER for isolated mixed UCIs*
$\langle \alpha, \beta \rangle \Rightarrow \langle \alpha, \alpha, \beta \rangle$, if $\alpha \in \mathbf{Con}_{\sigma}$ and $\beta \in \mathbf{Con}_{u}$, where σ is a truth-conditional type.

Note that the new dimension that is added by the LER ends up in the *s*-dimension of the three-dimensional expression. This contrasts with functional mixed UCIs, which are also specified as [+2-*dimensional*] and therefore need a two-dimensional lexical entry, but which are also [+*functional*], which means that their use-conditional content needs at least one argument. Since after lexical extension such content must end up in the *s*-dimension, we get a third dimension by adding the neutral element U as the *u*-dimension:

(4.59) *LER for functional mixed UCIs*
$\langle \alpha, \beta \rangle \Rightarrow \langle \alpha, \beta, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle}$ and $\beta \in \mathbf{Con}_{\langle \sigma, \nu \rangle}$, where σ and τ are truth-conditional types and ν is a use-conditional type.

The remaining type, functional shunting UCIs, is a special case of functional mixed UCIs, when it comes to their lexical entries. That is, we do not even need a special rule for them. For the sake of completeness, I will nevertheless state it explicitly. What is special about shunting UCIs and what motivates them being called *shunting* in the first place is that they do not leave anything meaningful back in the truth-conditional dimension. That is, while they have proper functional content in the second dimension, the first dimension contains a dummy function that maps its argument onto the trivial truth-conditional element T:

(4.60) *LER for functional shunting UCIs*
$\langle \lambda x_{\sigma}.T, \alpha \rangle \Rightarrow \langle \lambda x_{\sigma}.T, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle}$, where σ is truth-conditional type and τ is a use-conditional type.

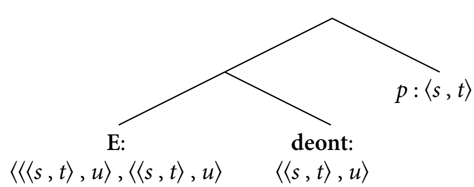
Use-conditional modifiers are special class of UCIs, because they do not introduce any new use-conditional content, but instead act upon the use-conditional content of other expressions. Crucially, this can only be done as long as the use-conditional content resides in the *s*-dimension, because once it is in the third dimension, it cannot become the argument of any other expression. Furthermore, the LER for use-conditional modification is where the restriction against propositional expressive modification can be set up. For languages like English or German, a first attempt of an LER for modifiers of expressive content may look as follows:

(4.61) *LER for non-propositional expressive modifiers* (*to be revised*)
$\alpha \Rightarrow \left\langle I_{\langle\sigma,\sigma\rangle}, \alpha, U \right\rangle$, if $\alpha \in \mathbf{Con}_{\langle\langle\sigma,\tau\rangle,\langle\sigma,\tau\rangle\rangle}$, where σ is a truth-conditional type and τ is a use-conditional type.

As can easily be checked, this LER does not license an expression like **negex** in (4.50), since it has been assigned type $\langle u, u\rangle$ in its *s*-dimension and therefore does not fall under the scope of (4.61). However, if we were dealing with a language that allowed for such expressions, we could easily add a more general LER that accounts for them as well, without changing the underlying combinatoric system of the logic.

The restrictiveness of the LER in (4.61) is problematic, nevertheless. Even if it rules out, as desired, *u*-propositional modifiers and allows for expressive modifiers, it does not allow for higher-order modifiers. That is, even if the modification of UCIs becomes viable due to (4.61), the modifiers created by the rule themselves cannot be modified. We do not have a hierarchy of use-conditional modification, but are stuck with first-order use-conditional modifiers. However, this will be needed for the purposes of this book. As I will argue in Chapter 5 on sentence mood, the mood of clause types like declaratives and interrogatives is composed from two sentence mood operators, a deontic and an epistemic one (following Truckenbrodt 2006a). The details of the analysis do not matter at the moment, but the idea is that the deontic operator is an ordinary functional expletive UCI, while the epistemic operator is a UC-modifier that operates on it. That is, given a propositional content *p*, the structure of how such a sentence can be sketched as follows:[19]

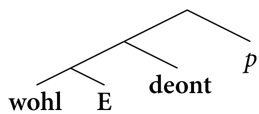
(4.62)



[19] This must be understood neither as a real syntactic representation of a declarative nor as a proper account of the entire semantic composition. It is merely a schematic sketch of what happens in the *s*-dimension of a declarative. See chapter 5 for the complete analysis.

This is fine, as the lexical extension of the epistemic operator is directly accounted for by (4.61). A problem arises, however, when we go a bit further in this brief preview. In Chapter 6, where I provide an analysis of the interaction between sentence mood and modal particles in German, I suggest that some modal particles, like *wohl*, modify the epistemic sentence mood operator, and therefore must be of a higher-order modifier type, as in the following structure:

(4.63)



In order to be able to take the epistemic operator as its argument, the s-dimensional component of *wohl* must have a type that maps the type of **E** to itself. That is, it must have the gigantic type $\langle\langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle, \langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle\rangle$. However, such a type is not covered by the LER for expressive modifiers. What corresponds to the variable σ in (4.61) is here the type $\langle\langle s,t\rangle, u\rangle$. Crucially, this is a use-conditional type and not a truth-conditional type as required by the LER.[20] Therefore, it is not possible to extend an expressive like *wohl* into a three-dimensional object.

To overcome this problem, I will set up a more general rule that allows for use-conditional modification of higher degrees. In order to find a proper way to formulate an LER that enables this, let us first ask what kinds of type we want to be able to derive. Given a functional expletive UCI of type α, we want the new LER to extend all expressions of the type hierarchy starting with (4.64b), which illustrates the pattern that we are searching for.

(4.64)
a. α (UC-predicate)
b. $\langle\alpha,\alpha\rangle$ (UC-modifier)
c. $\langle\langle\alpha,\alpha\rangle, \langle\alpha,\alpha\rangle\rangle$ (2nd-order UC-modifier)
d. $\langle\langle\langle\alpha,\alpha\rangle, \langle\alpha,\alpha\rangle\rangle, \langle\langle\alpha,\alpha\rangle, \langle\alpha,\alpha\rangle\rangle\rangle$ (3rd-order UC-modifier)
e. …

To make it possible to cover this theoretically infinite hierarchy of modifier types into a single general lexical extension rule, I will introduce a type construction rule, that enables me to generalize over all the types of interest. This rule takes a type α and a natural number $n \geq 0$ and

[20] By clause (4.45e) in the type definition on p. 127.

derives a modifier type based on α. To get the idea behind the rule, we first show how the numbers give us the type hierarchy in (4.64):

(4.65) a. $\alpha^0 = \alpha$ (UC-predicate)
b. $\alpha^1 = \langle\alpha,\alpha\rangle$ (UC-modifier)
c. $\alpha^2 = \langle\langle\alpha,\alpha\rangle,\langle\alpha,\alpha\rangle\rangle$ (2nd order UC-modifier)
d. $\alpha^3 = \langle\langle\langle\alpha,\alpha\rangle,\langle\alpha,\alpha\rangle\rangle,\langle\langle\alpha,\alpha\rangle,\langle\alpha,\alpha\rangle\rangle\rangle$ (3rd order UC-modifier)
e. …

The superscribed number gives the level of modification. That is, α^n is an n-level modifier on type α. Note too that the number also tells us the total number of occurrences of the base type α in α^n, since it is given by 2^n. In addition to this intuitive characterization of the modifier type construction rule, we can now define it in a recursive fashion, to produce the complete hierarchy of modifier types on a base type α:

(4.66) *Modifier type construction rule*

Given a base type α, for each $n \geq 0$, α^n is the *nth*-level modifier type on α, defined such that

$$\alpha^n = \begin{cases} \alpha & \text{if } n = 0 \\ \left\langle\alpha^{n-1},\alpha^{n-1}\right\rangle & \text{if } n > 0 \end{cases}$$

With this definition, we can now set up a lexical extension rule for use-conditional modification that not only covers first-order modification, but allows, at least in principle, for modifiers of arbitrary orders:[21]

(4.67) *LER for generalized use-conditional modification*
$\alpha \Rightarrow \langle I_{\sigma^n},\alpha,U\rangle$, if $\alpha \in \mathbf{Con}_{\langle\sigma,\tau\rangle^n}$, where σ is a truth-conditional type and τ is a use-conditional type.

Setting $n = 1$, this new LER amounts to the LER for (first-level) use-conditional modification in (4.61) on page 140, since $\sigma^1 = \langle\sigma,\sigma\rangle$ and $\langle\sigma,\tau\rangle^1 = \langle\langle\sigma,\tau\rangle,\langle\sigma,\tau\rangle\rangle$. That is, the specific rule for first-order

[21] Note that (4.66) is not biunique as it can derive some complex types by different inputs, as there are often several possibilities to divide complex types into chunks that fulfill the input conditions of (4.66). This holds for the types of identity functions. For instance, a type like $\langle\langle\sigma,\sigma\rangle,\langle\sigma,\sigma\rangle\rangle$ can be derived by the following three instances of (4.66):

(i) a. $\langle\langle\sigma,\sigma\rangle,\langle\sigma,\sigma\rangle\rangle^0$ b. $\langle\sigma,\sigma\rangle^1$ c. σ^2

However, this problem does not hold for the general LER in (4.67) as a whole, since its side conditions require that the type be split into a truth- and a use-conditional part and therefore, we must always use the smallest division, because a type consisting of a truth-conditional and a use-conditional type is again a use-conditional type.

modifiers becomes obsolete, as it is subsumed under the new LER. More importantly, the new rule allows for the lexical extension of higher-order modifiers. Setting $n = 2$ and $\alpha = \langle\langle s,t\rangle, u\rangle$ gives us the lexical extension needed in order to account for *wohl*:

$$\begin{aligned}(4.68)\quad & \textbf{wohl} : \langle\langle s,t\rangle, u\rangle^2 \Rightarrow I_{\langle s,t\rangle^2} \blacklozenge \textbf{wohl} : \langle\langle s,t\rangle, u\rangle^2 \bullet U \\ &= I_{\langle\langle\langle s,t\rangle,\langle s,t\rangle\rangle,\langle\langle s,t\rangle,\langle s,t\rangle\rangle\rangle} \blacklozenge \textbf{wohl} : \\ &\quad \langle\langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle, \langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle\rangle \bullet U\end{aligned}$$

Even if (4.67) is designed to account for higher-order UC-modifiers, it is interesting to note that it not only provides the desired generalization regarding modification, but that it also subsumes the LER for functional expletive UCIs given in (4.56) on page 138, namely if we set $n = 1$, since by (4.66), it holds that $\alpha^0 = \alpha$. That is, the two kinds of UCI are more closely related than they may seem to be at first glance. What ties them together under the umbrella of the new LER is that they both have functional content in the s-dimension, but do not have any informative t- or u-content (i.e., they both have an identity function in their t-dimension, and U in their u-dimension). We may therefore call them *expletive s-functional UCIs* to highlight their similarities.

Before moving on to provide proper definitions for the new logic, let me turn to a specific question that will have some ramifications for the entire framework, namely the question of how variables are treated within $\mathcal{L}_{\text{TU}}$. Note that all the LERs dealt with so far are only defined for constants, and not for variables. The important question now is whether we need LERs for variables. Of course, this some sense, this would be strange, because variables are strictly speaking not part of the lexicon. However, without a rule to build three-dimensional variables, there would be no way to insert variables into the derivational system. Therefore, I set up the following general LER for variables:

(4.69) *LER for variables*
$x_\sigma \Rightarrow \langle x_\sigma, x_\sigma, U\rangle$, if $x \in \textbf{Var}_\sigma$, where σ is a truth-conditional type.

Comparing this clause with (4.55) on page 138 reveals that variables which are to be extended must always be plain truth-conditional expressions. The reason for this restriction is that I cannot think of a case in which one would need a variable for use-conditional expressions, and given their immediacy, I think that would be somewhat counterintuitive. However, if there are cases in which a more general approach to variables in $\mathcal{L}_{\text{TU}}$ is needed, the system can easily be adjusted by opening the corresponding LERs for variables as well.[22] For present purposes, however, I leave it as it is and stick to the restricted version.

To summarize, I have argued that the lexicon, and more specifically the use of LERs, is the adequate means to add restrictions to the framework without cementing them too firmly into the core of $\mathcal{L}_{\text{TU}}$. This move allows us to impose restrictions on possible derivations by constraining their lexical input, while leaving enough possibilities for variation between different languages by altering the set of LERs that hold for them. For instance, it could be the case that some languages do not exhibit functional mixed UCIs, whereas others are incapable of UC-modification. Examining whether there are implicational dependencies between the various extension rules could provide the basis for a typology of use-conditional meaning. For instance, the relation discussed above that holds between the LERs for general UC-modifiers and functional expletives nicely captures the fact that the existence of functional expletives is an obvious precondition for UC-modifiers. In addition, I can imagine that the maximal value which n could take can reasonably be subject to cross-linguistic variation. For instance, there may be $n = 0$ languages in which there is no UC-modification at all, whereas other languages allow for modification, but only, say, at the first level.

The mere use of LERs enables simpler lexical entries for the expressions mentioned above; it does not however itself establish the constraints we are after. This is because the LERs only tell us how to unfold specific one- or two-dimensional objects into three-dimensional expressions. It does not in itself exclude that the lexicon itself may contain completely specified three-dimensional expressions which can be used in the proof rules without prior extension. Even if there is no LER that expands an expression into a negex-type of object, it is not ruled out that the lexicon contains just such an expression. Therefore, in order to enable the proper functions of the set of LERs, I propose the following hypothesis on possible lexical items:[23]

(4.70) *Hypothesis L^2*
The lexical entries are at most two-dimensional. They may encode up to one truth-conditional and up to one use-conditional dimension.

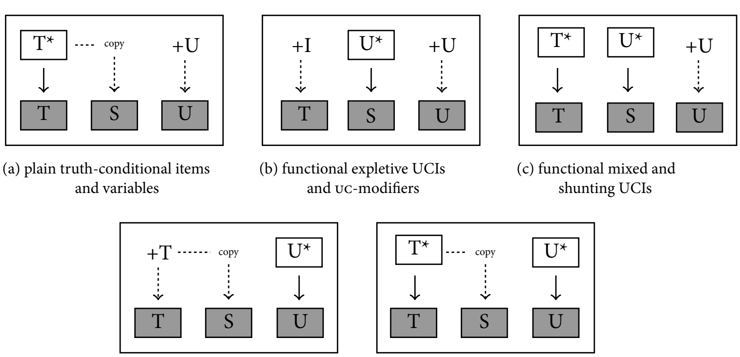
[22] Instead of a condition of the form $\alpha \in \mathbf{Con}_\sigma$, we would have the more general $\alpha \in \mathbf{Exp}_\sigma$ in every LER.

[23] The name of this hypothesis is obviously inspired by Zimmermann's (1991: 164) hypothesis L.

Note that for now, this is just an empirical hypothesis. However, as I will show, it can be implemented into $\mathcal{L}_{\mathrm{TU}}$ by a restriction on semantic derivations and the set of LERs I assume.

According to hypothesis L^2, lexical entries can encode (i) just truth-conditional content, (ii) just use-conditional content, or (iii) both. Crucially, they cannot have two different use-conditional dimensions, in contrast to the three-dimensional objects produced by the LERs, which distinguish between the *s*-dimension and the *u*-dimension. Intuitively, this makes sense, as the distinction between these two dimensions is rather a matter of composition than a question of different kinds of content. That the three dimensions do not line up perfectly with the conceptual difference between truth- and use-conditional content is also shown by the fact that the *s*-dimension may also contain truth-conditional content. That is, the two dimensions that may be given by a lexical entry are not the same dimensions as the dimensions that we find in their three-dimensional extensions. I therefore call them t^*-dimension and u^*-dimension respectively. The different ways in which these two *lexical dimensions* are distributed into the three *compositional dimensions* by the various LERs is illustrated in Figure 4.8. The gray boxes represent the three later dimensions, whereas the white boxes stand for the lexically given dimension. The dotted arrows and plus signs outside the boxes indicate the respective extensions.

To summarize the foregoing exposition, let me collect the set of LERs, **LER**, for functional modifying languages, i.e. languages that allow us to modify UCIs that are not yet *u*-propositional in a single list.



(a) plain truth-conditional items and variables

(b) functional expletive UCIs and UC-modifiers

(c) functional mixed and shunting UCIs

(d) isolated expletive UCIs

(e) isolated mixed UCIs

FIGURE 4.8 Relation between lexical and compositional dimensions

(4.71) **LER** *for functional modifying languages*

a. $\alpha \Rightarrow \langle \alpha, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_\sigma$, where σ is a truth-conditional type.

b. $\alpha \Rightarrow \langle I_{\sigma^n}, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle^n}$, where σ is a truth-conditional type and τ is a use-conditional type.

c. $\alpha \Rightarrow \langle T, T, \alpha \rangle$, if $\alpha \in \mathbf{Con}_u$.

d. $\langle \alpha, \beta \rangle \Rightarrow \langle \alpha, \alpha, \beta \rangle$, if $\alpha \in \mathbf{Con}_\sigma$ and $\beta \in \mathbf{Con}_u$, where σ is a truth-conditional type.

e. $\langle \alpha, \beta \rangle \Rightarrow \langle \alpha, \beta, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle}$ and $\beta \in \mathbf{Con}_{\langle \sigma, \nu \rangle}$, where σ and τ are truth-conditional types and ν is a use-conditional type.

f. $\langle \lambda x_\sigma . T, \alpha \rangle \Rightarrow \langle \lambda x_\sigma . T, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle}$, where σ is a truth-conditional type and τ is a use-conditional type.

g. $x_\sigma \Rightarrow \langle x_\sigma, x_\sigma, U \rangle$, if $x \in \mathbf{Var}_\sigma$, where σ is a truth-conditional type.

What is still missing is a way to connect the lexical expressions to the semantic derivation by means of the LERs. In order to achieve this, I set up the new general proof rule in (4.72) for the use of LERs, where $\rightsquigarrow$ designates the translation function that takes a natural language expression A to its representation α in the logic.

(4.72) *Extended lexical insertion*

$$\frac{A}{\langle \alpha_1, \alpha_2, \alpha_3 \rangle}\,\mathrm{LxL} \qquad \text{if } A \rightsquigarrow \alpha \text{ and there is a } \mathit{LER} \in \mathbf{LER}, \text{ such that } \alpha \Rightarrow \langle \alpha_1, \alpha_2, \alpha_3 \rangle.$$

What this rule does is basically to combine two rules into one. First, it serves as a lexical insertion rule that inserts the logical translation of a natural expression A into the logic. What is crucial about (4.72) though is that it does not only insert the simple lexically-given translation, but also extends the lexical content into the three-dimensional format required by the rest of the compositional system. Every derivation in $\mathcal{L}_{\mathrm{TU}}$ therefore starts with the application of this rule at its leaves. Hard-wiring LERs into the lexical insertion rule also has the neat side effect of implementing hypothesis L^2. Given that the set of LERs assumed in (4.71) does not include any rule that takes already three-dimensional expressions as input, a hypothetical expression with three lexical dimensions cannot be inserted into the semantic derivation as the insertion rule (4.72) could not apply to it.

4.4.3 Abbreviation conventions

Before proceeding to an overview of the entire framework of $\mathcal{L}_{\mathrm{TU}}$, let me provide some abbreviation conventions that I will use throughout the rest of this book, many of which I have already introduced in this chapter, and which will make the derivations more legible by reducing a lot of the formal clutter.

The first convention, which I have already used, is that instead of writing tuples of expressions, I employ Potts's (2005) bullet and McCready's (2010) diamond to write multidimensional expressions:

(4.73) $\langle \alpha, \beta, \gamma \rangle \leftrightsquigarrow \alpha \blacklozenge \beta \bullet \gamma$

This not only honors the $\mathcal{L}^{\star}_{\mathrm{CI}}$ tradition by sticking to the familiar notation, but also helps to visually separate the dimension more clearly, and reduces the number of brackets. A further advantage is that the two different separators open up more possibilities for abbreviating multidimensional expressions, by omitting some dimensions. Recall that many expressions contain information in one or two dimensions which can be deduced from the remaining dimensions. Therefore, whenever possible, I will omit this redundant material to further simplify the presentation of proofs.[24] I will briefly go through the abbreviation conventions to be used in what remains of this book.

The majority of expressions that will populate the proofs have only meaningful truth-conditional content, in which case the second and third dimension become predictable from the first one. The second dimension is a copy of the first one, and the third dimension contains the neutral use-conditional expression U. In this case, I will drop the two use-conditional dimensions. Note that the system ensures that this abbreviation is unambiguous, as it will always be abbreviated to an expression whose type is purely truth-conditional, which is not the case for any other abbreviation.

(4.74) $\alpha \blacklozenge \alpha \bullet U \leftrightsquigarrow \alpha$ (where α is a truth-conditional function)

More generally, I will omit empty dimensions together with the preceding separator. For instance, isolated mixed UCIs are additionally associated with complete use conditions, but have no "active" use-conditional content (i.e. unsaturated functional content) in the second

[24] The fact that a lot of information can be deduced by knowing one or two dimensions has been employed to set up the lexical extension rules. The abbreviation conventions are like their reversal as they hide the added material.

dimension. For such expressions, I will drop the diamond together with its second dimension:

(4.75) $\alpha \blacklozenge \alpha \bullet \beta \leftrightsquigarrow \alpha \bullet \beta$

Similarly, functional mixed UCI have active use-conditional content in the shunting dimension, but none in the u-dimension. We can reduce the expression as follows:

(4.76) $\alpha \blacklozenge \beta \bullet U \leftrightsquigarrow \alpha \blacklozenge \beta$

This, by the way, constitutes an abbreviation schema that is only made possible by the use of the diamond/bullet notation. In the case that β is of type u, (4.75) and (4.76) would produce the same output, if we were just abbreviating triples to tuples. That is, both $\langle \alpha, \beta, U \rangle$ and $\langle \alpha, \alpha, \beta \rangle$ would be shortened to $\langle \alpha, \beta \rangle$, so we could not know whether β had already been stored into the third dimension or not. Using the diamond and bullet helps to disambiguate these simplified expressions:

(4.77) a. $\langle \alpha, \beta, U \rangle \leftrightsquigarrow \alpha \blacklozenge \beta : u$
b. $\langle \alpha, \alpha, \beta \rangle \leftrightsquigarrow \alpha \bullet \beta : u$

Potts's (2005) original CI expressions are translated into triples where the first projection is an identity function, whereas the s-dimension contains a functional expression and the u-dimension contains the trivial object. This can be abbreviated according to the following convention:[25]

(4.78) $I_\sigma \blacklozenge \alpha : \langle \sigma, \tau^u \rangle \bullet U \leftrightsquigarrow \alpha : \langle \sigma, \tau^u \rangle$

Note that the type system will unambiguously tell us whether a reduced expression $\alpha : \langle \sigma, \tau \rangle$ abbreviates $\langle \alpha, \alpha, U \rangle$ or $\langle I, \alpha, U \rangle$. This is because, as a consequence of the LERs, only the second dimension can contain expressions of functional u-types. If the reduced expression has such a type, as is indicated by the superscripted u in (4.78), we know that it must correspond to $\langle I, \alpha, U \rangle$. If it is an ordinary truth-conditional expression, it expands to $\langle \alpha, \alpha, U \rangle$.

Finally, the $\mathcal{L}_{\mathrm{TU}}$ counterpart of McCready's (2010) shunting expressions, which are actually just a special case of functional mixed UCIs, can be abbreviated according to the following convention, using an additional superscript:

(4.79) $\lambda x.T : \langle \sigma, t \rangle \blacklozenge \alpha : \langle \sigma, \tau^u \rangle \bullet \gamma \leftrightsquigarrow \alpha : \langle \sigma, \tau \rangle^s \bullet \gamma$

[25] The superscribed u in the abbreviation convention means that the type variable ranges only over use-conditional types.

(1) *Functional application*

$$\frac{\alpha : \langle \sigma^t , \tau^t \rangle \bullet \gamma \qquad \beta : \sigma^t \bullet \delta}{\alpha (\beta) : \tau^t \bullet \gamma \odot \delta}$$

(2) *Expressive application*

$$\frac{\alpha : \langle \sigma , \tau \rangle^u \bullet \gamma \qquad \beta : \sigma^t \bullet \delta}{\beta : \sigma^t \blacklozenge \alpha (\beta) : \tau^u \bullet \gamma \odot \delta}$$

(3) *Mixed application*

$$\frac{\alpha_1 : \langle \sigma^t , \tau^t \rangle \blacklozenge \alpha_2 : \langle \sigma^t , v^u \rangle \bullet \gamma \qquad \beta : \sigma^t \bullet \delta}{\alpha_1 (\beta) : \tau^t \blacklozenge \alpha (\beta) : v^u \bullet \gamma \odot \delta}$$

(4) *Shunting application*

$$\frac{\alpha : \langle \sigma, \tau \rangle^s \bullet \gamma \qquad \beta : \sigma^t \bullet \delta}{T, \alpha (\beta) : \tau^u \bullet \gamma \odot \delta}$$

(5) *Shunting elimination*

$$\frac{\alpha : \sigma^t \blacklozenge \beta : u \bullet \gamma}{\alpha : \sigma^t \bullet \gamma \odot \beta : u}$$

FIGURE 4.9 The compositional system of $\mathcal{L}_{\text{TU}}$ in an $\mathcal{L}_{\text{CI}}^{+}$-fashion

Note that, in contrast to the superscript used in (4.78), the *s* in (4.79) is mandatory, since otherwise, the output of (4.79) would look like the one produced by (4.78).

These abbreviation schemata, together with the generalized proof rule for multidimensional application in (4.46), allow us to present the new system in a manner that resembles the proof rules of McCready (2010) quite closely. This is shown in Figure 4.9 above. Similarly to McCready's notation in $\mathcal{L}_{\text{CI}}^{+}$, I use superscripts to distinguish truth-conditional from use-conditional types by means of the superscripts *t* and *u*. However, recall that none of the schemata in Figure 4.9 has the status of a special rule in the system of $\mathcal{L}_{\text{TU}}$. Save for shunting elimination (which mirrors use-conditional elimination), the rules in Figure 4.9 merely constitute special instances of multidimensional application, according to which in both the first and second dimensions, functional application is the way of combining the two expressions. I present the rules in Figure 4.9 simply for a more direct comparison with the original version of $\mathcal{L}_{\text{CI}}^{+}$. It must also be kept in mind that every expression in the schemata is officially a proper three-dimensional object.

Beside reducing predictable dimensions, I will sometimes write dimensions as vertical stacks in order to save horizontal space, as I did for $\mathcal{L}_{\text{CI}}^{\star}$. I will do this in a bottom-up fashion so that the truth-conditional content builds the base upon which the other two dimensions are stacked.

Having established this set of abbreviation conventions, an illustration of how they help greatly to simplify the proof in $\mathcal{L}_{\text{TU}}$ visually is given by the following exemplary derivation of a sentence containing a functional expletive and a mixed UCI.

(4.80)

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\textit{(Der) verdammte}}{\mathbf{bad} : \langle e,u\rangle}\,\text{LxL} \quad \dfrac{\textit{Gerd}}{\mathbf{g}:e}\,\text{LxL}}{\mathbf{g}:e \blacklozenge \mathbf{bad}(\mathbf{g}) : u}\,\text{MA}}{\mathbf{g}:e \bullet \mathbf{bad}(\mathbf{g}):u}\,\text{UE} \quad \dfrac{\dfrac{\textit{bequatscht}}{\begin{array}{c}\blacklozenge\ \lambda x\lambda y.\mathbf{bad}(\mathbf{talks\text{-}to}(x)(y)) : \langle e,\langle e,u\rangle\rangle \\ \mathbf{talks\text{-}to} : \langle e,\langle e,t\rangle\rangle\end{array}}\,\text{LxL} \quad \dfrac{\textit{Elke}}{\mathbf{e}:e}\,\text{LxL}}{\begin{array}{c}\blacklozenge\ \lambda y.\mathbf{bad}(\mathbf{talks\text{-}to}(\mathbf{e})(y)) : \langle e,u\rangle \\ \mathbf{talks\text{-}to}(\mathbf{e}) : \langle e,t\rangle\end{array}}\,\text{MA}}{\begin{array}{c}\bullet\,\mathbf{bad}(\mathbf{g}) : u \\ \blacklozenge\ \mathbf{bad}(\mathbf{talks\text{-}to}(\mathbf{e})(\mathbf{g})) : u \\ \mathbf{talks\text{-}to}(\mathbf{e})(\mathbf{g}) : t\end{array}}\,\text{MA}}{\begin{array}{c}\bullet\,\mathbf{bad}(\mathbf{talks\text{-}to}(\mathbf{e})(\mathbf{g})) : u \\ \mathbf{talks\text{-}to}(\mathbf{e})(\mathbf{g}) : t\end{array}}\,\text{UE}$$

To simplify the appearance of $\mathcal{L}_{\text{TU}}$ derivations, I will sometimes switch from the proof tree notation to a more linear notational variant, which is inspired by Barker and Shans' (2008) tower notation for continuations, and which is akin to the informal notation that I used in Chapter 2. In those cases in which I want to display all dimensions explicitly, the abbreviation convention is as follows:

(4.81) $$\langle \alpha, \beta, \gamma \rangle \leftrightsquigarrow \dfrac{\dfrac{\gamma}{\beta}}{\alpha}$$

If I need to display just the non-redundant information in these formulas, I will shrink the towers by omitting just those levels that can be deduced. To disambiguate the dimensions, I will append the diamond and/or bullet in front of the use-conditional levels. Having no prefix at all then designates the truth-conditional layer. The proof tree in (4.80) thus transfers to the following linear version:

(4.82)

$$\begin{array}{ll}
& \begin{pmatrix} \textit{(Der) verdammte} & \textit{Gerd} \\ \blacklozenge\ \mathbf{damn} : \langle e,u\rangle & \mathbf{g}:e \end{pmatrix} \begin{pmatrix} \dfrac{\begin{array}{c}\textit{bequatscht} \\ \blacklozenge\ \lambda x\lambda y.\mathbf{bad}(\mathbf{talks\text{-}to}(x)(y)) : \langle e,\langle e,u\rangle\rangle\end{array}}{\mathbf{talks\text{-}to} : \langle e,\langle e,t\rangle\rangle} & \begin{array}{c}\textit{Elke} \\ \mathbf{e}:e\end{array} \end{pmatrix} \\[2ex]
\overset{MD}{\Rightarrow} & \begin{pmatrix} \dfrac{\blacklozenge\ \mathbf{bad}(\mathbf{g}) : u}{\mathbf{g}:e} & \dfrac{\blacklozenge\ \lambda y.\mathbf{bad}(\mathbf{talks\text{-}to}(\mathbf{e})(y)) : \langle e,u\rangle}{\mathbf{talks\text{-}to}(\mathbf{e}) : \langle e,t\rangle} \end{pmatrix} \\[2ex]
\overset{UE}{\Rightarrow} & \begin{pmatrix} \dfrac{\bullet\,\mathbf{bad}(\mathbf{g}) : u}{\mathbf{g}:e} & \dfrac{\blacklozenge\ \lambda y.\mathbf{bad}(\mathbf{talks\text{-}to}(\mathbf{e})(y)) : \langle e,u\rangle}{\mathbf{talks\text{-}to}(\mathbf{e}) : \langle e,t\rangle} \end{pmatrix} \\[2ex]
\overset{MD}{\Rightarrow} & \dfrac{\dfrac{\bullet\,\mathbf{bad}(\mathbf{g}) : u}{\blacklozenge\ \mathbf{bad}(\mathbf{talks\text{-}to}(\mathbf{e})(\mathbf{g})) : u}}{\mathbf{talks\text{-}to}(\mathbf{e})(\mathbf{g}) : t} \\[2ex]
\overset{UE}{\Rightarrow} & \dfrac{\bullet\,\mathbf{bad}(\mathbf{g}) \odot \mathbf{bad}(\mathbf{talks\text{-}to}(\mathbf{e})(\mathbf{g})) : u}{\mathbf{talks\text{-}to}(\mathbf{e})(\mathbf{g}) : t}
\end{array}$$

All the abbreviation conventions I have introduced in this section will help to make the derivations in $\mathcal{L}_{\text{TU}}$ more legible, and I will make heavy use of them in the rest of this book. However, I would like to stress again that in fact, the objects combined in the derivations are all three-dimensional tuples of expressions.

4.4.4 The architecture of $\mathcal{L}_{TU}$

Having proved the type definitions and derivational rules for $\mathcal{L}_{\mathrm{TU}}$, as well as having introduced the concept of lexical extension rules, I have yet to give a full definition of $\mathcal{L}_{\mathrm{TU}}$. However, since most of what I have not discussed so far does not deviate much from standard definitions, I will leave these definitions implicit here—all definitions can be found in the Appendix. Instead, I will provide an overview of the overall architecture of the framework, thereby addressing some of the aspects I have not introduced yet.

The underlying idea of $\mathcal{L}_{\mathrm{TU}}$ is that it combines two systems in one. On the one hand, we have the underlying syntactic rules of $\mathcal{L}_{\mathrm{TU}}$ that define how well-formed expressions are built. This, except for the new use-conditional types and some connectors, looks very much as in every textbook on higher order-type logics (Carpenter 1997; Dowty, Wall, and Peters 1981; Gamut 1991a). On the other hand, there is the compositional system that deals with three-dimensional expressions that are built from expressions of the underlying lower-dimensional logic. These three-dimensional expressions are what function as the semantic representations of natural language expressions and what deliver their interpretation. That is, what the framework of $\mathcal{L}_{\mathrm{TU}}$ does is connect the interpretation of natural language expressions to the interpretation of three-dimensional expressions, which in turn consist of three expressions of the underlying logic. The entire process by which this is done is graphically illustrated in Figure 4.10 (overleaf). In the following, I will give an informal outline of how the different pieces of the framework work together in order to deliver a multidimensional interpretation for a natural language expression. Again, for full and formal definitions, consult the Appendix.

We start with a possibly complex natural language expression A of language L, whose interpretation, which I write as $\|A\|$, we want to have calculated by $\mathcal{L}_{\mathrm{TU}}$. The first step, obviously, is to analyse A syntactially and split it into its atomic expressions, say, $e_1, \ldots, e_n$. These lexical expressions are then mapped by the translation function $\rightsquigarrow_L$ onto expressions of $\mathcal{L}_{\mathrm{TU}}$, say, $a_1, \ldots, a_n$, that function as their logical translation. Two things have to be noted here. First, every lexical

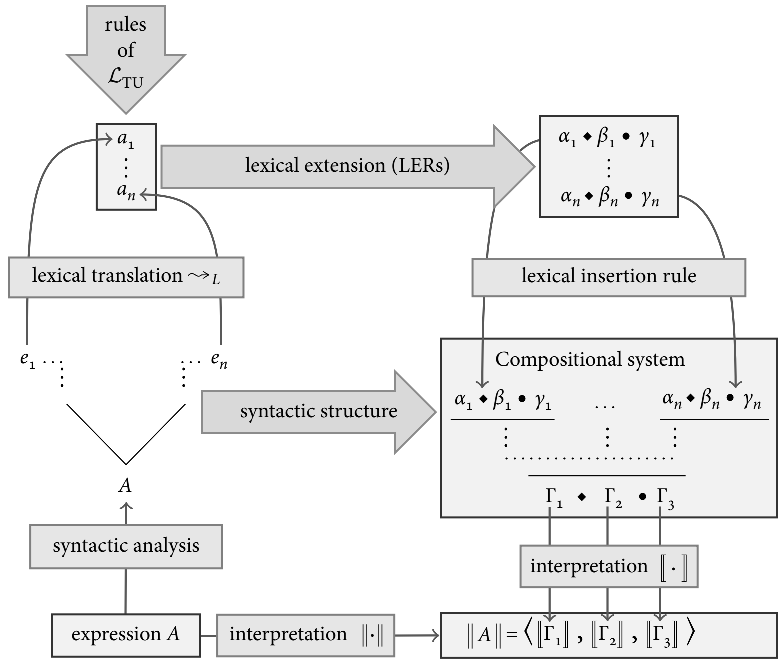


FIGURE 4.10 Graphical illustration of the architecture of $\mathcal{L}_{\mathrm{TU}}$

translation must result in an expression that is well-formed according to the underlying rules of $\mathcal{L}_{\mathrm{TU}}$. Secondly, there are no restrictions here as to how many dimensions the lexical translations may already have. However, the set of LERs, which come into play in the next step, puts constraints on this, as every lexical translation must be subject to an LER, in order to be able to be inserted by the lexical insertion rule LxL, which involves the application of LERs, into the compositional system. Once inserted, the rules of proof are used to combine the now three-dimensional expressions, whereby the structure of the proof is constrained by the syntactic structure of the natural language expression being analysed. Once the derivation has yielded a three-dimensional expression as its outcome, each of the three dimensions is interpreted by the logical interpretation function $[\![\cdot]\!]$. The tuple of the three interpreted dimensions then represents the interpretation of the expression A which we started with.

Let me illustrate this process with a concrete example. Let us choose the following English expression as our A:

(4.83) That damn Daniel is dancing.

The next step is to analyse this sentence and split it into atomic expressions. Ignoring some details, we get the following atomic expressions, which then are translated by $\rightsquigarrow_E$ into expressions of $\mathcal{L}_{\mathrm{TU}}$:

(4.84) a. *(That) damn* $\rightsquigarrow_E$ $\mathbf{damn} : \langle e, u \rangle$
b. *Daniel* $\rightsquigarrow_E$ $\mathbf{daniel} : e$
c. *is dancing* $\rightsquigarrow_E$ $\mathbf{dance} : \langle e, t \rangle$

These lexical translations, which all adhere to the well-formedness conditions of $\mathcal{L}_{\mathrm{TU}}$, are then extended by the LER that is applicable in each case:

(4.85) a. $\mathbf{damn} : \langle e, u \rangle \Rightarrow I_e \spadesuit \mathbf{damn} : \langle e, u \rangle \bullet U$
b. $\mathbf{daniel} : e \Rightarrow \mathbf{daniel} : e \spadesuit \mathbf{daniel} : e \bullet U$
c. $\mathbf{dance} : \langle e, t \rangle \Rightarrow \mathbf{dance} : \langle e, t \rangle \spadesuit \mathbf{dance} : \langle e, t \rangle \bullet U$

These extended semantic objects can then be inserted into the derivation system by the use of the lexical insertion rule (LxL). That is, the derivation for (4.83) begins by applying (LxL) to each of the lexical expressions:

(4.86) a. $$\dfrac{\textit{damn}}{I_e \spadesuit \mathbf{damn} : \langle e, u \rangle \bullet U}\ \mathrm{LxL}$$

b. $$\dfrac{\textit{Daniel}}{\mathbf{daniel} : e \spadesuit \mathbf{daniel} : e \bullet U}\ \mathrm{LxL}$$

c. $$\dfrac{\textit{is dancing}}{\mathbf{dance} : \langle e, t \rangle \spadesuit \mathbf{dance} : \langle e, t \rangle \bullet U}\ \mathrm{LxL}$$

After this, the rules of proof kick in and combine the three-dimensional objects inserted by (LxL) according to the syntactic structure of the sentence. That is, *damn* is first combined with *Daniel* via multidimensional application. The resulting u-proposition is then stored into the third dimension by an application of use-conditional elimination, before the resulting expression becomes the argument of *is dancing* in a final step, again via multidimensional application.

(4.87)

$$\dfrac{\dfrac{\dfrac{\dfrac{\textit{damn}}{I_e \spadesuit \mathbf{damn} : \langle e, u \rangle \bullet U}\ \mathrm{LxL} \quad \dfrac{\textit{Daniel}}{\mathbf{daniel} : e \spadesuit \mathbf{daniel} : e \bullet U}\ \mathrm{LxL}}{\mathbf{daniel} : e \spadesuit \mathbf{damn}(\mathbf{daniel}) : u \bullet U}\ \mathrm{MA}}{\mathbf{daniel} : e \spadesuit \mathbf{daniel} : e \bullet \mathbf{damn}(\mathbf{daniel}) : u}\ \mathrm{UE} \quad \dfrac{\textit{is dancing}}{\mathbf{dance} : \langle e, t \rangle \spadesuit \mathbf{dance} : \langle e, t \rangle \bullet U}\ \mathrm{LxL}}{\mathbf{dance}(\mathbf{daniel}) : t \spadesuit \mathbf{dance}(\mathbf{daniel}) : t \bullet \mathbf{damn}(\mathbf{daniel}) : u}\ \mathrm{MA}$$

Having derived the three-dimensional expression at the root of this proof, we can now use the interpretation of its dimension as the interpretation for our A, that is for (4.83).[26]

(4.88) $\|$That damn Daniel is dancing$\| =$
$\langle [\![\mathbf{dance}(\mathbf{daniel})]\!], [\![\mathbf{dance}(\mathbf{daniel})]\!], [\![\mathbf{damn}(\mathbf{daniel})]\!] \rangle$

That is, while $[\![\cdot]\!]$ interprets the expressions of the logical language, $\|\cdot\|$ assigns a three-dimensional interpretation to natural language expressions. I call this multidimensional interpretation the *meaning profile* of an expression. In order to speak about the three respective dimensions separately, I make use of the following three derivations of $\|\cdot\|$:

(4.89) *Dimensions of meaning of natural language expressions*
a. $\|A\|^t = \pi_1\|A\|$, is the t-content of A.
b. $\|A\|^s = \pi_2\|A\|$, is the s-content of A.
c. $\|A\|^u = \pi_3\|A\|$, is the u-content of A.

Crucially, even if the s-content is part of an expression's multidimensional meaning profile—it is needed to obey compositionality—what matters for the truth and felicity of an utterance are the first and third dimensions, which constitute the interpretational heart of hybrid semantics.

(4.90) If S is a sentence, then
a. S is true in a world w and a context c, if $w \in \|S\|^t$.
b. S is felicitous in a world w and a context c, if $c \in \|S\|^u$.

The complete set of definitions for $\mathcal{L}_{\mathrm{TU}}$ is given in the Appendix, which summarizes all the definitions provided so far, as well as some additional ones that I introduce in what follows.

Before proceeding with an assessment of $\mathcal{L}_{\mathrm{TU}}$, parallel those I carried out for $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$, let me conclude with some remarks on how extensions and intensions will be treated in the remainder of this book. So far, I have been rather sloppy with this distinction, but since many of the phenomena I will address in the next part of the book take intensional arguments, it will become important, so I will make it explicit along the following lines, which are fairly standard. Since the underlying logic of $\mathcal{L}_{\mathrm{TU}}$ is a two-sorted type logic, there will be a lot

[26] Note that both interpretation functions must be relativized to a variable assignment g in the obvious way. In addition, the meaning profile must also be relativized to the specific language. See the Appendix for explicit definitions.

of explicit world variables as the first argument of all expressions for which they are suitable. To provide the extension of an expression, I will use the special variable i. Translations of natural language expressions always involve this variable (if suitable). That is, the translation of, say, *love* into $\mathcal{L}_{\mathrm{TU}}$ is $\mathbf{love}(i) : \langle e, t\rangle$, whose interpretation then gives the extension of *love* at the world denoted by i. In case we need the intension of an expression, we can then simply lambda-abstract from that special variable. Accordingly, the intension of *love* is given by the interpretation $\lambda i.\mathbf{love}(i) : \langle s, \langle e, t\rangle\rangle$. In case other world variables are needed, I will use w and w' and so on. In order to avoid cluttering of the proofs with all the world variables, I will follow the common conventions and use indexed expressions. That is, for $\mathbf{love}(i)$ I will simply write $\mathbf{love}_i$. In addition, I will omit parentheses that delimit the scope of the world-abstraction, so that I write $\lambda i.\mathbf{sleep}_i(\mathbf{peter})$ for the more correct $\lambda i.(\mathbf{sleep}_i(\mathbf{peter}))$.

4.5 Assessment of $\mathcal{L}_{\mathrm{TU}}$

Now, that I have set up the hybrid logic $\mathcal{L}_{\mathrm{TU}}$, I will subject it to the same assessment procedure that Potts's (2005) original $\mathcal{L}_{\mathrm{CI}}$ and McCready's (2010) extension $\mathcal{L}^{+}_{\mathrm{CI}}$ already underwent in §§3.3 and §3.5, to check whether it can address the problems which the assessments have revealed for its two predecessors.

4.5.1 Types of UCIs in $\mathcal{L}_{TU}$

Let us start with the types of UCIs which I introduced in Chapter 2, and for which $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$ were tested. For reference, the overview of the five types of UCI and their characteristic features, as well as the checklists for the previous two assessments, are reproduced in Table 4.1 (overleaf). As we can see from Table 4.1(b) (overleaf), $\mathcal{L}^{+}_{\mathrm{CI}}$ already fares very well in this respect, and therefore, $\mathcal{L}_{\mathrm{TU}}$ should, at the very least, achieve the same result with respect to the types of UCIs it accounts for.

4.5.1.1 Isolated expletive UCIs in $\mathcal{L}_{\mathrm{TU}}$ Isolated expletive UCIs come as fully-fledged use-conditional expressions that do not interact in any meaningful way with other linguistic material. In the lexicon, they are accordingly listed as propositional use-conditional expressions of type u. Kaplan's (1999) *oops* and other interjections are characteristic examples. That is, *oops* translates lexically into $\mathbf{oops} : u$, which can then be extended into a three-dimensional object by means of the appropriate

TABLE 4.1 Types of UCIs and whether they can be accounted for by $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$

(a) Types of UCIs

	f	*2d*	*rs*
isolated expletive UCIs	–	–	
isolated mixed UCIs	–	+	
functional UCIs, expletive	+	–	–
shunting	+	–	+
functional mixed UCIs	+	+	

(b) Types of UCIs accounted for by $\mathcal{L}_{\mathrm{CI}}$ and $\mathcal{L}^{+}_{\mathrm{CI}}$

	$\mathcal{L}_{\mathrm{CI}}$	$\mathcal{L}^{+}_{\mathrm{CI}}$
isolated expletive UCIs	✓	✓
isolated mixed UCIs	✗	✓
functional UCIs, expletive	✓	✓
shunting	✗	✓
functional mixed UCIs	✗	✓

LER and inserted in the proof by LxL. This already constitutes an entire valid derivation:

(4.91) $$\frac{\textit{oops}}{T \blacklozenge T \bullet \textbf{oops} : u}\ \text{LxL}$$

Because the interpretation of T is the set of worlds, the two-dimensional interpretation of *oops* delivers trivial truth conditions for *oops*, which reflects the fact that they do not communicate anything meaningful in terms of descriptive content. In the use-conditional dimension, it denotes the set of contexts in which the speaker has observed a minor mishap. The truth and use conditions for *oops* are therefore given by the following two conditions:

(4.92) a. *Oops!* is true in world w and context c', if $w \in W$.
b. *Oops!* is felicitous in world w and context c', if $c' \in \{c\colon\ c_S$ observed a minor mishap in $c_W\}$.

The first condition is trivial, because necessarily, every world is in W, whereas the second condition is informative, because it imposes genuine use conditions on the utterance context of *oops*.

4.5.1.2 Functional mixed UCIs in $\mathcal{L}_{\mathrm{TU}}$ In contrast to $\mathcal{L}_{\mathrm{CI}}$, where functional mixed UCIs cannot be dealt with, and to $\mathcal{L}^{+}_{\mathrm{CI}}$, where they are the most complex type of UCI, they are the most straightforward case in $\mathcal{L}_{\mathrm{TU}}$, as it is designed to directly implement true multidimensionality, of which functional mixed expressives are the most obvious case. They are both [+*f*] and [+*2d*]; that is, they have meaningful functional content in both dimensions. By means of LER (4.59), the neutral use-conditional element U is added as the third dimension, before a functional mixed

UCI combines with its argument(s). Both dimensions apply to the respective expression in the first and second dimension of its argument. For illustration, see the following derivation, which is the $\mathcal{L}_{\mathrm{TU}}$-equivalent of the $\mathcal{L}^{+}_{\mathrm{CI}}$-proof in (3.80) on page 85. I make heavy use of the abbreviation schemata in this and the examples to come.

(4.93)
$$\dfrac{\dfrac{\dfrac{\textit{senseiga}}{\iota x.\textbf{teacher}_i(x) : e}\,\text{LxL} \qquad \dfrac{\textit{irasshaimasita}}{\lambda x.\textbf{come}_i(x) : \langle e,t\rangle \blacklozenge \lambda x.\textbf{honor}(x)(c_S) : \langle e,u\rangle}\,\text{LxL}}{\textbf{come}_i(\iota x.\textbf{teacher}_i(x)) : t \blacklozenge \textbf{honor}(\iota x.\textbf{teacher}_i(x))(c_S) : u}\,\text{MA}}{\textbf{come}_i(\iota x.\textbf{teacher}_i(x)) : t \bullet \textbf{honor}(\iota x.\textbf{teacher}_i(x))(c_S) : u}\,\text{UE}$$

This yields the desired interpretation. The utterance is true in a world and a context, if the world is in the set of worlds denoted by the first dimension of meaning, namely the set of worlds in which the teacher came.[27] It is felicitous if the current context is in the set of contexts in which the speaker honors the teacher.

4.5.1.3 Functional expletives and shunting UCIs in $\mathcal{L}_{\mathrm{TU}}$ In $\mathcal{L}_{\mathrm{TU}}$, functional expletives and functional shunting UCIs are special instances of functional mixed UCIs, whose first dimension is not contentful in the way it is in functional mixed UCIs, which mirrors the fact that they do not add anything at the truth-conditional tier:

(4.94)
$$\dfrac{\dfrac{\dfrac{\dfrac{\textit{(That) damn}}{\textbf{bad} : \langle e,u\rangle}\,\text{LxL} \qquad \dfrac{\textit{Kaplan}}{\textbf{kaplan} : e}\,\text{LxL}}{\textbf{kaplan} : e \blacklozenge \textbf{bad(kaplan)} : u}\,\text{MA}}{\textbf{kaplan} : e \bullet \textbf{bad(kaplan)} : u}\,\text{UE} \qquad \dfrac{\textit{got promoted}}{\textbf{got-promoted}_i : \langle e,t\rangle}\,\text{Lx}}{\textbf{got-promoted}_i\textbf{(k)} : t \bullet \textbf{bad(kaplan)} : u}\,\text{MA}$$

The difference between the expletive and the shunting kinds of functional UCI is that the former have an identity function in the first dimension and do not alter their argument in the first dimension, while the latter map it onto the neutral element T, thereby modeling the effect that they “shunt” their truth-conditional argument away into the use-conditional layer (example from McCready 2010: 37):

(4.95)
$$\dfrac{\dfrac{\dfrac{\textit{Yokumo}}{\lambda p.T : \langle\langle s,t\rangle, \langle s,t\rangle\rangle \blacklozenge \lambda p.[\textbf{bad}(p) \odot \textbf{surprise}_i(p)] : \langle\langle s,t\rangle, u\rangle}\,\text{LxL} \qquad \begin{array}{c}\textit{koko ni kita (na)}\\ \vdots\\ \lambda i.\textbf{you-came-here}_i : \langle s,t\rangle\end{array}}{T \blacklozenge \textbf{bad}(\lambda i.\textbf{you-came-here}_i) \odot \textbf{surprise}(\lambda i.\textbf{you-came-here}_i) : u}\,\text{MA}}{T \bullet \textbf{bad}(\lambda i.\textbf{you-came-here}_i) \odot \textbf{surprise}(\lambda i.\textbf{you-came-here}_i) : u}\,\text{UE}$$

[27] Note that in order to arrive at the intension of the sentence, we must first abstract from the world variable i.

4.5.1.4 Isolated mixed UCIs in $\mathcal{L}_{\mathrm{TU}}$ The last type of UCI is analysed in $\mathcal{L}_{\mathrm{TU}}$ as a mixture between functional mixed expressives and isolated expletives. Isolated mixed expressives come with a complete use-conditional proposition, but also have a descriptive component in their first dimension. Examples I discussed in Chapter 2 include racist epithets like *Kraut*. The racist attitude constitutes the third dimension, while their descriptive content corresponds to one of their non-racist counterparts:

(4.96)
$$\dfrac{\dfrac{\textit{Heinz}}{\mathbf{heinz} : e}\,\text{LxL} \qquad \dfrac{\textit{is a Kraut}}{\mathbf{german}_i : \langle e,t\rangle \bullet \mathbf{bad}({}^{\cap}\mathbf{german}_i) : u}\,\text{LxL}}{\mathbf{german}(\mathbf{heinz}) : t \bullet \mathbf{bad}({}^{\cap}\mathbf{german}) : u}\,\text{MA}$$

To conclude, $\mathcal{L}_{\mathrm{TU}}$ can deal with all five types of UCI that can be accounted for by $\mathcal{L}^{+}_{\mathrm{CI}}$. Now, let us turn to cases that cause problems for $\mathcal{L}^{+}_{\mathrm{CI}}$.

4.5.2 Further cases

In Chapter 3, I showed that while $\mathcal{L}^{+}_{\mathrm{CI}}$ is able to deal with all five kinds of UCIs, there are three further cases that have been proven to be problematic for it: namely expressive modifiers, multidimensional quantification, and abstraction across dimensions (see §3.5). I will briefly go through these cases again to illustrate how $\mathcal{L}_{\mathrm{TU}}$ can resolve these issues.

4.5.2.1 Use-conditional modifiers One of the main reasons to extend the core idea of $\mathcal{L}^{+}_{\mathrm{CI}}$ into a truly multidimensional system was to account for the existence of expressive modifiers, while at the same time keeping the types and combinatorics of the logic clean.[28] It therefore comes as no surprise that use-conditional modifiers easily receive a proper treatment in $\mathcal{L}_{\mathrm{TU}}$. Since we can read off the first and third dimensions from the second, use-conditional modifiers only have to be specified for their second dimension in the lexicon. The LER for generalized modification at (4.61) then ensures that they are supplemented by content in the missing two dimensions. The properly extended modifier can then apply to its use-conditional argument by means of multidimensional

[28] Contrast this with the approach I suggested in Gutzmann (2011a), which was more in line with the Pottsian approach and introduced even more types and application rules in order to extend $\mathcal{L}_{\mathrm{CI}}$ to cover expressive modifiers as well.

application, just as every other expression does. The derivation in (4.48) on page 129, which I repeat here, constitutes an example of this type.

(4.48)

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\textit{fucking}}{\textbf{fucking} : \langle\langle e,u\rangle,\langle e,u\rangle\rangle}\,\mathrm{Lx} \quad \dfrac{\textit{bastard}}{\textbf{bastard} : \langle e,u\rangle}\,\mathrm{Lx}}{\textbf{fucking(bastard)} : \langle e,u\rangle} \quad \dfrac{\textit{Burns}}{\textbf{burns} : e}\,\mathrm{Lx}}{\textbf{burns} : e \blacklozenge \textbf{fucking(bastard)(burns)} : u}}{\textbf{burns} : e \bullet \textbf{fucking(bastard)(burns)} : u} \quad \dfrac{\textit{got promoted}}{\textbf{got-promoted}_i : \langle e,t\rangle}\,\mathrm{Lx}}{\textbf{got-promoted}_i\textbf{(burns)} : t \bullet \textbf{fucking(bastard)(burns)} : u}$$

As discussed at length in §4.4.2, the set of LERs available for a language restricts what kinds of expressive modification are possible and which are not. For the time being, I have adopted the strict version of PONI, by setting up LER (4.67) such that it only applies to subpropositional content, and therefore expressions like **negex** in (4.50) that violate PONI are excluded. However, as I have argued, whether PONI holds or not should not be a proper part of the core logic, but an empirical question that could have different answers for different languages. Implementing PONI by means of LERs—which are needed anyway—achieves that without imposing a deeper restriction that would disturb the logic if it had to be abandoned for a language in which PONI does not seem to hold.

4.5.2.2 Multidimensional quantification in $\mathcal{L}_{\mathrm{TU}}$ Recall from the discussion in §3.5.4 that one of the problems with $\mathcal{L}_{\mathrm{CI}}^{+}$ was that it cannot deal properly with certain cases of quantified expression, not only when they are in object position—which is inherently more difficult to deal with—but also if they are in subject position. Consider again an example like the following:

(4.97) Everyone is gawking at Natalie.

The most natural reading of (4.97) is that it says truth-conditionally that everyone (in the domain of quantification, but let us ignore that) looks at Natalie while expressing use-conditionally that the speaker is annoyed by how everybody is looking at Natalie. Just as $\mathcal{L}_{\mathrm{CI}}^{+}$ failed to provide an analysis of such examples, $\mathcal{L}_{\mathrm{TU}}$—in its present form—is not able to analyse them either. To see why, consider the following attempt at a derivation in its unabbreviated form.

(4.98)

$$\dfrac{\dfrac{\textit{everyone}}{\begin{array}{c}\blacklozenge\ \mathbf{everyone} : \langle\langle e,t\rangle , t\rangle\\ \mathbf{everyone} : \langle\langle e,t\rangle , t\rangle\end{array}}\text{LxL} \qquad \dfrac{\dfrac{\textit{gawks at}}{\begin{array}{c}\blacklozenge\ \lambda x\lambda y.\mathbf{bad}(\mathbf{look\text{-}at}_i(x)(y)) : \langle e,\langle e,u\rangle\rangle\\ \lambda x\lambda y.\mathbf{look\text{-}at}_i(x)(y) : \langle e,\langle e,t\rangle\rangle\end{array}}\text{LxL} \quad \dfrac{\textit{Natalie}}{\begin{array}{c}\blacklozenge\ \mathbf{n} : e\\ \mathbf{n} : e\end{array}}\text{LxL}}{\begin{array}{c}\blacklozenge\ \lambda y.\mathbf{bad}(\mathbf{look\text{-}at}_i(\mathbf{n})(y)) : \langle e,u\rangle\\ \lambda y.\mathbf{look\text{-}at}_i(\mathbf{n})(y) : \langle e,t\rangle\end{array}}\text{MA}}{\text{↯}}\text{✗}$$

After the mixed UCI *gawks at* has been applied to its argument, it becomes a mixed UCI predicate of type $\langle e,t\rangle$ in the t-dimension and type $\langle e,u\rangle$ in the second dimension. The problem is that, as a plain truth-conditional quantifier, *everyone*'s second dimension is the same as the first (see LER (4.55) on page 138), namely a generalized quantifier of type $\langle\langle e,t\rangle , t\rangle$. Now, this expression cannot be applied to the verb phrase *gawks at Natalie* as it should, because the types in the s-dimension do not match properly, even if they do so in the first dimension.

It is easy to see what has to be done in order to proceed with the composition. Change the second dimension of *everyone* from $\langle\langle e,t\rangle , t\rangle$ to $\langle\langle e,u\rangle , u\rangle$, so that it can also be applied to the corresponding s-dimension of the VP.[29] In order to enable this, I introduce a special operator "☆", which shifts the type of a quantifier in the required way. Its combinatorics and semantics are defined as follows:

(4.99) $\text{☆}Q \in \mathbf{Exp}_{\langle\langle e,u\rangle,u\rangle}$, if $Q \in \mathbf{Exp}_{\langle\langle e,t\rangle,t\rangle}$.

(4.100) $[\![\text{☆}Q]\!]^g$ = the function $f \in D_{\langle\langle e,u\rangle,u\rangle}$ such that for every $E \in D_{\langle e,u\rangle}$, $f(E) = \{c \in C : \{x \in D_e : E(x)(c) = 1\} \in [\![\text{☆}Q]\!]^g\}$.[30]

Just like other type-shifting operators like type-raising (Partee and Rooth 1983), this operator can be freely introduced into the semantic derivation. The following rule achieves this:

(4.101) *Quantifier hybridization*

$$\dfrac{Q : \langle\langle e,t\rangle , t\rangle \blacklozenge Q : \langle\langle e,t\rangle , t\rangle \bullet U}{Q : \langle\langle e,t\rangle , t\rangle \blacklozenge \text{☆}Q : \langle\langle e,u\rangle , u\rangle \bullet U}\text{☆}$$

With this new rule, we can "hybridize" quantifiers like *everyone*, *every linguist*, etc. so that they are capable of combining with a use-conditionally typed VP as in (4.98). This delivers the desired results.

[29] Note that, with such a change, the former plain truth-conditional expression becomes a new kind of expressive modifier.

[30] For the sake of simplicity, I employ sets in this definition, instead of their characteristic functions.

(4.102)

$$\dfrac{\dfrac{\dfrac{\dfrac{\textit{everyone}}{\textbf{everyone} : \langle\langle e,t\rangle ,t\rangle}\,\text{LxL}}{\begin{array}{c}\blacklozenge\ \star\textbf{everyone} : \langle\langle e,u\rangle ,u\rangle\\ \textbf{everyone} : \langle\langle e,t\rangle ,t\rangle\end{array}}\,\star \qquad \dfrac{\dfrac{\textit{gawks at}}{\begin{array}{c}\blacklozenge\ \lambda x\lambda y.\textbf{bad}(\textbf{look-at}_i(x)(y)) : \langle e,\langle e,u\rangle\rangle\\ \lambda x\lambda y.\textbf{look-at}_i(x)(y) : \langle e,\langle e,t\rangle\rangle\end{array}}\,\text{LxL} \quad \dfrac{\textit{Natalie}}{\begin{array}{c}\blacklozenge\ \mathbf{n} : e\\ \mathbf{n} : e\end{array}}\,\text{LxL}}{\begin{array}{c}\blacklozenge\ \lambda y.\textbf{bad}(\textbf{look-at}_i(\mathbf{n})(y)) : \langle e,u\rangle\\ \lambda y.\textbf{look-at}_i(\mathbf{n})(y) : \langle e,t\rangle\end{array}}\,\text{MA}}{\begin{array}{c}\blacklozenge\ \star\textbf{everyone}(\lambda y.\textbf{bad}(\textbf{look-at}_i(\mathbf{n})(y))) : u\\ \textbf{everyone}(\lambda y.\textbf{look-at}_i(\mathbf{n})(y)) : t\end{array}}\,\text{MA}}{\begin{array}{c}\bullet\ \star\textbf{everyone}(\lambda y.\textbf{bad}(\textbf{look-at}_i(\mathbf{n})(y))) : u\\ \textbf{everyone}(\lambda y.\textbf{look-at}_i(\mathbf{n})(y)) : t\end{array}}\,\text{Ue}$$

With the definition for the semantics of the shifted quantifier $\star$**everybody**, the formula in the third dimension, $\star\textbf{everyone}(\lambda y.\textbf{bad}(\textbf{look-at}_i(\mathbf{n})(y))) : u$, denotes the set of contexts in which for everybody (in the domain of quantification), the speaker finds it annoying that they look at Natalie. Crucially, we do not get the reading in which the universally quantified proposition itself becomes the argument of the expressive attitude expressed by *gawk at*. That is, it does not mean that it is only the fact that *everyone* looks at Natalie is annoying, which is the correct prediction. If, say, Walther is in the domain of quantification for (4.97), the utterance should imply that it is annoying that Walther is looking at Natalie. If the wide-scope reading of the universal quantifier were the correct reading, this would not hold.[31]

Note that even if the definition of the $\star$-shifter as given in (4.100) may look ad hoc, it is really a rather standard type-lifting operator. If type u were transparent for $\mathcal{L}_{\text{TU}}$, i.e. if we have $u = \langle c, t\rangle$, then a more general and transparent definition of the use-conditional type shifter would be possible along the following lines:

(4.103) $$\star' = \lambda Q_{\langle\langle e,t\rangle,t\rangle}\lambda E_{\langle e,\langle c,t\rangle\rangle}\lambda c_c.Q(\lambda x_e.(E(x)(c))) : \langle\langle\langle e,t\rangle ,t\rangle ,\langle\langle e,\langle c,t\rangle\rangle ,\langle c,t\rangle\rangle\rangle$$

[31] Note that this analysis of two-dimensional quantification inherits the well-known binding problem common to most strictly multidimensional semantics, which dates back at least to Karttunen and Peters (1979). The problem can easily be illustrated if we alter example (4.102) to an existentially quantified one. Then, the sentence will be true if somebody looks at Natalie, and it will be felicitous if somebody's looking at Natalie annoys the speaker. However, nothing ensures that it is the same object that satisfies the two conditions. Even if this does not matter very much for the current example since the use conditions presuppose that somebody is looking at Natalie anyway, there are cases like *A damn dog barks* in which such a reading is too weak. This is not a problem specific to $\mathcal{L}_{\text{TU}}$, but holds generally for multidimensional approaches. However, since quantification is not a major topic of this book, I cannot provide a solution for the binding problem here. For some suggestions, see, e.g., Dekker (2008); Geurts and Maier (2003); Nouwen (2007).

However, as already mentioned above, it seems safer to have u be opaque and not to allow for context variables to be part of the logical language. In addition, a general type-lifter like this may overgeneralize, so I stick to the idiosyncratic version given in (4.100).

Furthermore, we should ask whether the move to introduce such an operator in order to get two-dimensional quantification right could be made for $\mathcal{L}_{\mathrm{CI}}^{+}$ as well. In principle, an analogous operator, call it "☆^{+}", can easily be given along the following lines, because expressions mapping from at-issue to shunting types (to use the original $\mathcal{L}_{\mathrm{CI}}^{+}$-terminology) are licensed. Actually, this is more easily done as the type difference between t and t^{s} is a merely syntactic one and does not have to be reflected interpretation-wise.[32]

(4.104) $\text{☆}^{+} = \lambda Q.Q : \langle\langle\langle e,t\rangle , t\rangle , \langle\langle e,t^{s}\rangle , t^{s}\rangle\rangle$

This operator then can be used to set up a suitable type-shifting rule for $\mathcal{L}_{\mathrm{CI}}^{+}$ that hybridizes an ordinary at-issue quantifier into a two-dimensional mixed quantifier, similarly to how it is done in $\mathcal{L}_{\mathrm{TU}}$:

(4.105)
$$\dfrac{Q : \langle\langle e,t\rangle , t\rangle}{Q : \langle\langle e,t\rangle , t\rangle \blacklozenge \text{☆}^{+}Q : \langle\langle e,t^{s}\rangle , t^{s}\rangle}\,\text{☆}^{+}$$

However, even with this type-shifting rule added to the inventory of $\mathcal{L}_{\mathrm{CI}}^{+}$, we cannot really employ it for an analysis of examples that involve cross-dimensional application. The reason is that there is no rule in $\mathcal{L}_{\mathrm{CI}}^{+}$ to apply such a mixed expression to another mixed expression, which is what would have to be done in order to get the intended reading.

(4.106)
$$\dfrac{\dfrac{\dfrac{\textit{everyone}}{\mathbf{everyone} : \langle\langle e,t\rangle , t\rangle}\,\text{Lx}}{\begin{array}{c}\blacklozenge\ \text{☆}^{+}\mathbf{everyone} : \langle\langle e,t^{s}\rangle , t^{s}\rangle \\ \mathbf{everyone} : \langle\langle e,t\rangle , t\rangle\end{array}}\,\text{☆}^{+} \qquad \dfrac{\dfrac{\textit{gawks at}}{\begin{array}{c}\blacklozenge\ \lambda x\lambda y.\mathbf{bad}(\mathbf{look\text{-}at}_{i}(x)(y)) : \langle e,\langle e,t^{s}\rangle\rangle \\ \lambda x\lambda y.\mathbf{look\text{-}at}_{i}(x)(y) : \langle e,\langle e,t\rangle\rangle\end{array}}\,\text{Lx} \quad \dfrac{\textit{Natalie}}{\mathbf{n} : e}\,\text{Lx}}{\begin{array}{c}\blacklozenge\ \lambda y.\mathbf{bad}(\mathbf{look\text{-}at}_{i}(\mathbf{n})(y)) : \langle e,t^{s}\rangle \\ \lambda y.\mathbf{look\text{-}at}_{i}(\mathbf{n})(y) : \langle e,t\rangle\end{array}}}{\lightning}\,\text{✗}$$

32 This is reminiscent of the function played by the COMMA feature in Potts's (2005) $\mathcal{L}_{\mathrm{CI}}$.

Even if the types matched in each dimension of the two expressions, $\mathcal{L}^{+}_{\mathrm{CI}}$ does not allow intradimensional application—that is, applying each dimension of a functional expression to the corresponding dimension of its argument. Instead, it licenses only the point-wise application of both dimensions of a mixed expression to a sole dimension of non-mixed expression. That is, what is lacking in $\mathcal{L}^{+}_{\mathrm{CI}}$ and would be needed in order to account for such examples as well is, in addition to the type-shifting rule, an application rule that can be defined as follows:

(4.107) *Multidimensional application for* $\mathcal{L}^{+}_{CI}$

$$\frac{\alpha_1 : \langle \sigma^a, \tau^a \rangle \blacklozenge \alpha_2 : \langle \rho^s, \upsilon^s \rangle \qquad \beta_1 : \sigma^a \blacklozenge \beta_2 : \rho^s}{\alpha_1(\beta_1) : \tau^a \blacklozenge \alpha_2(\beta_2) : \upsilon^s}$$

This rule is obviously already very similar to the rule of general multidimensional application employed in $\mathcal{L}_{\mathrm{TU}}$, so that its addition could be regarded as a first step towards a system of compositional multidimensionality. However, I take it that the fact that $\mathcal{L}^{+}_{\mathrm{CI}}$ needs an extra rule for such multidimensional quantificational constructions on top of the type shifter, whereas in $\mathcal{L}_{\mathrm{TU}}$ their analysis falls out naturally once the ☆-operator is added, nicely demonstrates the advantages of the truly multidimensional approach.

4.5.2.3 Abstraction in $\mathcal{L}_{\mathrm{TU}}$ A problem for $\mathcal{L}^{\star}_{\mathrm{CI}}$ that is somewhat related but nevertheless different from the problem of mixed expressives with quantified arguments is that $\mathcal{L}^{\star}_{\mathrm{CI}}$ is not able to employ abstractions over use-conditional dimensions (see the discussion in §3.5.3). This may be needed, for instance, under a QR-approach to quantifiers in object position. Let us consider a simpler variant of example (3.96) from Chapter 3:

(4.108) Hans begafft jeden.
Hans gawks-at everybody
'Hans gawks at everybody.'

According to the QR-approach, the quantifier in (4.108) must be raised at LF in order to take scope over the sentence, whereby it leaves behind a variable of type *e* in the object position, which can be fed into the VP-meaning and later be abstracted over again. As I have shown in (3.97), this cannot be done in $\mathcal{L}^{+}_{\mathrm{CI}}$, since the variable in the second dimension remains unbound, and therefore we do not arrive at the correct interpretation. In contrast, consider the corresponding derivation in $\mathcal{L}_{\mathrm{TU}}$.

(4.109)

$$\dfrac{\textit{begafft}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \lambda y\lambda z.\mathbf{bad}(\mathbf{look\text{-}at}_i(y)(z)) : \langle e,\langle e,u\rangle\rangle\\ \mathbf{look\text{-}at}_i : \langle e,\langle e,t\rangle\rangle\end{array}}\,\mathrm{LxL} \qquad \dfrac{t_1}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ x : e\\ x : e\end{array}}\,\mathrm{LxL}$$

$$\dfrac{\textit{Hans}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \mathbf{h} : e\\ \mathbf{h} : e\end{array}}\,\mathrm{LxL} \qquad \dfrac{\cdots}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \lambda z.\mathbf{bad}(\mathbf{look\text{-}at}_i(x)(z)) : \langle e,u\rangle\\ \mathbf{look\text{-}at}_i(x) : \langle e,t\rangle\end{array}}\,\mathrm{MA}$$

$$\dfrac{\cdots}{\dfrac{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \mathbf{bad}(\mathbf{look\text{-}at}_i(x)(\mathbf{h})) : u\\ \mathbf{look\text{-}at}_i(x)(\mathbf{h}) : t\end{array}}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \lambda x.\mathbf{bad}(\mathbf{look\text{-}at}_i(x)(\mathbf{h})) : \langle e,u\rangle\\ \lambda x.\mathbf{look\text{-}at}_i(x)(\mathbf{h}) : \langle e,t\rangle\end{array}}\,\lambda x}\,\mathrm{MA}$$

$$\dfrac{\textit{jeden}_1}{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \star\mathbf{everybody} : \langle\langle e,u\rangle,u\rangle\\ \mathbf{everybody} : \langle\langle e,t\rangle,t\rangle\end{array}}\,\mathrm{LxL}$$

$$\dfrac{\cdots}{\dfrac{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \star\mathbf{everybody}(\lambda x.\mathbf{bad}(\mathbf{look\text{-}at}_i(x)(\mathbf{h}))) : u\\ \mathbf{everybody}(\lambda x.\mathbf{look\text{-}at}_i(x)(\mathbf{h})) : t\end{array}}{\begin{array}{c}\bullet\ \star\mathbf{everybody}(\lambda x.\mathbf{bad}(\mathbf{look\text{-}at}_i(x)(\mathbf{h}))) : u\\ \blacklozenge\ \mathbf{everybody}(\lambda x.\mathbf{look\text{-}at}_i(x)(\mathbf{h})) : t\\ \mathbf{everybody}(\lambda x.\mathbf{look\text{-}at}_i(x)(\mathbf{h})) : t\end{array}}\,\mathrm{UE}}\,\mathrm{MA}$$

The new ingredient that I have employed in this derivation is a multidimensional abstraction rule for truth-conditional arguments, which abstracts over the same variable in the first and second dimension.

(4.110) *Truth-conditional abstraction*

$$\dfrac{\langle \alpha : \tau, \beta : \rho, \gamma\rangle}{\langle \lambda x.\alpha : \langle\sigma,\tau\rangle, \lambda x.\beta : \langle\sigma,\rho\rangle, \gamma\rangle}\,\lambda x_\sigma$$

where σ is a truth-conditional type

Crucially, this rule is defined only for truth-conditional variables and abstracts over both dimensions in the same way. Note also that the third dimension remains untouched. What is shifted in that dimension stays there and cannot be manipulated any further.

To conclude this assessment, $\mathcal{L}_{\mathrm{TU}}$ is not only able to deal with all five kinds of UCI; something $\mathcal{L}^{+}_{\mathrm{CI}}$ is already able to do; it can also address the three cases that were problematic for McCready's (2010) extension of $\mathcal{L}_{\mathrm{CI}}$. Table 4.2 summarizes the results.

4.6 Chapter summary

In this chapter, I took up the challenge posed by the detailed examination of Potts's (2005) and McCready's (2010) logical approaches to multidimensional meaning presented in Chapter 3, which revealed various problems regarding compositionality and constructions that

TABLE 4.2 Types of UCIs and further cases accounted for by $\mathcal{L}_{\mathrm{TU}}$

(a) Types of UCIs in $\mathcal{L}_{\mathrm{TU}}$

isolated expletive UCIs	✓
isolated mixed UCIs	✓
functional UCIs, expletive shunting	✓ ✓
functional mixed UCIs	✓

(b) Further cases in $\mathcal{L}_{\mathrm{TU}}$

2-place UCIs	✓
uc-modifiers	✓
quantification	✓
abstraction	✓

go beyond simple applications. I suggested that the solution to these problems was to embrace true multidimensionality, which means that every expression in a semantic derivation is defined for all meaning dimensions. That is, while in $\mathcal{L}^{*}_{\mathrm{CI}}$ we have what can be called *interpretational* multidimensionality, the new logic $\mathcal{L}_{\mathrm{TU}}$ is characterized by *compositional* multidimensionality as well. This move also allowed us to reduce the number of proof rules needed, because we only need one application and one elimination schema, while at the same time being able to account for expressive modifiers. Contrast this with $\mathcal{L}^{+}_{\mathrm{CI}}$, which employs a total of four application and two elimination rules without addressing use-conditional modification.

I have already shown how the various types of UCI and the more complicated cases can be dealt with using the tools provided by $\mathcal{L}_{\mathrm{TU}}$. In the next two chapters, I will present case studies in which the new logic $\mathcal{L}_{\mathrm{TU}}$ is employed to give detailed analysis of two linguistic phenomena. In addition to shedding some light on these phenomena, this should illustrate that $\mathcal{L}_{\mathrm{TU}}$ can be fruitfully applied to linguistic analyses.

5

Sentence mood

5.1 Introduction

As the first case study in which I apply the logic $\mathcal{L}_{\mathrm{TU}}$ developed in the previous chapter to natural language phenomena, I will undertake an examination of the notion of sentence mood, a notion that—despite its long philosophical tradition—still has not attracted as much work and is not as well understood as illocutionary force, its younger sister, which, with speech act theory, has evolved its own area of research.

The idea that there is something in addition to the pure descriptive semantic content of a sentence goes back to as early as Frege (1918), who assumes that there is an additional element in the meaning of declarative sentences, besides their propositional content or, in his parlance, "thought".

> An interrogative sentence and an assertoric one contain the same thought; but the assertoric sentence contains something else as well, namely, assertion. [. . .] Therefore, two things must be distinguished in an assertoric sentence: the content, which it has in common with the corresponding propositional question; and assertion. (Frege 1918: 5)

Hence, in the spirit of Frege's remarks, the following three examples taken from Chierchia and McConnell-Ginet (2000: 212) all have the same content, yet they differ with respect to the additional component Frege mentions:

(5.1) a. Bond gives every fish to Loren.
b. Does Bond gives every fish to Loren?
c. Give every fish to Loren, Bond!

The basic idea of the Fregean picture is that the content of these three sentences is the same, namely that Bond gives every fish to Loren. However, they differ in the way the content is evaluated or presented. This additional component came to be known by the name of *sentence mood*, especially thanks to the work of Stenius (1967).[1] The descriptive

[1] Other labels for this component include the variant *sentential mood* and the notion of *sentential force*.

content over which the sentence mood operates is called the *sentence radical* by Stenius, who in turn derives his inspiration for this term from Wittgenstein's (1953) famous remarks about the picture of the boxer in his *Philosophical Investigations*:

> Imagine a picture representing a boxer in a particular stance. Now, this picture can be used to tell someone how he should stand, should hold himself; or how he should not hold himself; or how a particular man did stand in such-and-such a place; and so on. One might (using the language of chemistry) call this picture a proposition-radical. This is how Frege thought of the *assumption*. (Wittgenstein 1953: §22)

According to this picture, a sentence divides into two semantic parts, the mood and the radical.

(5.2)
$$\begin{array}{ccc} & \text{sentence} & \\ \swarrow & & \searrow \\ \text{mood} & & \text{radical} \end{array}$$

Sentence mood is sometimes represented by operators that prefix the descriptive content of a sentence, so that the three examples in (5.1) can be represented as follows (cf. Chierchia and McConnell-Ginet 2000):

(5.3) a. $\vdash[\mathbf{all}(\mathbf{fish}_i)(\lambda x.\mathbf{give}_i(x)(\mathbf{loren})(\mathbf{bond}))]$
b. $!\ [\mathbf{all}(\mathbf{fish}_i)(\lambda x.\mathbf{give}_i(x)(\mathbf{loren})(\mathbf{bond}))]$
c. $?\ [\mathbf{all}(\mathbf{fish}_i)(\lambda x.\mathbf{give}_i(x)(\mathbf{loren})(\mathbf{bond}))]$

The important question is then, what do these sentence mood operators contribute? To put it more precisely, this means that the following question must be answered by anyone who assumes sentence mood operators like the ones in (5.3).

(i) What is the contribution that sentence mood makes to the overall meaning profile of a sentence?

Before I start reviewing some of the answers given to this question, let me stress that sentence mood has to be strictly distinguished from *illocutionary force*. Although both terms are clearly connected, they are not the same (Ludwig 2003: 139). They belong to different levels of linguistic analysis. Illocutionary force is a property of a concrete utterance, clearly belongs to the realm of pragmatics, and is one of the central notions of speech act theory (Austin 1962; Searle 1969). In contrast, sentence mood is a semantic feature of a sentence and can be regarded as the semantic correlate of syntactic sentence *types* (Brandt, Reis, Rosengren, and Zimmermann 1992: §1). Semantic sentence mood thus can be thought of as mediating between syntactic sentence types and pragmatic illocutionary force. We then arrive at the following picture: the syntactic structure of a sentence—the sentence type—somehow determines the mood of a sentence, which in turn constrains the potential illocutionary force of an utterance of that sentence.

(5.4) *syntax* *semantics* *pragmatics*
sentence type $\Longrightarrow$ sentence mood $\Longrightarrow$ illocutionary force

Since it is important not to mix up these different notions, the terms by which different values of the levels are named have to be distinguished as well. That is, we need a term both for the "assertoric" sentence mood and for the "assertoric" illocutionary force. I will make use of the following terminological differentiation which has proven to be useful (Grewendorf and Zaefferer 1991: 270):

(5.5)

sentence mood	*illocutionary force*
declarative	assertion
interrogative	question
imperative	directive
exclamative	exclamation

Given this view on the relation between sentence types, sentence mood, and illocutionary force, the following challenging questions arise corresponding to the arrows in (5.4) above:

(ii) How is sentence mood determined by the syntactic structure of the sentence?
(iii) How does sentence mood constrain the potential illocutionary forces that can be performed by an utterance of the sentence?

Both questions are tightly connected to question (i) raised above: What and how does sentence mood contribute to the overall semantic meaning of a sentence? Question (ii) is connected to question (i) because, if we want the contribution of sentence mood to be calculated compositionally instead of merely assigning sentence mood to different sentence types, we had better know how sentence mood derives from different syntactic factors, such as the position of the inflected verb, the presence of *wh*-phrases, and so forth. Questions (iii) and (i) are connected by the question of the nature of sentence mood meaning. Only if we have a precise idea of the meaning of sentence mood are we in a position to account for the relation between sentence mood and illocutionary force and explain how the former constrains the latter.

In the following section, I will briefly review some accounts that have proposed answers to these questions, before I come to the approach championed by Truckenbrodt (2006a) that will build the basis for my use-conditional analysis of sentence mood.

5.2 Kinds of approaches to sentence mood

To give an impression of the variety of views on sentence mood, I review three previous approaches that represent different lines of thought about this notion. Since, especially in the German linguistics literature, the question of how the intuitive notion of sentence mood should be fleshed out properly in theoretical terms has been subject to dispute for many years, reviewing the whole debate would go way beyond the scope of this book.[2] However, the three proposals I will go through in the following give a good impression of the various directions from which sentence mood can be approached, while at the same time being illustrative of the different problems attending each of them. The three proposals I will discuss can be regarded as representatives of the following kinds of approach:

(5.6) *Kinds of approach to sentence mood*

Type I	integrative approaches	(§5.2.1)
Type II	implicit approaches	(§5.2.2)
Type III	multidimensional approaches	(§5.2.3)

Given that the main focus of this book lies on the interaction between various dimensions of meaning, it should be of no surprise that the categorization that underlies the three kinds of approach in (5.6) is based on how they spell out the connection between the two dimensions of mood and radical; that is, what kind of relations hold between the content of a sentence and the semantic contribution of sentence mood. As the label suggests, integrative approaches build the contribution of sentence mood into the ordinary semantic content. In other words the answer that integrative approaches give to question (ii) is that the overall content of a sentence consists of a direct composition of mood and

[2] See, amongst many others, Altmann (1987, 1993); Brandt et al. (1992); Brandt, Rosengren, and Zimmermann (1989); Doherty (1987); Jacobs (1991a); Meibauer (1987).

content, so that mood is part of the content as well. For illustration, let us assume that an operator DEC is the sentence mood operator for declaratives. Without talking about its concrete interpretation, the general idea of an integrative approach can be illustrated as follows, using the simple declarative *Peter snores* as an example:

(5.7) Peter snores. $\rightsquigarrow$ $\textsc{dec}(\lambda i.\mathbf{snore}_i(\mathbf{peter}))$

Regarding question (i) on the relation between the syntax of a sentence and its mood, the various proposals falling under this category vary greatly regarding how explicitly they work out this relation. The overall tendency is that some lexical or syntactic features are responsible for introducing the sentence mood operators into the semantic representation of a sentence. Integrative approaches have been widely suggested, mostly when only some specific sentence mood only is under consideration (cf., e.g., Romero and Han (2004) for negative *yes/no*-questions); but in the account developed by Brandt, Reis, Rosengren, and Zimmermann (1992) there is also a more general integrative approach available, which is the representative one that I will review in §5.2.1. As I will argue, integrative approaches, even if they try to account for important observations, make wrong predictions, due to their characteristic lack of distinction between the two kinds of content. In this respect, they repeat the failure of the performative hypothesis (Ross 1970; Sadock 1974) on the sentence mood level.[3]

The second group of approaches is called *implicit*, because they do not make use of explicit semantic representations of sentence mood and therefore circumvent the problem of predicting wrong truth conditions. Instead of the mood of a sentence being hardwired into its semantic content, it is the type of the semantic content that determines the mood of the sentence. There is no need for specialized sentence mood operators, according to such approaches. Schematically, this idea can be represented thus:

(5.8) Peter snores. $\rightsquigarrow$ $\lambda i.\mathbf{snore}_i(\mathbf{Peter}) : \langle s, t\rangle \xrightarrow{\textit{deduce}} \textsc{dec}$

An example of an implicit approach is Lohnstein's (2000, 2007) theory of sentence mood, in which sentence mood is reduced to different factors like the different partitions of the set of possible worlds by the semantic content of a sentence. The basic idea is that *yes/no*-questions

[3] For overviews of the main points of critique of the performative hypothesis, see Gazdar (1978); Levinson (1983).

denote bipartitions, declaratives denote reduced bipartitions, and *wh*-questions more fine-grained partitions. What kind of partitions a sentence denotes is finally traced back to the presence and position of syntactic features. However, as I have argued elsewhere (Gutzmann 2011b), this approach is not able to deal properly with all sentence moods, as it is unable to deal with independently used verb-last clauses, which often have highly specialized sentence moods and therefore provide excellent test patterns for any systematic approach to sentence mood. For this reason, I will not repeat my discussion of the Lohnstein (2007) approach here. Instead, the account that I will discuss as a representative for the category of implicit approaches is that proposed by Portner (2004). In contrast to Lohnstein, Portner concentrates on the different roles semantic content of various types play in updating the context or common ground, and therefore his approach stands in the dynamic tradition associated with the work of Stalnaker (1974, 1978, 2002), Heim (1982), and Kamp (1981). The basic idea of his approach is that the type of the content of a sentence—proposition, set of propositions, or property—determines how an utterance of the sentence can update the discourse context. The restrictions on possible updates then play the role that sentence mood operators play in integrative approaches, even if there are no such operators. Accordingly, the syntactic structure of a sentence only determines the mood of a sentence insofar as it is responsible for a difference in the denotation that a sentence has. As I will show with regard to German, this leads to the same problem from which the Lohnstein (2007) approach suffers. An approach in which the syntax has so little influence on the mood expressed by a sentence—this is a characteristic but not a necessary property of the implicit approaches—makes it hard to account for more specialized sentence moods which are often connected with rather marked forms of syntactic structures, at least for languages like German that employ such "border types" besides the standard ones (Altmann 1993).

The third type of approach is, meanwhile, similar to the group of implicit approaches, as it shares the idea that the contribution of sentence mood should not become part of the content of a sentence in order to avoid the problems of the integrative approaches. On the other hand, approaches of the third kind are similar to integrative ones inasmuch as they explicitly represent sentence mood. Crucially, this is not done at the same semantic level, and accordingly, such accounts are called *multidimensional*. Schematically, this can be represented by the fraction notation which I introduced in Chapter 2.

(5.9) Peter snores $\rightsquigarrow$ $\dfrac{\textsc{dec}(\lambda i.\mathbf{snore}_i(\mathbf{peter}))}{\lambda i.\mathbf{snore}_i(\mathbf{peter})}$

The one multidimensional approach that I am aware of is sketched by Portner (2007) in a paper in which he addresses various non-truth-conditional phenomena, one of which is sentence mood operators.[4] He suggests an analysis of sentence mood along Pottsian lines, so that mood operators can be explicitly represented without affecting the ordinary content of a sentence. Even if, in his brief remarks, Portner does not give an answer to question (ii), of how mood operators depend on the syntax of the sentence, this can in principle be done, and for this reason I will take his approach as a starting point for developing my own hybrid approach to sentence mood later on in §5.5.

5.2.1 An integrative approach

Integrative approaches to sentence mood are characterized by the fact that they compose the contribution of sentence mood and the sentential content into a single semantic representation. That is, the propositional content of a sentence is given by the sentence mood operating over the sentential content. Furthermore, according to many integrative approaches, most sentences even embedded ones, have some kind of mood. The paradigmatic case for an approach of the integrative kind is the theory of sentence mood developed by Brandt et al. (1992). Their theory is not only worked out for a wide range of syntactic sentence types, but also very explicit as to how the sentence mood and the syntactic structure of a sentence are related.

One of the defining features of the Brandt et al. (1992) approach is that they reject the common assumption that sentence mood involves the expression of a speaker attitude towards the propositional content.[5] Instead, they assume that sentence mood is a reference type specifier for sentence denotations (Brandt et al. 1992: 35). That is, different sentence moods are constituted by different operators that scope over the propositional content of a sentence in order to specify the reference of a sentence. For this reason, their approach is often called a *referential* approach. The idea of reference specification of sentences is in turn based on Brandt et al.s' understanding of propositions as being

[4] In Gutzmann (2008), a precursor to this work, I suggested a similar approach to Portner's (2007), without, however, being conscious of his approach at that time.

[5] For discussion see, amongst others, Brandt et al. (1992); Brandt, Rosengren, and Zimmermann (1989); Doherty (1987); Jacobs (1991a); Meibauer (1987).

instantiated by facts or events, following Bierwisch (1988). Accordingly, they assume a transitive functor INST that expresses the instantiation of a proposition by an event or fact. Thus, we can have something like (5.10), which I will write as in (5.11) in order to bring it more in line with the notational style employed in this book:

(5.10) $[e \textbf{ INST } p]$ (5.11) $\textbf{INST}(p)(e)$

Both are read as "*e* instantiates *p*" (Brandt et al. 1992: 35). The starting point of the referential account is, then, that in their semantic representation, verbs not only have positions for their arguments, but also a slot for an argument referring to an event that instantiates the proposition expressed by the verb itself. Or, more precisely, every verb is an argument to the instantiation function given in (5.11). Therefore, a natural language verb like *snore* receives a semantic translation along the following lines:

(5.12) *snore* $\rightsquigarrow \lambda x \lambda e.\textbf{INST}(\textbf{snore}(x))(e)$

The basic idea of Brandt et al.s' integrative approach is that different sentence types are associated with different operators that act upon this instantiation function and, more specifically, bind the event argument of the verb. These operators represent the mood of a sentence. What kind of operator is used is determined by syntactic $[\pm wh]$-features in the functional domain of a clause. Let me illustrate how this works by sketching their analysis of declaratives and interrogatives.

According to Brandt et al. (1992: 32), simple verb-second declaratives carry two $[-wh]$-features, one in $\mathrm{CP}^{\mathrm{spec}}$ and one in C^{o}.[6] The semantic representation that is assigned to this feature distribution in the CP is an existentially quantified function that takes the verb phrase as its argument, so that the event/fact variable in the semantic form of the verb phrase gets bound by the existential quantifier if the VP is fed into the function. The semantic form of the sentence mood operator in declaratives can hence be formulated as follows:

[6] I have to note that this is a simplification of their account as their approach is actually based on a somewhat deviant analysis of the syntactic structure of German sentence types (Brandt et al. 1992: 32). According to their view, clauses with the finite verb in the first or second position (so-called V1- and V2-clauses) do not project a full CP. Instead, an IP is their highest functional projection. In contrast, clauses with the finite verb in the last position (VL-clauses), receive a hybrid analysis in which a CP and an IP are intersected in one functional projection. However, these syntactic particularities of their approach do not matter for the line of argument presented here.

(5.13) $\lambda Q.\exists e[Q(e)]$

Given that we have a semantic translation for *snore* as in (5.12) and a suitable translation for *Peter*, the semantic parsetree for the simple V2-sentence *Peter snores* looks as follows:

(5.14) Peter snores.

$\exists e_1[\textsc{inst}(\mathbf{snore}(\mathbf{peter}))(e_1)]$

$\lambda Q.\exists e_1[Q(e_1)]$ $\quad$ $\lambda e_2.\textsc{inst}(\mathbf{snore}(\mathbf{peter}))(e_2)$

$\mathbf{peter}$ $\quad$ $\lambda x.\lambda e_2.\textsc{inst}(\mathbf{snore}(x))(e_2)$

The formula at the root node of this tree is read as "There is a fact e_1, such that e_1 instantiates the proposition that Peter snores", which is supposed to capture the assertoric character of the declarative sentence mood.

For interrogatives, Brandt et al. (1992: 38–44) assume an operator OPEN that corresponds to the [+*wh*]-feature present at CP$^{\text{spec}}$ in interrogatives:

(5.15) $\lambda R \lambda P.\mathbf{open}(R(P))$

Somewhat simplifying their approach, the idea is that this OPEN operator has scope over the existential quantifier that is introduced into the semantic tree by the [–*wh*]-feature attached to C^0. Therefore, a semantic parsetree for the simple V1-interrogative *Does Peter snore?* would look like (5.16) in Brandt et al.s' integrative framework:

(5.16) Does Peter snore?

$\textsc{open}(\exists e[\textsc{inst}(\mathbf{snore}(\mathbf{peter}))(e)])$

$\lambda P.\mathbf{open}(\exists e[P(e)])$ $\quad$ $\lambda e_2.\textsc{inst}(\mathbf{snore}(\mathbf{peter}))(e_2)$

$\lambda R \lambda P.\mathbf{open}(R(P))$ $\quad$ $\lambda Q.\exists e[Q(e)]$ $\quad$ $\mathbf{peter}$ $\quad$ $\lambda x.\lambda e_2.\textsc{inst}(\mathbf{snore}(x))(e_2)$

The root node of this parsetree has to be read as "It is open whether there is a fact e_1, such that e_1 instantiates the proposition that Peter snores." Again, this is supposed to capture the mood of interrogatives.

This short outline of the approach developed by Brandt et al. (1992) should be enough to give a flavor of how an integrative approach to sentence mood would look. At least, it is sufficient to show what I think is the conceptual problem with such an approach. Simply put, because they integrate the contribution of sentence mood with the rest of a sentence's content, such integrative approaches generally generate wrong truth conditions, or, in case of interrogatives, they even generate truth conditions where there should be no truth conditions at all. This may sound like a harsh objection, but I think it is justified. The case is clearly evident with the semantics that Brandt et al. assign to interrogatives. Consider again the root note of the semantic parsetree in (5.16), where we find the following formula:

(5.17) $\textsc{open}(\exists e[\textsc{inst}(\mathbf{snore}(\mathbf{peter}))(e)])$

Neither Brandt, Rosengren, and Zimmermann (1989) nor Brandt et al. (1992) are explicit about the semantic status of a formula like (5.17); it looks like an ordinary proposition and hence, it should give rise to truth conditions like the following:

(5.18) "Does Peter snore?" is true iff it is open whether there is a fact *e* such that *e* instantiates the proposition that Peter snores.

Obviously, this is not how interrogatives work. They do not express truth conditions like this. There are two reasons why this cannot be the right way to analyse interrogatives.

The first concerns Brandt et al.s' assumption that there is no speaker attitude expressed with sentence mood. Whether something is open or not should be evaluated against the knowledge of an agent: that is, in the case of interrogatives, the speaker in most cases (cf. Jacobs 1991a for a similar argument). This problem does not arise for an attitudinal account, as it would be easy to define **OPEN** as being evaluated against the knowledge of the speaker, for example.

However, leaving this problem aside, there is a second, more fundamental argument against integrative approaches like the one proposed by Brandt, Rosengren, and Zimmermann (1989) or Brandt et al. (1992), one that applies to integrative approaches independently of the question of whether attitudes are involved or not. It concerns the very nature of capturing the meaning of interrogatives along the lines of the condition in (5.18). Crucially, such truth conditions not only state that an interrogative is true if the proposition in question is open, but also that it is false if it is not open. Bearing this in mind, consider the following everyday dialogue:

(5.19) A: Is Casey already here?
B: No.

I imagine that everyone will take B's answer in (5.19) to convey that Casey is not already there. However, if there really are truth conditions for A's interrogative in (5.19) along the lines of (5.18), B's reaction should be a rejection instead of an answer. That is, B's utterance should be understood as rejecting the fact that it is open whether there is an *e* that instantiates the propositions that Casey is already there. Of course, this is not the way we understand the question in (5.19). This can also be seen if we alter B's answer to the question in such a way that it is obviously intended as a rejection of the allegedly expressed proposition:

(5.20) A: Is Casey already here?
B: # That's not true.
B′: # You're mistaken.
B″: # No, I know that she isn't.

Such answers are clearly odd; but the conditions in (5.18) were on the right track, they should be perfectly acceptable. The problem is that the content assigned to an interrogative seems to be more like something suitable for an assertion, but not for a question. However, if a theory of sentence mood should play any important rule in connecting syntactic sentence types like V1-interrogatives with pragmatic speech acts like questioning, sentence mood should somehow "fit" the kind of illocutionary force that is usually assigned to a sentence of that type. This is not achieved by the integrative approach representatively discussed here: I should stress once more that this is not a problem particular to Brandt et al.s' approach, but rather a fundamental problem of the integrative approach in general. As interrogatives clearly show, the contribution of sentence mood cannot be something propositional, at least not if it is located at the same truth-conditional tier as the ordinary content. Whatever the contribution of the interrogative mood, it should not affect the ordinary content of the sentence (the "radical"), which should still come out as a set of propositions. The solution to this problem that I will discuss in §5.2.3 is to shift the contribution of sentence mood into another meaning dimension, so that we can have both unaffected sentential content and explicitly represented sentence mood operators. Before I come to this kind of approach however, I will first discuss implicit approaches, which have different problems.

5.2.2 An implicit approach

The feature common to the group of approaches that I have labeled *implicit* is that they do not employ actual sentence mood operators. Instead, sentence mood, and with it the restrictions on speech acts that can be performed by an utterance, is implicit in the content denoted by a sentence. That is, different moods are based on different types of denotation. For instance, declarative clauses express propositions, while *yes/no*-interrogatives express sets of propositions. The specifics may vary from approach to approach, but the general idea is that different forms of content determine different moods.

The implicit approach that I will discuss here as being representative of this category is proposed by Portner (2004) and stands in the dynamic tradition. The basic idea of this approach is to extend the standard update function assigned to *assertions* in dynamic semantic frameworks to cover interrogatives and imperatives as well. However, at least for German, it does not make the right predictions, because it cannot deal with minor sentence types, in which the content–mood correspondence is not as straightforward.

In dynamic theories of meaning, the meaning of a declarative sentence is not considered to be a truth value or proposition. Instead, the focus lies on the ability of a declarative sentence to change the context of the discourse. Utterances are thus considered to be functions from contexts to contexts, and the semantic value of a sentence is its *context change potential* (Heim 1982); that is, the way in which it can potentially affect the context if uttered. The common way in which declarative sentences can affect the context is to update the *common ground* by reducing the so-called *context set*. In simple terms, the common ground is that set of propositions that constitutes common belief between all interlocutors in a discourse (Stalnaker 2002b). The context set then is the set of possible worlds that is given by the intersection of all the propositions in the common ground of the discourse; that is, the set of worlds that is compatible with all propositions in the common ground. The addition of a proposition to the common ground of a context c thus increases the number of propositions in the common ground, but reduces the context set for that context by elimination of all worlds from the context set that are incompatible with the new proposition (Stalnaker 1978). Given a context c and a proposition p, the way in which the assertion of p changes the common ground CG_c for context c and the context set I_c for context c can be defined as follows (cf. Haas-Spohn 1991):

(5.21) *Context change* (assertion)
a. $\mathrm{CG}(c) + p = \mathrm{CG}(c) \cup \{p\} = \mathrm{CG}(c')$
b. $I(c) + p = I(c) \cap \{p\} = I(c')$

That is, what the basic update function "+" for declarative clauses (i.e. assertions) does is just add the new proposition to the common ground, thereby reducing the context set.

Portner's (2004) proposal is to generalize this update function to the utterance of other sentence types as well, namely interrogatives and imperatives. His basic idea is to enrich the ontology of contexts by two further discourse components in addition to the common ground. For interrogatives, he assumes a *question set* (*QS*), and for imperatives, he assumes a *to-do list* (*TDL*) for each participant in a discourse. Of course, both the question set and the to-do list are relativized to a context *c*. Now, the idea is that the utterance of a sentence updates the context by adding the sentence's content to the appropriate discourse component. That is, to add the semantic content of an interrogative to the question set represents the sentence mood of interrogatives, namely *questioning*, or *asking* as (Portner 2004) calls it. Accordingly, $requiring_A$ is the sentence mood of imperatives and updates the context *c* by adding the semantic content of the imperative to A's to-do list of that context *c*. The way in which interrogatives and imperatives respectively change the context can be defined in a similar fashion as for declaratives above:

(5.22) *Context Change* (asking)
$QS(c) + q = QS(c) \cup \{q\} = QS(c')$

(5.23) *Context Change* ($\mathrm{requiring}_A$)
$TDL(c)(A) + P = TDL(c)(A) \cup \{P\} = TDL(c')(A)$

Of course, to enhance the context with a question set and a to-do list is not a new idea. Employing the former was already suggested by Ginzburg (1995a,b) and Roberts (1998) in order to model the effect of updating a context with an interrogative. To make use of to-do lists to account for the dynamic effects of imperatives is proposed for instance by Han (2000), Potts (2003), and Roberts (2004). However, the new twist in Portner's (2004) analysis is that he wants to determine the way in which an utterance dynamically changes the context solely on the basis of its semantic content. His starting point is the observation that declarative, interrogative, and imperative clauses all denote different semantic objects. A declarative clause denotes a proposition, an interrogative a set of propositions, and, according to his approach, an imperative clause

TABLE 5.1 Sentence type, discourse component, and sentence mood

Sentence type	*Denotation*	*Discourse component*	*Mood*
declaratives	proposition p	*common ground* set of propositions	assertion $CG(c) \cup \{p\}$
interrogatives	set of propositions q	*question set* set of sets of propositions	asking $QS(c) \cup \{q\}$
imperatives	property (P)	*to-do list function* function from individuals to sets of properties	requiring$_A$ $TDL(c)(A) \cup \{P\}$

denotes a property. Accordingly, the discourse components for each sentence type are different objects too. The common ground is a set of propositions, the question set is a set of sets of propositions, and the to-do list for a discourse participant A is a set of properties. These differences are illustrated in Table 5.1 above, borrowed from Portner (2004).

A glance at Table 5.1 reveals that the update functions for each sentence mood can be abstracted to yield a general update function. If we compare the kind of semantic object that is denoted by each sentence type with its corresponding discourse component, we notice that the latter is always just a set of the former, and that updating a discourse component just means adding the semantic object denoted by a sentence to the discourse component which is constituted by a set of such objects. Accordingly, a general update function can be defined along the following lines (cf. Portner 2004):

(5.24) *Context Change* (general)
The general update function U takes a set of x's and another x, and adds the new x to the set of x's. More formally:

$$U = \{\langle D, \langle a, r\rangle\rangle : \exists X.[D \in \wp(X) \;\&\; a \in X \;\&\; r = D \cup \{a\}]\}$$

The general update function U thus takes a discourse component D and an appropriate argument a that should update D and delivers the intersection between D and $\{a\}$ as the result r. For instance, if X is a set of propositions, then the corresponding discourse component D is also a set of propositions, since $D \in \wp(X)$. Furthermore, a is a proposition, since X is a set of propositions and $a \in X$. The result r of updating D with a is then the intersection between a set of propositions and the set $\{a\}$. This is of course just assertion as defined in (5.21) on the facing page.

Portner's (2004) approach provides a neat generalization of the update functions for declaratives, interrogatives, and imperatives. Furthermore, he argues that since we have this update function, there is neither the need for sentence mood to be explicitly represented in the semantics of a sentence, nor the need to derive sentence mood from the morphological and syntactic features of sentence types. In his approach, sentence mood can be directly read off from a sentence's semantic content, because it corresponds to the kind of semantic object denoted by the sentence. However, as appealing as such a way of thinking about sentence mood might be, it is not fine-grained enough to capture the subtle and complex relations that hold between the morphological and syntactic structure of sentences, their semantic content and their sentence mood. That is, as long as there is not a simple relation between content type and update type, Portner's (2004) approach will face problems. This holds especially for German, where these relations seem to be even more complex, and I dare to speculate that there are even more complicated cases in other languages.

There are a couple of cases in the German clause type system for which Portner's (2004) generalized update function makes wrong predictions—and the fact that there are some cases deprives his update function of its appealing generality. For instance, the independent use of *dass*-VL clauses (*that*-verb-last clauses) in German constitutes such a case. For the most part, German *dass*-VL clauses are used in embedded contexts: as the object of a propositional attitude predicate or in indirect speech reports, for example.

(5.25) Peter glaubt, [dass du nicht dein ganzes Geld
Peter believes that you not your entire money
ausgibst].
spend
'Peter believes that you do not spend all your money.'

(5.26) Peter sagt, [dass du nicht dein ganzes Geld ausgibst].
Peter says that you not your entire money spend
'Peter says that you do not spend all your money.'

In embedded positions like these, German *dass*-VL clauses denote propositions just as their English counterparts introduced by *that*. Beside this embedded use, however, *dass*-VL clauses have an independent, unembedded use as root clauses, something that is not possible for English *that*-clauses.

(5.27) Dass du nicht dein ganzes Geld ausgibst!
that you not your entire money spend
'Do not spend all your money!'
(lit.: 'That you do not spend all your money!')

Crucially, such unembedded *dass*-VL sentences only allow for deontic readings. The sentence mood of (5.27) is more like an imperative and cannot be interpreted as having declarative mood.[7] This, however, is at odds with Portner's (2004) generalized update function. If *dass*-VL sentences denote proposition, as is shown by their embedded usage, the update function should add them to a set of propositions, that is, the common ground. But adding something to the common ground is assertion, whereas the deontic interpretation attested for (5.27) should result in adding something to the to-do list of, presumably, the addressee. Therefore, the independent use of sentences like (5.27) is more akin to imperative clauses with respect to their update potential than to simple V2-declaratives. But crucially, regarding their semantic content, *dass*-VL sentences are like V2-declaratives, because they denote propositions and not properties like imperatives do. The independent use of *dass*-VL sentences therefore falls outside of the content–mood correlation assumed by Portner.

It is of no help—if one wants to rescue the correspondence between content and sentence mood—to assume that *dass*-VL sentences denote properties when used as independent sentences, since, for that not to be mere stipulation, there has to be something that distinguishes embedded and unembedded *dass*-VL clauses and which, by compositionality, therefore differentiates their denotations. For instance, one might argue that there is an additional covert element in the syntax of root *dass*-sentences that is absent from embedded *dass*-clauses (or vice versa). But if you have something in the syntactic or morphological structure that is responsible for this difference—which, without further evidence, is an ad hoc stipulation anyway—the whole motivation for the generalized update function to account for the relation between sentence types and sentence moods solely on semantic grounds is flawed. One could then just as likely assume that this covert element is not something that transforms a proposition into a property, but a sentence mood operator

[7] Note that this usage is not elliptical (Brandt et al. 1992; Meibauer 1989; Oppenrieder 1989).

that is responsible for the deontic interpretation of independent *dass*-sentences.

If we dig deeper, into the realm of "minor" sentence moods beyond declarative, interrogative, and imperative mood, we find more examples of form–function pairs that are problematic for the generalized update function defined in (5.24). In addition to the three moods assumed by Portner (2004), we find, for instance, exclamative or optative mood.[8] Even if we assume appropriate discourse components like *wish lists* or *expectation sets*, it is not clear how to account for such moods with the general update function when the type of semantic content of the sentence is the sole information that is taken into account. For instance, a sentence like (5.29) that has the same structure as the embedded interrogative in (5.28) and hence seems to denote a set of propositions receives an exclamative reading when used independently.

(5.28) Peter fragt Hein, [wie schnell Günther ist].
Peter asks Hein how fast Günther is
'Peter asks Hein how fast Günther is.'

(5.29) Wie schnell Günther ist!
how fast Günther is
'How fast Günther is!'

As appealing as an implicit approach to the meaning of sentence mood may seem, cases like those discussed above pose severe objections to approaches to sentence mood that are based on a sentence's semantic content alone, represented here by Portner's (2004) approach.[9] I conclude that an account of the meaning of sentence mood cannot rest solely on the differences between content types and cannot assign the correct mood to all sentence types without the stipulation of covert elements that would belie the main motivation of such an approach.

[8] For exclamatives, see Castroviejo Miró (2006); Rett (2008), (2012); Roguska (2007); Rosengren (1992); for optatives, see Grosz (2012); Rosengren (1993).

[9] A further problem that implicit approaches face is that it is hard to see how they can account for the interaction between modal particles and sentence mood, which I will address in the next chapter. Since the mood of a sentence is solely given by the type of denotation of its content, there is no way in which the presence of a modal particle could influence the mood, except if it altered the sentence's denotation, which seems highly unreasonable, as modal particles do not affect the truth-conditional content of a sentence. Even if there may be some particles that can be analysed entirely with regard to the effects they have on the update function—McCready (2009: §3.2) treats the sentence-final use of English *man* as yielding a modified update function called "strong assertion"—there are many particles that seem to have an impact other than influencing the update function.

Therefore, I will now turn to the remaining category of approaches to sentence mood given in (5.6), namely multidimensional approaches.

5.2.3 A multidimensional approach

One of the main advantages that implicit approaches to sentence mood have over integrative variants is that they circumvent the problem of ascribing false truth conditions. However, they do so by giving up on explicit representations of sentence mood, which makes it hard for them to deal with sentence types that fall outside the three standard varieties. A resolution of this dilemma is provided by the path taken by multidimensional approaches. We get explicit sentence mood operators without false truth conditions if we separate their contribution from the ordinary semantic content of a sentence ((5.9) repeated from p. 172):

(5.9) Peter snores $\rightsquigarrow \dfrac{\textsc{dec}(\lambda i.\mathbf{snore}_i(\mathbf{peter}))}{\lambda i.\mathbf{snore}_i(\mathbf{peter})}$

A multidimensional approach to sentence mood is also suggested by Portner in a later paper (Portner 2007), in which he discusses different aspects of non-truth-conditional meaning, which he calls "instructions for interpretation as separate performatives". He bases his approach on a variant of Potts's (2005) $\mathcal{L}_{\mathrm{CI}}$, which I have already presented in §4.3.1 (pp. 107–17), with the relevant rules given in (4.6) and (4.7) on page 109. Using this compositional system, he is able to assume sentence mood operators that, when applied to the content of a sentence, end up in a separate meaning dimension. The two meaning dimensions of the declarative mood operator can be given as follows (Portner 2007: 420):[10]

(5.30) a. $[\![\textsc{dec}]\!]^{t,c} = \emptyset$
b. $[\![\textsc{dec}]\!]^{u,c} = \lambda p \lambda w.c_S$ requests that p is in the common ground in w

Using these two meaning dimensions for the sentence mood operator and the composition rules (4.6) and (4.7) from the previous chapter, we can derive the meaning of a simple declarative.[11]

(5.31) $$\dfrac{\langle \emptyset, \textsc{dec}\rangle \qquad \big\langle \lambda i.\mathbf{snore}_i(\mathbf{peter}), \emptyset\big\rangle}{\big\langle \lambda i.\mathbf{snore}_i(\mathbf{peter}), \textsc{dec}(\lambda i.\mathbf{snore}_i(\mathbf{peter}))\big\rangle}$$

[10] I have used different labels from Portner's in order to bring it more in line with the notational conventions of this book.

[11] For the moment, I do not bother to transfer Portner's approach properly into $\mathcal{L}_{\mathrm{TU}}$.

We thus end up with the ordinary semantic content in the first dimension (interpreted as a proposition), and the "instruction" that is expressed by the declarative operator applying to the semantic content. By this distribution of the meaning components into two independent dimensions, Portner's (2007) multidimensional approach solves the dilemma mentioned above. In fact, the final approach that I will develop in this chapter will resemble his approach in all its basic features. However, one important question that Portner (2007) does not address in his two-page sketch is where these sentence mood operators come from. If we want to arrive at an approach to sentence mood, we must not be satisfied by merely assigning the correct interpretation to complete sentences by introducing mood operators where they fit. Instead, we must also say something about how the morphosyntactic structure of a sentence determines what sentence mood operators are exhibited by what sentence types. We have already seen some hints of what such correlations can look like in the discussion of Brandt et al.s' (1992) integrative approach in §5.2.1. As we have seen, Brandt et al. correlate the distribution of [±*wh*]-features in the CP with the presence of different mood operators. Even if their integrative approach is on the wrong track, such correlation is what we should look for in order to arrive at a compositional approach to sentence mood. In the next section, I will therefore review, in more detail, the approach developed by Truckenbrodt (2006). His approach, which belongs to a certain extent to the integrative category and which I will therefore revise later, aims to provide just such a compositional correlation between the form and interpretation of sentences in German.

5.3 A compositional approach to sentence mood

In a series of papers, Truckenbrodt (2004, 2006a,b) develops a new approach to the relation between morphosyntactic properties of German sentence types and the semantic sentence mood they express. His approach is based on the observation that the movement of the finite verb to C° in German ("V-to-C" for short) is connected to its illocutionary potential, which is observed by other authors as well (e.g. Gärtner 2002; Lohnstein 2000). This connection can be illustrated by the following set of minimal pairs that differ only in the position of the finite verb:

(5.32) Peter **kommt** pünktlich nach Hause ~~kommt~~.
Peter comes on time to home
'Peter gets home on time.'

(5.33) Dass Peter pünktlich nach Hause **kommt**.
that Peter on time to home comes
'Peter must get home on time!'
(lit.: 'That Peter gets home on time!')

Except for the complementizer *dass* in (5.33), both sentences are construed from exactly the same lexical material, and except for the V-to-C movement of the finite verb *kommt* in (5.32), both share the same syntactic structure. Crucially, they have quite different meanings. While the former can be used to make assertive speech acts like assertions, prognoses, and so forth, the latter can never be used to perform such speech acts. Instead, it can be used to perform directive speech acts like requests, commands, or threats. These differences suggest that they encode different sentence moods. Since (5.32) can realize assertive speech acts, its mood should be declarative, whereas the sentence mood of (5.33) has to be imperative, because it only allows deontic, but no assertive readings.

A minimal pair for interrogatives is provide by the two examples in (5.34) and (5.35). In this case, the semantic difference caused by the V-to-C movement is more subtle.

(5.34) Wann **kommt** Peter nach Hause ~~kommt~~?
when comes Peter to home
'When does Peter get home?'

(5.35) Wann Peter nach Hause **kommt**?
when Peter to home comes
'I wonder when Peter gets home.'
(lit.: 'When Peter gets home?')

Both sentences can be used to realize erotetic speech acts, that is, to perform questions. The difference between them is that the use of the former seems to presuppose that the addressee is aware of the answer or, at least, that the speaker thinks that the addressee may know the answer. In an utterance of the VL-interrogative however, there is no such assumption. That is why VL-interrogatives are traditionally called deliberative questions. Even if this difference is not as big as the difference between V2 declaratives and *dass*-VL clauses, it is still very robust. This is illustrated in Truckenbrodt's "Cuban cigar scenario" (Truckenbrodt 2006a: 274, my emphasis, DG):

(5.36) Stefan: Ich hab seit Jahren nichts mehr von Peter gehört.
'I haven't heard from Peter in years'.
Heiner: Ich auch nicht.
'Me neither.'
a. Stefan: #**Mag** er immer noch kubanische Zigarren?
'Does he still like Cuban cigars?'
b. Stefan: Ob er immer noch kubanische Zigarren **mag**?
'I wonder whether he still likes Cuban cigars.'

In the context of the previous two utterances, Stefan's utterance of a V-to-C interrogative in (5.36a) is inappropriate because he knows that Heiner cannot know anything about Peter's smoking behavior. In contrast to this, (5.36b) is a perfect continuation of the previous discourse. This shows that utterances of VL-interrogative do not convey that the hearer knows the answer.

The sole difference between the three minimal pairs discussed above is the position of the finite verb. The conclusion that the V-to-C movement has something to do with sentence mood is thus very natural and becomes the central factor in Truckenbrodt's theory of sentence mood. The main task Truckenbrodt (2004, 2006a,b) addresses is then how the observed differences in sentence mood can be compositionally derived from V-to-C movement and other morphosyntactic features of a sentence. In the following, I discuss Truckenbrodt's latest version of his account, as presented in Truckenbrodt (2006b) in some detail, before adapting it to the use-conditional system of $\mathcal{L}_{\mathrm{TU}}$ developed in the previous chapter.

5.3.1 Epistemic interpretation

The core of Truckenbrodt's theory of sentence mood is the epistemic interpretation of the morphosyntactic [±*wh*]-feature, which also played a role in Brandt et al.s' (1992) approach. He assumes that both [−*wh*] and [+*wh*] trigger an epistemic interpretation: that is, the propositional semantic content expressed by a sentence gets interpreted inside an epistemic attitude (Truckenbrodt 2006b: 395). In contrast to such more "traditional" attitudinal approaches to sentence mood as, for instance, that advocated by Doherty (1985, 1987), which models epistemic attitudes by meaning postulates, Truckenbrodt accounts for them with presuppositions that are triggered by the presence of [±*wh*] in the CP. Furthermore, [−*wh*] and [+*wh*] are "contextual" presupposition triggers, so to speak, as they are only at work when they occur in specific functional positions of the sentence. Here is how he formulates the rule for epistemic interpretation (Truckenbrodt 2006b: 395):

(5.37) *Epistemic interpretation of* [±*wh*]
A visible specification of [−*wh*] or [+*wh*] in C or $\mathrm{CP}^{\mathrm{spec}}$ at LF triggers a presupposition that looks for an epistemic context. The proposition p is embedded in that epistemic context.

These epistemic presuppositions are defined as in (5.38), which is a slight reformulation of Truckenbrodt's (2006a: 290) original definition that integrates it more with the notations used in this book.

(5.38) *Epistemic presuppositions of* [±*wh*]
Let $\xi = \langle c, \mathrm{CP}_{\langle \mathrm{Epist} \rangle} \rangle$, where c is a context, let p be the meaning of CP. Then the meaning and context change of ξ
a. is defined if the context c entails a further context $E(y)$, a set of worlds that stand for the content of a specific epistemic attitude of y.
b. if defined, the update ξ results in a new context:
$E(y) + p = E(y) \cap p = E'(y)$
c. if defined, $\xi \Leftrightarrow E(y) \subseteq p$

This definition says that the presupposition for an epistemic context—which, according to (5.38), is triggered by the presence of [−*wh*] or [+*wh*] in C or $\mathrm{CP}^{\mathrm{spec}}$ at LF—has to be fulfilled in order to update c with the meaning of the sentence. If there is indeed an epistemic context in c and the presupposition is therefore fulfilled, the incoming proposition is added to the set of propositions that represents that epistemic context. Or, if you prefer a static formulation, the meaning of the entire sentence is that the proposition it expresses is part of the set of propositions characterized by the epistemic predicate that fulfills the presupposition.

5.3.2 Movement and visibility

So far, the proposal provides an interpretation of the [±*wh*] feature. However, it does not say anything about how this interpretation is related to V-to-C movement, one of the syntactic features that have a heavy influence on sentence mood, as we have seen above. Truckenbrodt (2006b) construes the basic connection between the syntactic structure of a sentence and its interpretation with a set of rules that determines the effects that V-to-C has. Basically, the [±*wh*] feature has to be attached to particular lexical items to be visible on different levels of representation like LF or PF. The first rule concerns [−*wh*] as a trigger of V-to-C movement (Truckenbrodt 2006b: 394):

(5.39) *Trigger of V-to-C* (imperatives apart)
[−*wh*] needs to be attached to an overt element at PF in German.

This rule accounts for the complementary distribution between complementizers and finite verbs in CP that can be observed in German. If there is an overt complementizer like *dass*, [−*wh*] can be attached to it and no V-to-C takes place. But if there is no complementizer to which [−*wh*] can be attached, the finite verb moves to $\mathrm{CP}^{\mathrm{spec}}$ where it can take up [−*wh*], thus satisfying (5.39).

So far, there is one problem with the two rules (5.37) and (5.39). As we have seen in (5.27) on page 181, the independent use of *dass*-VL sentences does not allow for epistemic interpretation. However, *dass* is clearly a [−*wh*]-complementizer, as is shown by selectional restriction of clause-subordinating predicates like *hoffen* 'hope' that can only embed [−*wh*] complements.

(5.40) Ich hoffe, **dass**$_{[-wh]}$/***ob**$_{[+wh]}$ ich die Prüfung bestehen
I hope that/whether I the exam pass
werde.
will
'I hope that/*whether I will pass the exam.'

To overcome this problem, Truckenbrodt (2006b: 396) postulates a further constraint on the epistemic interpretation of [−*wh*]. Consider again the formulation in (5.37). It is formulated such that only a specification of [±*wh*] that is *visible* at LF triggers the presupposition for an epistemic context. Hence, it is easy to exclude certain constellations from triggering the epistemic interpretation by setting up a visibility condition for LF:

(5.41) *Visibility condition on* [−*wh*]
[−*wh*] is visible at LF only if it is attached to a meaningful element.

Whereas other complementizers like *weil* 'because' are meaningful as they contribute semantic content as well, Truckenbrodt (2006b: 396) claims that *dass* does not have any semantic meaning. An argument for this is that a sentence introduced by *dass* has the same semantic content as the corresponding V2-sentence:

(5.42) a. dass Peter schnarcht $\rightsquigarrow \lambda i.\mathbf{snores}_i(\mathbf{peter})$: $\langle s,t\rangle$
b. Peter schnarcht ~~Peter schnarcht~~ $\rightsquigarrow \lambda i.\mathbf{snores}_i(\mathbf{peter})$: $\langle s,t\rangle$

Supposing that *dass* is indeed semantically empty, the visibility constraint in (5.41) ensures that *dass* does not trigger an epistemic interpretation since it is invisible at LF, and therefore [−*wh*] is invisible at LF and does not trigger an epistemic interpretation.

5.3.3 Deontic interpretation

Epistemic interpretation of *wh*-features is not the only component of Truckenbrodt's (2006a) account of sentence mood. That something additional is needed becomes obvious if we consider the mood of *dass*-sentences again. Since there is no [−*wh*] visible at LF, there is no epistemic interpretation. So far, so good. But then again, where does the imperative-like mood that *dass*-clauses exhibit, as shown in (5.33), stem from? To account for this, Truckenbrodt (2006b) assumes a further attitudinal component that plays a major role in the composition of sentence mood, namely a deontic speaker attitude which is represented by a corresponding deontic operator DEONT$_S$. This operator is introduced according to the following general "Root rule" (Truckenbrodt 2006b: 394):

(5.43) *Root rule*

Utterances (more generally: communicative acts) are interpreted as purposeful, i.e., expressing a volition on the part of the speaker:

$\text{CG} \longrightarrow \text{CG} + \text{DEONT}_S(\ldots)$

The meaning of the utterance is interpreted in the scope of this volition, i.e., as part of "…" in the preceding formula.

In contrast to the rule for epistemic interpretation (5.37), which is tied to the syntactic [±*wh*]-feature, the deontic interpretation is not triggered by any features of the sentence. Instead, it is motivated by conceptual and functional considerations, in that speakers do want to achieve something by their utterances. Therefore, the root rule licenses a deontic interpretation for every sentence type irrespective of its morphosyntactic make-up. This also means that every sentence mood involves at least this deontic component. Since the deontic operator is introduced for the entire sentence it is always the highest operator; it scopes over the entire content of a sentence, including the epistemic operator that may be introduced by (5.37).

This is basically the entire apparatus that Truckenbrodt (2006b) uses to derive sentence mood from the morphosyntactic features of a sentence. Before I present two further additions to these two basic rules, let me briefly illustrate with a couple of examples how the system works so far. First, take again the now familiar root *dass*-sentences:

(5.44) **Dass** du nicht wieder die Schlüssel **vergisst**!
that you not again the keys forget
'Don't forget the keys again!'
(lit.: 'That you don't forget the keys again!')

With *dass*, we have an overt complementizer in the CP to which [–*wh*] can be attached. Therefore, rule (5.39) saying that [–*wh*] has to be attached to an element at PF is fulfilled and no V-to-C movement need occur. However, because *dass* is semantically meaningless, it is not visible at LF due to the visibility constraint (5.41). Hence, no epistemic interpretation is triggered, because according to (5.37) only specifications of [±*wh*] that are visible at LF do so. Finally, the root rule (5.43) provides a deontic interpretation for the entire sentence. Together, Truckenbrodt's (2006b) rules thus correctly derive the deontic interpretation for root *dass*-VL clauses like (5.45a), which can be paraphrased as in (5.45b) and given the semantic representation as in (5.45c).

(5.45) a. Dass du nicht wieder die Schlüssel vergisst!
b. The speaker wants [the hearer not to forget the keys again]
c. $\textbf{DEONT}_S(\lambda i.\textbf{not}(\textbf{again}(\textbf{forget}_i(\textbf{the-keys}_i)(\textbf{the-addressee}))))$

As a second example, consider simple V2-declaratives like the one in (5.46). In V2-declaratives, there is no complementizer in $\mathrm{CP^{spec}}$ that can take up the [–*wh*]-feature. In order to satisfy (5.39), the finite verb hence has to move to CP, so that [–*wh*] can be attached to it:

(5.46) Jim **wohnt** in Berlin ~~wohnt~~.
'Jim lives in Berlin.'

The finite verb *wohnt* 'lives' obviously has semantic meaning. Accordingly, the visibility constraint on LF (5.41) is fulfilled and V-to-C is triggered. The [–*wh*]-feature then triggers a presupposition that looks for an epistemic context in which the proposition expressed by the sentence can be embedded. Then again, the root rule finally embeds the entire semantic structure, i.e. the proposition with the epistemic attitude, under the deontic operator. For (5.46), we thus end up with the following semantic representation, where **E** is an epistemic predicate accessible in the utterance context.

(5.47) a. The speaker wants [that **E** [that Jim lives in Berlin]].
b. $\textsc{deont}_S(\mathbf{E}(\lambda i.\mathbf{live\text{-}in}_i(\mathbf{berlin})(\mathbf{jim})))$

The concrete epistemic attitude contributed by **E** has to be derived in the context, as laid out in (5.38) (p. 187). For instance, it could be something like *it is common ground*, such that the entire sentence (5.46) conveys that the speaker wants it to be common ground that Jim lives in Berlin. This seems to be a good paraphrase of the overall meaning of (5.46) and comes very close to the meaning that Portner (2007: 420) gives to his declarative sentence mood operator, as seen in (5.30) (p. 183). It picks up the idea of the dynamic approach, that the fundamental contribution of a declarative consists in updating the context by adding a proposition to the common ground. More complex epistemic attitudes are of course also possible. A complex solution for **E**, one that would resemble Searle's (1969) view on assertion, could be, for instance, *the addressee knows that the speaker believes that Jim lives in Berlin* (Truckenbrodt 2006b: 395).

5.3.4 Hearer knowledge

The third example I want to discuss directly leads us to a further rule for the interpretation of *wh*-features. Consider verb-last interrogatives again. For convenience, I repeat example (5.35) from page 185 here:

(5.48) **Wann** Peter nach Hause **kommt**?
when Peter to home comes
'I wonder when Peter gets home.'
(lit.: 'When Peter gets home?')

With *wann* 'when', this sentence involves a [+*wh*]-expression in its CP. Because the visibility constraint does not apply to [+*wh*], we do not have to bother about the question of the meaningfulness of *wann*; it triggers an epistemic interpretation anyway. And since there is no [−*wh*]-feature, no V-to-C movement is triggered and the finite verb stays in the IP at the right edge of the sentence. As always, everything gets interpreted under a deontic attitude due to the root rule. Example (5.48) thus gets a deontic/epistemic reading. Assuming that **E** concerns just knowledge in this case, we get an interpretation along the lines of the following paraphrase:

(5.49) The speaker wants [to know [when Peter gets home]].

Crucially, there is no assumption about hearer knowledge represented in this paraphrase. This gets the empirical facts right, as illustrated by the Cuban cigar scenario in (5.36) (p. 186).

However, when it comes to ordinary V2-interrogatives, two questions arise. First, why do they exhibit movement of the finite verb at all? Since there seems to be no [−*wh*]-feature, there is no trigger for V-to-C. Secondly, where does the assumption that the hearer may know the answer come from? That such an assumption seems to be part of the mood of V2-interrogatives is shown by their infelicity in the Cuban cigar scenario, in which it is clear that the addressee does not know the answer to the question. To answer these two questions, Truckenbrodt (2006b: 397) follows Brandt et al.s' (1992: 32) analysis of interrogatives insofar as he also assumes that in addition to the [+*wh*]-feature in $\mathrm{CP}^{\mathrm{spec}}$, there is an another *wh*-feature in C^{o} in interrogatives. While this additional feature is also [+*wh*] in VL-interrogatives, it is [−*wh*] in V2-interrogative sentences. Comparing V2-interrogatives with their VL counterparts, we have the following distribution of [+*wh*] and [−*wh*] in interrogatives (Truckenbrodt 2006b: 398):

(5.50) *VL-interrogatives*

a. $[_{\mathrm{CP^{spec}}}$ Wann$_{[+wh]}]$ $[_{C^{o}}$ $_{[+wh]}]$ Peter nach Hause kommt?
'I wonder when Peter gets home.' (lit.: 'When Peter gets home?')

b. $[_{\mathrm{CP^{spec}}}$ $_{[+wh]}]$ $[_{C^{o}}$ Ob$_{[+wh]}]$ Peter nach Hause kommt?
'I wonder if Peter gets home.' (lit.: 'If Peter gets home?')

(5.51) *V2-interrogatives*

a. $[_{\mathrm{CP^{spec}}}$ Wann$_{[+wh]}]$ $[_{C^{o}}$ kommt$_{[-wh]}$] Peter nach Hause?
'When does Peter get home?'

b. $[_{\mathrm{CP^{spec}}}$ $_{[+wh]}]$ $[_{C^{o}}$ Kommt$_{[-wh]}$] Peter nach Hause?
'Does Peter get home?'

For VL-interrogatives, the rules already derive the correct result. Therefore, we do not want the additional [+*wh*] to make any substantial changes to the interpretation. Likewise, in V2-declaratives, there are two instances of [−*wh*], but we do not want to double the epistemic interpretation. In order to achieve this, Truckenbrodt (2006b: 398) postulates an identity constraint on the interpretation of [±*wh*]-features that ensures that a double specification has no effect:

(5.52) *Identity constraint on [*±wh*]*

Identical specifications of [+*wh*] or of [−*wh*] on X and $\mathrm{XP}^{\mathrm{spec}}$

(and on X/XP and an adjunct to XP) are checked and interpreted as one feature for the purpose of (5.37).

This regulates, in declaratives and VL-interrogatives, the double specification of [–*wh*] and [+*wh*] respectively, ensuring that it does not have any interpretational effect. In verb-second interrogatives, we find both a [+*wh*]- and a [–*wh*]-feature. The presence of the additional [–*wh*] can solve the two questions raised above. First, since according to (5.39) on page 188, [–*wh*] has to be attached to an overt element at PF, it triggers V-to-C movement of the finite verb to C°. Furthermore, finite verbs clearly are meaningful expressions. The visibility condition (5.41) thus is fulfilled and the [–*wh*]-feature is visible at LF. Therefore, according to (5.37), the [–*wh*] in C° triggers an additional epistemic condition.

It is this second epistemic interpretation that is responsible for introducing the assumption that the addressee knows or, at least, may know the answer to the question. Truckenbrodt's (2006b: 399) suggestion is that such a hearer-orientated epistemic interpretation is chosen as the second epistemic context due to pragmatic constraints. The first epistemic presupposition gets resolved to the speaker's knowledge, and therefore a second embedding under such an epistemic context would be redundant. Furthermore, the first epistemic interpretation is embedded under the deontic attitude to satisfy the root rule, but after that, further embedding under the deontic context is not needed, so that the hearer knowledge becomes an independent condition.

5.3.5 Imperatives

Before I move on to argue for a reformulation of Truckenbrodt's (2006b) theory in a hybrid-semantics setting, let me briefly summarize what he says about imperatives. Most importantly, imperatives do not have an epistemic interpretation. This can be straightforwardly accounted for by the fact that there is no [±*wh*]-feature in imperatives. But then we face the question of what triggers V-to-C movement in imperatives if not the presence of [–*wh*]. A hint towards a solution is provided by a comparison of imperatives with root infinitives. These independent non-finite sentences also allow only a deontic interpretation and do not have a [±*wh*]-specification. As the following minimal pair illustrates, however, root infinitives do not involve V-to-C movement, in contrast to imperatives which do.

(5.53) **Tritt** bitte von der Bahnsteigkante zurück ~~tritt~~!
*step.*IMP *please from the track-edge back*
'Please step back from the edge of the track!'

(5.54) Bitte von der Bahnsteigkante **zurücktreten**.
*please from the track-edge step-back.*INF
'Please step back from the edge of the track!'

The important semantic difference between imperatives and root infinitives is that the former have a specific addressee while the latter do not. That is the reason why in German, prohibition signs and the like almost always make use of root infinitives instead of imperatives. They express general and therefore impersonal requests rather than the personal ones expressed by imperatives:

Truckenbrodt (2006b: 401) therefore suggests that V-to-C in imperatives is triggered by a feature [*A*] that is interpreted as *from A*. Accordingly, we get the following two interpretations for imperatives and root infinitives respectively:

(5.55) a. Tritt bitte von der Bahnsteigkante zurück!
b. The speaker wants **from the addressee** [the addressee to step back from the edge of the track].

(5.56) a. Bitte von der Bahnsteigkante zurücktreten.
b. The speaker wants [the addressee to step back from the edge of the track.]

The trigger for V-to-C movement thus is a different one for imperatives than it is for declaratives or interrogatives.

This rounds off my presentation of Truckenbrodt's (2006b) theory of sentence mood. However, as I will argue in the following section, it belongs—at least in some respects—to the category of integrative approaches to sentence mood, and therefore it inherits the problems that I demonstrated to be typical of such approaches in §5.2.1. This will lead to a major revision of his theory that brings it closer to the multidimensional approach discussed in §5.2.3.

5.4 From integration to multidimensionality

The compositional theory of sentence mood developed by Truckenbrodt (2006b), is a big step forward in our understanding of how syntactic and morphological features work together to determine the mood of German sentences. Even if there may be still some open questions and many aspects have to be worked out in more detail and with closer reference to the empirical data, these are issues that do not question his program in general.[12] However, I think that in one respect, or rather in two, his theory faces conceptual problems.

In the following, I will show that Truckenbrodt's account derives wrong truth conditions for various sentences and predicts wrong implicational patterns, just like the integrative accounts discussed in §5.2.1. The reason for this, as I will argue, is that he subsumes the epistemic and deontic sentence mood operator under the wrong kinds of meaning. He does this in two ways. On the one hand, he treats some aspects of sentence mood as presuppositions, which is not plausible, as I will show in §5.4.1. On the other hand, he treats some aspects as being truth-conditional, which leads to wrong truth conditions and thus replicates the problems of the integrative approach. This will be shown in §5.4.2.

5.4.1 Presuppositions?

The first miscategorization that affects Truckenbrodt's theory of sentence mood is the way it analyses the epistemic attitude that constitutes sentence mood, which is invoked by [±*wh*], as a presupposition. According to the reasonable standard tests for presuppositions (Geurts 1999), the epistemic interpretation does not behave like standard instances of presupposition. Consider, for instance, the presuppositions triggered by definite description or factive predicates:

(5.57) a. **The present king of France** is bald.
$\gg$ There is a present king of France.
b. John **regrets** that he has bought an expensive car.
$\gg$ John has bought an expensive car.

Whatever one's concrete view on presuppositions is, it is clear that a presupposition failure in cases like these should have some effect on the ordinary content of the sentence. If there is no present king of France, (5.57a) should either be false, fail to receive a truth value at all, or it should update the context in a usual way (e.g. leading to an absurd state). The same accounts for the presupposition due to the facticity of

[12] For instance, infinite *wh*-main clauses seem to pose a problem for Truckenbrodt's system (Gärtner 2014).

regret in (5.57b). Presuppostions lead to what I have called *hierarchical* multidimensionalty (Gutzmann 2012), which contrasts with the *parallel* multidimensionality of use-conditional meaning.

With this in mind, consider the putative presupposition for an epistemic context in v2-declaratives.

(5.58) Peter is at home.
$\gg$ There is an **E**, such that **E**(**at-home**$_i$(**peter**)).

Now, suppose that there is no epistemic attitude under which the proposition expressed by the sentence can be embedded (whatever that means). Does that have any effect on the meaning or truth value of (5.58)? According to my intuition, and most speakers will agree, it does not. Even if there is no epistemic predicate available in the context, *Peter is at home* is still true if Peter is at home. There does not have to be an epistemic attitude for (5.58) to be true or false. This contrasts with the hierarchical nature of presuppositions and rather speaks for thinking of the epistemic operator as contributing use-conditional meaning.

Furthermore, all the common tests for presupposition confirm that it is not a presupposition. Consider, for instance, the first item of the first stage of Geurts's (1999: 6–8) "presupposition test battery": the negation test. If an utterance that carries a putative presupposition gets negated, the presupposition should still be conveyed. The standard examples of presupposition given above pass this test easily. For the present king of France not to be bald, there certainly has to be a present king of France. Likewise, for John not regretting having bought an expensive car, he has to have bought an expensive car.

(5.59) a. The present king of France is **not** bald.
$\gg$ There is a present king of France.

b. John **does not** regret that he has bought an expensive car.
$\gg$ John has bought an expensive car.

In contrast, the epistemic interpretation is not constant under negation. Of course, if we negate example (5.58), we still get an epistemic interpretation. But crucially, although there is still an alleged presupposition for an epistemic attitude, this presupposition is not the same as the presupposition of the unnegated sentence. Instead, there now has to be an epistemic attitude that embeds the newly negated proposition. The original presupposition for epistemically embedding the unnegated proposition vanishes:

(5.60) Peter is **not** at home.

a. $\not\gg$ There is an **E**, such that **E**(**at-home**$_i$(**peter**)).

b. $\not\gg$ There is an **E**, such that **E**(**not**(**at-home**$_i$(**peter**))).

The presupposition in (5.60a) is not the same as in (5.60b). Accordingly, the alleged presupposition does not pass the negation test. This makes a presuppositional treatment of the epistemic interpretation very dubious. However, to reenforce these doubts, let us briefly apply a further test of Geurts's presupposition test battery. For instance, if we have an utterance $\varphi\{\chi\}$, i.e. an utterance of φ that conveys a presupposition χ, an utterance of the form "$\varphi\{\chi\}$ or ψ" should also convey that χ (Geurts 1999: 6). First, consider again our reference examples:

(5.61) a. Either the present king of France is bald or Homer is lazy.
$\gg$ There is a present King of France.

b. Either John regrets that he has bought an expensive car or Homer is lazy.
$\gg$ John has bought an expensive car.

As expected, both presuppositions pass this test without problems. In contrast, the epistemic interpretation does not. As in the negated examples in (5.60), the presupposition of $\varphi\{\chi\}$ vanishes if we apply the test. Instead, we end up with a different epistemic context:

(5.62) Either Peter is at home or Homer is bald.

a. $\not\gg$ There is an **E**, such that **E**(**at-home**$_i$(**peter**))

b. $\gg$ There is an **E**, such that **E**(**at-home**$_i$(**peter**) $\vee$ **bald**$_i$ (**homer**))

That these alleged presuppositions do not pass the presupposition tests makes the treatment of the epistemic interpretation of [±*wh*] as a presupposition unlikely. The same argument applies to the deontic interpretation. Just substitute a deontic predicate for **E** or put it in front of the epistemic contexts in (5.60a) and (5.62b). It is obvious that the expression DEONT$_S$(**E**(**at-home**$_i$(**peter**))) is not the same as DEONT$_S$(**E**(**not**(**at-home**$_i$(**peter**)))), so the putative deontic presupposition is not constant under negation either.

5.4.2 *Truth conditions?*

That Truckenbrodt's (2006b) two sentence mood operators both fail the standard presupposition tests renders treating them as presuppositions highly implausible. However, there is an even more severe objection to such an understanding: it derives wrong truth conditions and implicational patterns. To see why, let us suppose that both the epistemic and deontic presuppositions are resolved. For a simple declarative as in (5.63a), we then get, for instance, a deontic/epistemic embedding of its propositional content, paraphrasable as in (5.63b).

(5.63) a. Peter has written three books on presuppositions.
b. The speaker **wants** [the hearer **to believe** [that Peter has written three books on presuppositions]].

This complex deontic/epistemic proposition is then added to the common ground (Truckenbrodt 2006a: 267). So, what is the problem with this analysis? At first sight, it seems to get the meaning of declarative mood exhibited by V2-declaratives right. To see the problem with this analysis, consider first the following inference:

(5.64) $\dfrac{\text{Peter has written three books on presuppositions.}}{\text{Peter has written at least one book on presuppositions.}}$ ✓

Certainly, this inference is valid. Any satisfying approach to the semantics of (5.63a) should be able to explain the inference from the premise in (5.64) to its conclusion. But now consider the inference we end up with if we replace the premise in (5.64) with the interpretation which (5.63a) receives in Truckenbrodt's framework. Obviously, the new inference is not valid anymore.

(5.65) $\dfrac{\text{The speaker wants the hearer to believe that Peter has written three books on presuppositions.}}{\text{Peter has written at least one book on presuppositions.}}$ ✗

From the mere fact that the speaker wants the hearer to believe that Peter has written three books, it certainly does not follow that Peter has written one book on presupposition. For instance, Peter may have written three books about prepositions and not a single word on presupposition, but the speaker, being confused about these subjects, nevertheless wants the hearer to believe that Peter has written three books about presuppositions. Therefore, the inference in (5.65) cannot be valid, in contrast to that depicted in (5.64).

I am certain that one may respond to this argument that in (5.65), I have only substituted the premise and that the inference therefore fails to hold. Accordingly, so the counter-argument may continue, the validity of the inference would have been obtained if I had substituted the conclusion with its deontic/epistemic interpretation as well. That is, instead of (5.65), the inferences should go as follows:

(5.66) The speaker wants the hearer to believe that Peter has written three books on presuppositions.
―――――――――――――――――――――――― ✗
The speaker wants the hearer to believe that Peter has written at least one book on presuppositions.

I have two responses to such an alleged reply. First, even the new inference in (5.66) is still not valid. Of course, for this concrete example, it seems to go through, because it is so unlikely that somebody does not know that three entails at least one. But if we take a more "difficult" example, it becomes apparent that even (5.66) is not valid. First, consider the following standard inference:

(5.67) Peter drank three Pils.
―――――――――――― ✓
Peter drank three beers.

Since Pils is a kind of beer, (5.67) constitutes a valid inference pattern. Now consider the variant of (5.67) in which the standard propositions are substituted by their deontic/epistemic extensions.

(5.68) The speaker wants the hearer to believe that Peter drank three Pils.
―――――――――――――――――――――――― ✗
The speaker wants the hearer to believe that Peter drank three beers.

Now suppose that the speaker does not know that Pils is actually a special sort of beer, but rather believes that it is a special kind of whisky. In a *de dicto* reading, the premise of (5.68) then does not imply the conclusion. Alternatively, assume that the speaker suspects that the hearer thinks that Pils is a fancy soft drink and wants to make her believe that the speaker did not drink any alcoholic beverage, but without saying something false. In such a situation, the premise would be true, but the conclusion of (5.68) would not. Again, this shows that inferences that involve the sentence mood operators are not valid.

Truckenbrodt's (2006b) approach thus cannot explain inference patterns like (5.64) or (5.67), because the semantic representations that are assigned to simple declaratives do not obtain them. As already mentioned, the reason for this is that the sentence mood operators are dealt with in an integrative fashion. That is, if the alleged presuppositions triggered by the epistemic and deontic operator are satisfied, the resulting predicates are integrated into the same semantic interpretation that provides the ordinary content of a sentence and thereby becomes indistinguishable from the point of view of the logic. Therefore, Truckenbrodt's approach exhibits the same problem I raised in §5.2.1 for Brandt et al.s' (1992) integrative approach. It does not deliver correct truth conditions and therefore correct interpretations. Consider the truth conditions which Truckenbrodt's account would provide us with for a simple declarative sentence, given that the alleged presuppositions were satisfied:

(5.69) "Schnee ist weiß" is true (in German) iff the speaker wants the hearer to believe that snow is white.

These truth conditions are not equivalent to those provided by the traditional condition (T):

(5.70) "Schnee ist weiß" is true (in German) iff snow is white.

Of course, this alone is not an *a priori* objection to Truckenbrodt's account, since it may be the case that (5.69) is correct and that the simple T-sentence in (5.70) is wrong. However, the linguistic evidence clearly favors (5.70). We can see this, for instance, when we consider when people agree or disagree with an utterance of another speaker. If speaker A utters a sentence which her interlocutor B judges to be false, B is well advised to reject that utterance or somehow signal her disagreement, since otherwise, A would think that B accepts her utterance as true, which thus would lead to a defective common ground. Now, compare the following short dialogues and decide which seems more natural:

(5.71) A: I met my ex-boyfriend at the club yesterday.
B: I don't believe you!
A: Why not?
B: He was not in town yesterday, so he could not have been at the club.

(5.72) A: I met my ex-boyfriend at the club yesterday.
B: I don't believe you!
A: Why not?
B: #I know that you don't really want me know that, because you are still in love with him, and you are afraid that I will try to date him if I know that he's in town again.

Obviously, the dialogue in (5.71) is much more natural than the one in (5.72). In the former, B's second utterance is a perfect justification for why she does not believe A's assertion. Not so in the second example in which B justifies her rejection of A's utterance by the fact that A actually does not want B to know that her ex-boyfriend was at the club. But if Truckenbrodt's (2006b) analysis provided the right truth conditions for declaratives, the ratings should be the other way round: (5.72) should be better than (5.71).

For another method to test what the right truth conditions for an utterance are, take lying. Usually, if one lies, one asserts something that one believes to be false. Thus, lying makes direct reference to the truth conditions of an utterance. Setting aside the case of lying via falsely implicating (Meibauer 2005, 2014), the speech act of lying can be defined as in (5.73), following Falkenberg (1982: 75):

(5.73) *Lie* *A* lied at *t*, iff
a. *A* asserted at *t* that *p*,
b. *A* actively believed at *t* that $\neg p$.

Now, we can ask what it takes to count as lying if one utters the following sentence—that is, what it means for the speaker to believe in its negation:

(5.74) I have won a lot of money in the lottery.

Would we say that the speaker of (5.74) lies, if she believes that she has not won a lot of money in the lottery, or would we say she lies if she does not want her addressee to believe that she has won in the lottery? I think it is clear that in the latter case, nobody would conclude that the speaker is lying, although one may judge the utterance as *infelicitous* and wonder why she uttered it in the first place if she does not want to make her interlocutor believe that she has won in the lottery. In contrast, an utterance of (5.74) would be a perfect lie, if the speaker actively believes that she has not won a lot of money in the lottery, but nevertheless wants her addressee to believe that she has. This latter aspect—wanting the addressee to believe something one takes to be false—is actually a crucial aspect of lying. If the speaker does not want the hearer to believe that *p*, she is not lying in the first place, since condition (5.73a) is not fulfilled.

The way in which we would characterize an utterance as a lie is thus further support that the truth conditions derived by Truckenbrodt's (2006b) approach are not the right ones. Furthermore, the same objection I raised against the treatment of interrogatives in an integrative approach to sentence mood in §5.2.1 holds against his account. In Truckenbrodt's framework, interrogatives get assigned truth conditions, too:

(5.75) "Does Leonardo like pizza?" is true iff the speaker wants to know whether Leonardo likes pizza and the addressee knows whether Leonardo likes pizza.

Again, this is not the way in which interrogatives work. One would not answer *No* to the question in (5.75) just because one does not know the answer or if one thinks that the speaker does not want to know the answer. Instead, one would only give a negative answer if one believes that Leonardo does not like pizza.

Let me briefly summarize the findings of the argumentation just presented. First, Truckenbrodt's approach to the meaning of sentence mood assigns wrong truth conditions to declaratives and other sentence types. Secondly, it makes wrong predictions about how declaratives and other sentence types work in discourse. Furthermore, it does not preserve inferential patterns that are obviously valid. Finally, a presuppositional treatment of the sentence mood operators does not seem correct, as they neither pass standard presupposition tests nor do they lead to the common interpretational difficulties associated with presupposition failures.

Given these serious problems, the question may arise whether Truckenbrodt's (2006b) account should be abandoned entirely. I do not think so. The way in which he calculates the sentence mood from different syntactic and morphological features of a sentence seems to be on the right track and it does a good job in capturing the intuitions about the different mood exhibited by the various sentence types. It is the way in which the contribution of sentence mood to the overall meaning is conceptualized that leads to the aforementioned problems. Again, the reason for these problems is that, even if Truckenbrodt suggests a presuppositional treatment (which I reject), the meaning of the mood operators is, in the end, integrated into the semantic representation of the ordinary content. However, we can keep the syntax–semantics interface—the successful part of his theory—and enhance his approach, if we restructure the way in which sentence mood interacts with the ordinary sentential content. To properly work out how this can be done is the goal of the next section.

5.5 Use conditions and sentence mood

The basic idea of how the contribution of Truckenbrodt's (2006b) sentence mood to the overall meaning of an utterance can be fixed is already present in Portner's (2007) multidimensional approach, discussed in §5.2.3. The idea is that, instead of treating the epistemic and deontic interpretation as being presupposed and therefore, if satisfied, as part of the semantic content of the sentence, we should conceptualize sentence mood as contributing use-conditional content. More specifically, I suggest analysing sentence mood operators as UCIs that scope over the sentential content as their argument in order to express a use-conditional proposition. However, they do not contribute anything substantial to a sentence's truth-conditional content. Given the formal logic $\mathcal{L}_{\text{TU}}$ developed in Chapter 4, we can then, on the one hand, account for the restrictions of use that hold for the various sentence types. On the other hand, we are able to keep the ordinary truth-conditional content of a sentence unaffected by sentence mood, thereby ensuring that we maintain the correct truth conditions and inferential patterns.

Setting the compositional details aside for a moment, the analysis I am arguing for will deliver us the following truth and use conditions for a verb-second declarative:

(5.76) Homer is bald.

a. "Homer is bald" is true iff Homer is bald.

b. "Homer is bald" is felicitously used iff the speaker wants the hearer to know that Homer is bald.

Alternatively, we can give the two meaning dimensions for (5.76) as a set of worlds and a set of contexts respectively, as laid out in §2.1.1.

(5.77) a. $\|\text{Homer is bald}\|^{t} = \{w : \text{Homer is bald in } w\}$.

b. $\|\text{Homer is bald}\|^{u} =$
$\{c : c_S \text{ wants } c_A \text{ to know that Homer is bald in } c_W\}$

In such a multidimensional approach—in the spirit of Portner (2007)—sentence mood is separated from the propositional content of an utterance, since each is located at a different dimension of semantic meaning. This separation is of course not absolute. Sentence mood and propositional content are connected insofar as the sentence mood operators take the propositional content as an argument to yield their use-conditional content, or—to express it in slightly modified terms adopted from Potts (2005: §2.5.4)—they comment on a truth-conditional core. This separation of use-conditional content contributed by sentence mood and the usual truth-conditional content on which sentence mood comments renders Portner's and my proposal similar to Stenius's (1967) basic idea that a sentence consists of a mood and a propositional radical, as displayed in (5.2) on page 167. In light of the core idea of hybrid semantics that underlies this book, the distinction between mood and radical can be regarded as an instance of the more general distinction between the truth-conditional and use-conditional content of an utterance.

5.6 Formalization of a use-conditional approach to sentence mood

Having presented my proposal to analyse sentence mood as use-conditional content, it is time to spell this out in more detail and present the formal details of the analysis. This will prove to be straightforward, because, for the most part, I will just transfer Truckenbrodt's (2006b) approach to the hybrid semantic framework that I developed in Chapter 4.

Since in this book I am mainly interested in the semantics, it suffices just to follow Truckenbrodt's assumption that there is some morphosyntactic feature that triggers V-to-C movement on the syntactic side, and that, on the semantic side, introduces an epistemic operator. The same holds for the deontic interpretation that is not introduced by any syntactic feature, but by a general functional pragmatic rule (Truckenbrodt 2006b: 394). Accordingly, I suppose that there is a deontic attitude present in the semantic structure for every single matrix clause.

The basic idea is then to define both the deontic and epistemic mood operators as UCIs that work upon the propositional and otherwise truth-conditional content of a sentence. The output of applying them to their argument will then be a use-conditional proposition. Since, due to the root rule (5.43), a deontic attitude is present in the semantic tree for every sentence type, I will start with that, before moving on to the more restricted epistemic interpretation.

5.6.1 Deontic attitude

The first step in defining the needed deontic sentence mood predicate is easy. In the simplest case of *dass*-VL clause, there is nothing but the deontic operator that takes the propositional content expressed by the sentence as its argument to yield the use-conditional proposition that the speaker wants what is expressed by the truth-conditional content to be the case. Hence, the deontic predicate has to be a function from truth-conditional propositions into use-conditional ones. That is, the lexical entry for the deontic operator may look as follows:[13]

(5.78) *Deontic interpretation* (first version)

$$[\![\textsc{deont}_S : \langle \langle s,t \rangle, u \rangle]\!] = \lambda p. \{c : c_S \text{ wants } p \text{ to be true in } c_W\}$$

As a first approximation, this seems to be correct. The deontic operator is introduced into the semantic representation of a sentence via the root rule. However, in order for this actually to happen, the one-dimensional lexical entry in (5.78) has to be extended into a fully specified three-dimensional meaning profile, such that the proof system can make use of it. By applying the relevant LER for functional expletives to (5.78), we get the following meaning profile for the deontic operator:

(5.79) $\textsc{deont}_S : \langle \langle s,t \rangle, u \rangle \Rightarrow I_{\langle s,t \rangle} \blacklozenge \textsc{deont}_S : \langle \langle s,t \rangle, u \rangle \bullet U$

This three-dimensional meaning profile can then be applied to its argument according to the proof rule for multidimensional application. Originally defined as in (4.46) on page 128, I repeat this rule here, but use the diamond-bullet notation introduced in §4.4.3.

(5.80) *Multidimensional application*

$$\frac{\alpha_1 : \langle \sigma, \tau \rangle \blacklozenge \alpha_2 : \langle \rho, \nu \rangle \bullet \alpha_3 \qquad \beta_1 : \sigma \blacklozenge \beta_2 : \rho \bullet \beta_3}{\alpha_1(\beta_1) : \tau \blacklozenge \alpha_2(\beta_2) : \nu \bullet \alpha_3 \odot \beta_3}$$

Given this proof rule and the extended deontic operator in (5.79), a sample derivation for a *dass*-VL clause like (5.81) can be construed as in (5.82).

(5.81) Dass du nicht zu spät kommst!
that you not too late come
'Don't arrive late!' (lit.: 'That you don't arrive late!')

(5.82)

$$\cfrac{\cfrac{\textsc{deont}_S : \langle \langle s,t \rangle, u \rangle \qquad \lambda i.\neg\textbf{arrive-late}_i(\textbf{the-hearer}) : \langle s,t \rangle}{\begin{array}{c}\blacklozenge\ \textsc{deont}_S(\lambda i.\neg\textbf{arrive-late}_i(\textbf{the-hearer})) : u \\ \lambda i.\neg\textbf{arrive-late}_i(\textbf{the-hearer}) : \langle s,t \rangle\end{array}}\ \text{MA}}{\begin{array}{c}\bullet\ \textsc{deont}_S(\lambda i.\neg\textbf{arrive-late}_i(\textbf{the-hearer})) : u \\ \lambda i.\neg\textbf{arrive-late}_i(\textbf{the-hearer}) : \langle s,t \rangle\end{array}}\ \text{UE}$$

[13] In order to simplify this and the following definitions, I employ the lambda notation in the metalanguage to describe functions. It must not be confused with the lambda-operator in the logical language. I think there is no danger of this happening though.

Given this semantic derivation, the interpretation of the different meaning dimensions then yields the following interpretations for (5.81):

(5.83) a. $\|(5.81)\|^t = [\![\lambda i.\neg\textbf{arrive-late}(\textbf{the-hearer})]\!]$
$= \{w : c_A \text{ does not arrive late in } w\}$
b. $\|(5.81)\|^u = [\![\textsc{deont}_S(\lambda i.\neg\textbf{arrive-late}_i(\textbf{the-hearer}))]\!]$
$= \{c : c_S \text{ wants that } c_A \text{ does not arrive late in } c_W\}$

From these two values, we can derive the following truth and use conditions for (5.81). It is true in a world w' and a context c', if $w' \in \{w : c_A \text{ does not arrive late in } w\}$, that is, if the hearer does not arrive late. It is felicitously used in a world w' and a context c', if $c' \in \{c : c_S \text{ wants that } c_A \text{ does not arrive late in } c_W\}$: that is, if the speaker wants the hearer to not be late.[14] This looks correct. However, the definition of the deontic (5.78) is still a bit too simplistic. Recall that one of the main motivations for Truckenbrodt's (2006a,b) presuppositional treatment of the sentence mood operators is that he wants his approach to be more flexible with regard to the speech acts that can possibly be performed by an utterance of a sentence of a specific mood, instead of being restricted to single deontic and epistemic predicates like *want* and *know*. The presupposition that looks for a suitable deontic or epistemic predicate in the utterance context, which then is inserted into the semantic representation of the sentence, allows for such a flexibility in the contribution of sentence mood. That is, even if there are good reasons to abandon a presuppositional treatment, the use-conditional approach should still have a way to maintain the flexibility for which the presuppositional analysis has been designed.

So let us give ourselves that flexibility. To do this, I draw inspiration from McCready (2009: 8), who defines a function that, for every context, maps propositions onto emotional predicates in order to account for the evaluative aspect of sentence-initial, non-integrated use of *man* in English. I will define the deontic operator as such a function, but will invert the order of the first two arguments, such that the type of the operator can still be $\langle\langle s,t\rangle, u\rangle$ and the context argument can be kept out of the composition and only occur in the denotation. That is, the deontic sentence mood operator denotes a function from propositions into

[14] To be sure, the truth-conditional content given in (5.83a) plays a negligible discourse role, as the important part is played by the use conditions which state that (5.81) is felicitously uttered if the speaker wants the addressee not to arrive late. The truth-conditional content nevertheless has a function within the discourse insofar as it provides the hearer with the conditions that have to hold in order to fulfill the request.

functions from contexts into deontic predicates (on the same proposition) for the speaker of the context. In order to state the semantics of **DEONT**$_S$ properly, I will first define a corresponding function DEONT, which is a function from propositions into functions from contexts into deontic predicates for the speaker (on that proposition).

(5.84) DEONT $= \lambda p \lambda c$. there is a $d \in \mathcal{D}$ such that d is suitable for p in c and d holds for p in c_W, where $\mathcal{D}$ is a set of use-conditional deontic speaker-predicates $\mathcal{D} = \{\lambda p.c_S$ wants p to be true, $\lambda p.c_S$ wishes p to be true, $\lambda p.c_S$ orders p to be true, $\ldots\}$.

With this function in the domain of interpretation, we can now define a more flexible version of the deontic sentence mood operator than the one given in (5.78). Since the speaker dependence is now build into the denotation, the subscript for the speaker can be dropped from now on.

(5.85) *Deontic interpretation*
$[\![\textbf{DEONT}]\!] = \lambda p.\left\{c : \text{DEONT}(p)(c) \text{ in } c_W\right\} = \lambda p.\{c$: there is a $d \in \mathcal{D}$ such that d is suitable for p in c and d holds for p in $c_W\}$.

This semantics for the deontic sentence mood operator allows for more flexibility with regard to the deontic attitudes that it may express. Note that since it involves an existence condition on contextually suitable deontic predicates, the definition in (5.85) somewhat mimics the presuppositions for a deontic predicate assumed by Truckenbrodt (2006b). If this first condition is fulfilled, the sentence will be felicitous if one of these predicates holds for the propositional argument in the context.[15] Crucially, if there is no such predicate available in the context, the use conditions will not be fulfilled and thereby render an utterance of the sentence infelicitous. However, in contrast to a presuppositional treatment, this has no effect on the truth-conditional content.

This way of thinking about the deontic sentence mood operator seems to be more adequate than the simple version in (5.78) since it accounts for the varieties of interpretation that a deontic-only mood as expressed by *dass*-VL clauses may receive.

[15] I cannot say anything special regarding the question of what it actually means for a deontic predicate to be suitable for a proposition in a context and, more specifically, if this implies that there is only one predicate available. I count on an intuitive understanding of this, but obviously there is scope for interesting research into what exactly this means and how the predicates get calculated in discourse. However, this gap is not specific to my rendering, but also holds for Truckenbrodt's (2006b) presuppositional approach, as well as for McCready's (2009) mapping, which, I guess, should be a partial one.

5.6.2 Epistemic attitude

When it comes to the adaption of Truckenbrodt's (2006b) epistemic interpretation, things get rather more complicated. As we will see, the most straightforward approach does not deliver the correct results. Intuitively, the semantics one wants to assign to the epistemic sentence mood operator would be similar to the conception of the deontic operator. That is, *prima facie*, it should also be an expletive use-conditional function that takes the truth-conditional content of an utterance as its argument to yield a use-conditional proposition. Even if this is not the entire story, I nevertheless begin with this intuitive conception. In order to maintain flexibility, I define the epistemic operator by using a corresponding denotational function $\textsc{epis}$ that involves existential quantification over suitable epistemic predicates.

(5.86) *Epistemic interpretation* (first version)
$[\![\textbf{EPIS}]\!] = \lambda p.\left\{c : \textsc{epis}(p)(c) \text{ in } c_W\right\} = \lambda p.\{c : \text{there is an } e \in \mathcal{E}$ such that e is suitable for p in c and e holds for p in $c_W\}$, where $\mathcal{E}$ is a set of use-conditional epistemic predicates, $\mathcal{E} = \{c_S \text{ knows}, c_A \text{ believes}, \ldots\}$

Again, this looks correct because it builds a quasi-presuppositional condition into the felicity conditions that we get when this operator is applied to its t-propositional argument. However, the problem of this definition is that $\textbf{EPIS}$ is of type $\langle\langle s,t\rangle, u\rangle$. While intuitively correct, this causes problems, since the deontic operator $\textbf{DEONT}$ is of type $\langle\langle s,t\rangle, u\rangle$ as well. If the epistemic sentence mood operator really had the same type, the derivation of a simple V2-declarative would fail to yield the desired deontic/epistemic interpretation. There is only one way to construe a valid derivation involving these two type $\langle\langle s,t\rangle, u\rangle$ operators, which is depicted in (5.87). For convenience, I abstract away from a concrete example and use $\textbf{prop} : \langle s,t\rangle$ as the representation of a sentence's t-propositional content.

(5.87)
$$\dfrac{\dfrac{\textbf{DEONT} : \langle\langle s,t\rangle, u\rangle \qquad \dfrac{\dfrac{\textbf{EPIS} : \langle\langle s,t\rangle, u\rangle \qquad \textbf{prop} : \langle s,t\rangle}{\textbf{prop} : \langle s,t\rangle \blacklozenge \textbf{EPIS}(\textbf{prop}) : u}\,\text{MA}}{\textbf{prop} : \langle s,t\rangle \bullet \textbf{EPIS}(\textbf{prop}) : u}\,\text{UE}}{\textbf{prop} : \langle s,t\rangle \blacklozenge \textbf{DEONT}(\textbf{prop}) : u \bullet \textbf{EPIS}(\textbf{prop}) : u}\,\text{MA}}{\textbf{prop} : \langle s,t\rangle \bullet \textbf{EPIS}(\textbf{prop}) \odot \textbf{DEONT}(\textbf{prop}) : u}\,\text{UE}$$

From this proof, we can extract the schematic t- and u-content for a simple V2-declarative that expresses the propositional content $\textsc{prop}$. Let us start with the former, as it proves to be unproblematic.

(5.88) $\|\textsc{v2-decl}\|^t$
$= [\![\mathbf{prop}]\!]$
$= \{w : \textsc{prop}(w) = 1\}$

Apparently, the truth-conditional content PROP is correctly calculated by the derivation in (5.87). A V2-declarative sentence is true in a world if that world is in the set of worlds for which the propositional contention expressed by the sentence is true. Now, consider the *u*-content as derived by (5.87):

(5.89) * $\|\textsc{v2-decl}\|^u$ (*wrong outcome*)
$= [\![\textbf{EPIS}(\mathbf{prop}) \odot \textbf{DEONT}(\mathbf{prop}) : u]\!]$
$= \{c :$ there is a $d \in \mathcal{D}$ such that d is suitable for PROP in c and d holds for PROP in $c_W\} \cap \{c :$ there is an $e \in \mathcal{E}$ such that e is suitable for PROP in c and e holds for p in $c_W\}$
$= \{c :$ there is a $d \in \mathcal{D}$ such that d is suitable for PROP in c and d holds for PROP in c_W and there is an $e \in \mathcal{E}$ such that e is suitable for PROP in c and e holds for p in $c_W\}$

These are not the deontic/epistemic use conditions we are after. As stated in (5.89), the utterance of a V2-declarative would be felicitous if there were both a contextually suitable deontic and epistemic predicate such that both independently hold for the utterance's propositional content in the context. That is, assuming that the accessible predicates are c_S *wants* and c_A *believes*, an utterance of, say, *Pete snores* would be felicitous if the speaker wants Peter to snore and the hearer believes that Peter snores. This is obviously nonsense, and not the mood of a V2-declarative.

The problem, clearly, is that in the derivation (5.87) both sentence mood operators apply independently to the sentence's propositional content and the resulting *u*-propositions are intersected. Since both sentence mood operators are defined as type $\langle\langle s, t\rangle, u\rangle$ expressions, this is the only way to construct a proof. What we want instead is for the epistemic predicate to apply to the propositional argument and the resulting expression then to constitute the argument for the deontic operator to yield a deontic/epistemic embedding of the propositional content, just as in Truckenbrodt (2006b). To overcome these problems, we have to reformulate the epistemic sentence mood operator. First, I will redefine the operator **EPIS** such that it is not a functional expletive UCI, but rather an ordinary propositional attitude predicate that comes with a built-in subject and therefore behaves like a propositional modifier of type $\langle\langle\langle s, t\rangle, u\rangle, \langle\langle s, t\rangle, u\rangle\rangle$. The new definition then reads as follows, where the references to context arguments are substituted by corresponding world arguments.

(5.90) $[\![\textsc{epis}]\!] = \lambda p.\left\{w : \textsc{epis}(p)(w) \text{ in } w\right\} = \lambda p.\{c : \text{there is an } e \in \mathcal{E}$ such that e is suitable for p in w and e holds for p in $w\}$

Crucially, **EPIS** is not the real epistemic sentence mood operator any more. Instead, the expression that is introduced as a mood operator by the [$\pm$*wh*]-features is a new complex expression, which I will notate as **E**, which is a use-conditional modifier on UCIs of type $\langle\langle s,t\rangle, u\rangle$:

(5.91) *Epistemic interpretation*
$\mathbf{E} = \lambda D\lambda p.D(\textbf{EPIS}(p)) : \langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle$

This seems to be something we can work with. Let me illustrate how this new sentence mood operator helps to derive the correct truth and use conditions for an arbitrary V2-declarative with propositional content PROP. First, the new mood operator must be extended into a three-dimensional meaning profile. Since it is now a use-conditional modifier, the LER for generalized modifiers, defined in (4.67) (p. 142), is the relevant lexical extension rule.

(5.92) $\mathbf{E} : \langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle \Rightarrow I_{\langle\langle s,t\rangle,\langle s,t\rangle\rangle} \blacklozenge \mathbf{E} :$
$\langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle \bullet U$

We start with building the complex deontic/epistemic sentence mood operator by applying the expression defined in (5.91) to the deontic operator. The result of this use-conditional modification delivers us a deontic/epistemic predicate which then can embed the propositional content. In the last step of the derivation, the resulting u-proposition in the s-dimension is stored into the u-dimension by the rule for use-conditional elimination:

(5.93)
$$\cfrac{\cfrac{\cfrac{\textbf{DEONT} : \langle\langle s,t\rangle, u\rangle \qquad \mathbf{E} : \langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle}{\mathbf{E}(\textbf{DEONT}) : \langle\langle s,t\rangle, u\rangle}\text{MA} \qquad \textbf{prop} : \langle s,t\rangle}{\textbf{prop} : \langle s,t\rangle \blacklozenge \mathbf{E}(\textbf{DEONT})(\textbf{prop}) : u}\text{MA}}{\textbf{prop} : \langle s,t\rangle \bullet \mathbf{E}(\textbf{DEONT})(\textbf{prop}) : u}\text{UE}$$

From this proof, we get the truth and use conditions by the corresponding interpretation rules, as always. Again, we start with the t-content:

(5.94)
$$\begin{aligned} &\|\textsc{v2-decl}\|^t \\ &= [\![\textbf{prop}]\!] \\ &= \{w : \textsc{prop}(w) = 1 \text{ in } w\} \end{aligned}$$

This is the same content as that in (5.88), which was delivered by means of the old epistemic operator and, as expected, still gets the truth conditions for a declarative right. In order to check whether we have made progress regarding the u-content, first consider the following reduction licensed by the definition of the E operator and standard λ-conversions (more specially, β-reductions):

(5.95)
$$\begin{aligned} & \mathrm{E}(\textsc{deont})(\mathbf{prop}) && \mid \text{by definition of E} \\ \equiv\ & \lambda D \lambda p. D(\textsc{epis}(p))(\textsc{deont})(\mathbf{prop}) && \mid \text{by } \lambda\text{-conversion} \\ \equiv\ & \lambda p. \textsc{deont}(\textsc{epis}(p))(\mathbf{prop}) && \mid \text{by } \lambda\text{-conversion} \\ \equiv\ & \textsc{deont}(\textsc{epis}(\mathbf{prop})) \end{aligned}$$

To arrive at a declarative's use-conditional content, we now have to interpret this logical expression:

(5.96)
$$\begin{aligned} & \| \text{V2-DECL} \|^u \\ =\ & [\![\textsc{deont}(\textsc{epis}(\mathbf{prop}))]\!] \\ =\ & \{c : \text{there is a } d \in \mathcal{D} \text{ such that } d \text{ is suitable for } p \text{ in } c \text{ and} \\ & d(p)(c_W) = 1 \text{ and } p = \{w : \text{there is an } e \in \mathcal{E} \text{ such that } e \text{ is} \\ & \text{suitable for } p \text{ in } w \text{ and } e(p)(w) = 1\}\} \end{aligned}$$

In contrast to the failed attempt in (5.89), this seems to get the use-conditions for a standard declarative right. A declarative will be true in a context where there is an accessible deontic and an accessible epistemic predicate such that the deontic predicate holds, in the context, for the complex proposition that is gained when the epistemic predicate is applied to the propositional content. If the accessible predicates are, for instance, again c_S *wants* and c_A *believes*, then a declarative like *Peter snores* is felicitous in a context, if the speaker wants the hearer to believe that Peter snores. This is as desired. Taken together with the truth conditions given in (5.94), we arrive at the following general picture: a declarative is true, if the t-proposition it expresses holds, and it is felicitously uttered, if the speaker has a contextually specified deontic/epistemic attitude towards that proposition.

5.6.3 Hearer knowledge

The one sentence mood operator that remains to be transferred from Truckenbrodt's (2006b) account to the framework of $\mathcal{L}_{\text{TU}}$ is the second epistemic interpretation that is triggered by the [–*wh*]-feature that distinguishes V2-interrogatives from their VL-counterparts. It is on account of the presence of this additional epistemic operator, which is interpreted as hearer knowledge, that V2-interrogatives are infelicitous in contexts in which it is known that the hearer does not know an answer to the question, as was illustrated by the Cuban cigar scenario given in (5.36) on page 186. To implement this additional hearer knowledge condition into the $\mathcal{L}_{\text{TU}}$ setting, I simply define an additional operator, HKNOW, which is a functional expletive UCI that takes a propositional argument to yield a u-proposition:

(5.97) *Hearer knowledge*
$$\lambda p.\textbf{HKNOW}(p) : \langle\langle s,t\rangle, u\rangle$$

As a functional expletive UCI, it can be extended into a three-dimensional expression according to LER (4.61):

(5.98)
$$\lambda p.\textbf{HKNOW}(p) : \langle\langle s,t\rangle, u\rangle \Rightarrow$$
$$I_{\langle\langle s,t\rangle,u\rangle} \blacklozenge \lambda p.\textbf{HKNOW}(p) : \langle\langle s,t\rangle, u\rangle \bullet U$$

The lexical semantics of this operator consists in a use-conditional attribution of knowledge of the propositional content to hearer:

(5.99)
$$[\![\textbf{HKNOW}]\!] = \lambda p. \left\{c : c_A \text{ knows whether } p \text{ in } c_W\right\}$$

Crucially, in contrast to the stacking of the deontic and epistemic operator, the hearer knowledge operator is "free-floating" so to speak, as it expresses an independent use condition that is not embedded under the deontic context, but conjoined with the deontic/epistemic interpretation at the end of derivation. This is illustrated by the following derivation for a *yes/no*-V2-interrogative:[16]

(5.100)
$$\dfrac{\dfrac{\textsc{deont} : \langle\langle s,t\rangle,u\rangle \quad \mathrm{E} : \langle\langle\langle s,t\rangle,u\rangle,\langle\langle s,t\rangle,u\rangle\rangle}{\mathrm{E}(\textsc{deont}) : \langle\langle s,t\rangle,u\rangle}\,\text{MA} \qquad \dfrac{\dfrac{\textsc{hknow} : \langle\langle s,t\rangle,u\rangle \quad \textbf{prop} : \langle s,t\rangle}{\begin{array}{c}\blacklozenge\ \textsc{hknow}(\textbf{prop}) : u\\ \textbf{prop} : \langle s,t\rangle\end{array}}\,\text{MA}}{\begin{array}{c}\bullet\ \textsc{hknow}(\textbf{prop}) : u\\ \textbf{prop} : \langle s,t\rangle\end{array}}\,\text{UE}}{\dfrac{\begin{array}{c}\bullet\ \textsc{hknow}(\textbf{prop}) : u\\ \blacklozenge\ \mathrm{E}(\textsc{deont})(\textbf{prop}) : u\\ \textbf{prop} : \langle s,t\rangle\end{array}}{\begin{array}{c}\bullet\ \textsc{hknow}(\textbf{prop}) \odot \mathrm{E}(\textsc{deont})(\textbf{prop}) : u\\ \textbf{prop} : \langle s,t\rangle\end{array}}\,\text{UE}}\,\text{MA}$$

[16] Note that Truckenbrodt (2006b) uses a semantics for questions according to which *yes/no*-interrogatives denote their true answer (Groenendijk and Stokhof 1982; Karttunen 1977). If one wants to employ a different question semantics, one must tweak the system a little bit in order for the composition to work.

This proof then gives us use conditions that are a complex combination of a deontic/epistemic interpretation together with an attribution of hearer knowledge. Skipping the formal details, an utterance of a *yes/no*-interrogative is felicitous if there is an accessible deontic/epistemic context available that embeds the sentential content which actually holds in the utterance context: for instance, if the speaker wants to know whether Peter snores, and—this is the contribution of **HKNOW**—if the addressee knows whether Peter snores. Crucially, the last part of these use conditions is absent from the use conditions for VL-interrogatives, so that they can be felicitous in contexts like the Cuban cigar scenario in which the hearer does not know the answer to the question.

With the hearer knowledge operator, I have now transferred all of Truckenbrodt's (2006b) account into the hybrid semantic framework of $\mathcal{L}_{\mathrm{TU}}$, which, thereby, finishes my development of a unified approach to sentence mood in German.

5.7 Chapter summary

In this chapter, I have shown how the framework of hybrid semantics and, more specifically, its formal implementation in the logic $\mathcal{L}_{\mathrm{TU}}$, can be fruitfully put to use in order to account for the notion of sentence mood, which, despite having a long-standing philosophical tradition, has not been given much attention. At least, it is safe to say that there is nothing like a standard theory of sentential mood, in contrast to, say, sentential content and illocutionary force. The reason for this is, it seems to me, that most existing approaches are highly selective, as they deal only with one kind of sentence mood (relevant to the phenomenon to be addressed) and do not aim for an overall theory of sentence mood, not even for a particular language. The few existing approaches with a more general reach fall into three categories, two of which are, as I have argued, unsatisfactory, as they are either based on misleading conceptions that lead to the assignment of unintuitive truth conditions (the integrative approaches), or cannot account for the complex interaction between syntactic structure and semantic mood that goes beyond the main sentence types (the implicit approaches).

As I have tried to illustrate, all these problems can be overcome if we take a multidimensional approach, as sketched by Portner (2007), and develop a semantics of sentence mood that is framed in use-conditional terms and spells out the interaction between mood and radical in a hybrid semantic set-up. In order to work out such an approach that also does justice to the syntactic foundation of sentence mood, I took Truckenbrodt's (2006b) approach—which actually belongs to the integrative camp—and, after a detailed presentation and review as a starting point, transformed his sentence mood operator into different kinds of UCIs in order to arrive at a compositional multidimensional semantics for sentence mood. However, it should be noted that the general idea of a use-conditional approach to sentence mood does not depend on Truckenbrodt's approach.

I should also note that the approach presented in this chapter answers a question that possibly arose in the previous chapter, namely whether the assumption that all expressions convey both *t*- and *u*-content (as required by the derivational system of $\mathcal{L}_{\text{TU}}$) is sufficiently motivated or whether it would result in an abundance of dummy use-conditional content. While the latter may be true for lexical expressions, once they are extended into three-dimensional expressions by appropriate LERs, the presence of sentence mood in root clauses causes all sentences to have at least the use conditions expressed by their sentence mood operators.

Sentence mood—and the analysis developed in this chapter—will also play an important role in the next chapter, in which I will set out a hybrid semantic approach to German modal particles. As we will see, these particles interact in interesting ways with sentence mood, and the approach presented here will prove to be useful in order to account for these interactions.

6

Modal particles

6.1 Introduction

German modal particles form a small, more or less closed set of specific lexical items. Here are the words which Hartmann (1998: 660) assigns to the class of modal particles ("MPs" henceforth):

(6.1) *modal particles:* aber, auch, bloß, denn, doch, eigentlich, eben, etwa, einfach, erst, halt, ja, nun, mal, nur, schon, vielleicht, ruhig, wohl

In English, modal particles are often referred to by the term *discourse particles* (cf. Grosz 2005; Kratzer 2004; M. Zimmermann 2004a), a term that seems to be more adequate since many modal particles are not *prima facie* related to any standard variety of modality. However, since *discourse particle* is often used as a broader term to refer to other discourse-structuring particles as well (like so-called discourse markers), I will continue to use *modal particle* for the expressions at issue, without however intending to commit myself to the notion that they are *modal* in a strict sense.

Besides this terminological issue, a notorious problem regarding MPs is that it is not quite clear whether they constitute a genuine "part of speech" or not. The main reason for this is that almost every MP has a corresponding expression which clearly belongs to a different part of speech, such as adverbs, focus particles, or other discourse markers (cf. Hartmann 1998: 660).

(6.2) a. *adverbs:* etwa, doch, vielleicht, einfach, ruhig, mal, nun, eben, schon, eigentlich
b. *focus particles:* erst, auch, schon, nur, bloß
c. *conjunctions:* aber, denn
d. *other discourse markers:* ja, doch

Due to this overlap, there is no clear agreement among linguists working on modal particles whether one should assume that modal particles constitute a distinct part of speech on a par with conjunctions or adverbs, or not, if this question is indeed addressed at all. For instance, Meibauer (1994), Ormelius-Sandblom(1997), and Autenrieth (2002) argue for a distinct part of speech, whereas Altmann (1979), Thurmair (1989), and Kwon (2005) speak of a syntactic "modal particle function" that expressions of other parts of speech can have, instead of treating MPs as genuine part of speech. Even though I am not going to make a direct contribution to the debate concerning the status of MPs, my argument can directly profit from it, because the debate about their status has had the convenient fallout that the syntactic and semantic facts about MPs are very well documented. In the following section, I will review their properties, which will be important later when I apply the tool of $\mathcal{L}_{\mathrm{TU}}$ to an analysis of MPs, in §6.3.

One of the main motivations for using MPs as a case study for the application of $\mathcal{L}_{\mathrm{TU}}$ is that they show interesting interaction not only with the rest of the sentence's content but also with the sentence mood operators discussed in the previous chapter. My deployment of $\mathcal{L}_{\mathrm{TU}}$ in the analysis sentence mood demonstrated the general principle of hybrid semantics, of employing dimensions of meaning. Its actual implementation by $\mathcal{L}_{\mathrm{TU}}$ was not crucial in that respect, however, because there was hardly any interesting interaction between the sentence mood operators and the rest of the sentence's content (besides the former taking the later as their argument, of course). With MPs, things are different. Precisely because they show such restricted and particular semantic and syntactic behavior, they constitute a perfect second case study to demonstrate that the frameworks of hybrid semantics in general, and $\mathcal{L}_{\mathrm{TU}}$ in particular, are capable of dealing as well with complicated linguistic phenomena. This becomes even more evident, as MPs interact in interesting ways with sentence mood. Therefore, as an extra test case, I will put the two separate analyses together in §6.5. Taken together, they will provide new insights into the interdependencies between modal particles and sentence mood.

6.2 Properties of modal particles

The list in (6.3) summarizes the properties commonly ascribed to modal particles (cf., e.g., Thurmair 1989: 37; Meibauer 1994: 29; Autenrieth 2002: 27):

(6.3)
a. MPs are not inflectable.
b. MPs cannot receive main stress.
c. MPs occur only in the so-called middle field (Germ. *Mittelfeld*).
d. MPs commonly occur before the rheme.
e. MPs can be combined with each other.
f. MPs cannot be coordinated.
g. MPs cannot be expanded.
h. MPs are optional.
i. MPs cannot be negated.
j. MPs cannot be questioned.
k. MPs have sentential scope.
l. MPs are sentence-mood-dependent.
m. MPs modify the illocutionary type.

I have tried to arrange the properties systematically, ranging from grammatical features, that is morphological and syntactic ones, to more or less semantic/pragmatic properties, although this should not be taken as an empirical claim, since such distinctions are by no means trivial and depend on one's theoretical assumptions. I will not say much about the status of the properties when I discuss them in the following. This does not mean that I will not take a stand regarding these issues, which, I hope, will become clear when I develop the analysis in the course of this chapter. For now, I will consider the majority of features in (6.3) one by one in more detail. I will start with the more grammatical features in §6.2.1, before having a closer look at the semantic details in §6.2.2.

6.2.1 The syntax of modal particles

The syntactic behavior of modal particles is very well studied from a descriptive point of view. However, when it comes to drawing theoretical conclusions from the observed data, many questions still remain open. Two main subjects of dispute are (i) the above-mentioned question of whether modal particles constitute a distinct part of speech, and (ii) whether they are heads of phrases. I divide the syntactic features from (6.3) into two groups: distributional restrictions and projectional behavior. Furthermore, we can distinguish two kinds of distributional restriction. First, MPs are highly restricted with regard to the position in which they can occur within a sentence. Second, almost every MP is fixed to a certain set of sentence types in which it can occur. I will call the former kind *intrasentential restrictions*, while using *intersentential* *restrictions* to refer to the latter. As the intersentential restrictions refer to the semantic notion of sentence mood, I will discuss these in more detail in §6.2.3.1.

6.2.1.1 Intrasentential distribution The intrasentential restrictions that affect the distribution of MPs within a sentence are manifold, although only two of them seem to be hard restrictions. The first is that modal particles cannot precede the finite verb in German verb-second (V2) sentences: that is, they cannot occupy the *Vorfeld* ('prefield', cf. Höhle 1986).

(6.4) a. David ist **ja** ein Zombie.
David is MP *a zombie*
'David is a zombie (as you know).'
b. ***Ja** ist David ein Zombie.

In more theoretical terms, the prefield corresponds to the CP^{spec} position, so modal particles cannot occupy the specifier position of the functional C-projection. There may be both syntactic or semantic reasons for this prohibition. A syntactic explanation could be connected with the questionable syntactic status of MPs. There is no consensus in the literature as to whether MPs are better analysed as syntactic (non-projecting) heads or maximal projections (phrases).[1] If MPs are heads, then their failure to occur in the prefield directly follows from the fact that CP^{spec} is not a position for head movement. I will, however, provide a semantic explanation for this restriction later, in §6.4.5 (pp. 252–4). To give a sneak preview, I will refer to the fact that it is not arbitrary which expression moves to CP^{spec} in a V2-sentence, as there is a set of conditions licensing this movement—conditions that cannot be fulfilled by MPs for semantic reasons.

The requirement that MPs have to occur in the middle field is an important feature not only because it may reveal some interesting insights into the semantics of MPs, but also since it is the only restriction that holds only for MPs and not for adverbs, conjunctions, or many other particles.

(6.5) **Glücklicherweise** ist David ein Zombie.
luckily is David a zombie
'Luckily, David is a zombie.'

[1] For discussion, see Bayer and Obenauer (2011); Coniglio (2011); Grosz (2005); Ormelius-Sandblom (1997); Struckmeier (2013).

The ability to occur in the prefield hence constitutes a good test for distinguishing between MPs and other uninflected parts of speech.

6.2.1.2 Projectional behavior There are three features that are connected to the projectional status of modal particles, at least at first sight. Most importantly, modal particles cannot be extended—that is, they do not project in the sense of X-bar theory:

(6.6) *David ist **sehr ja** ein Zombie.
David is very MP *a zombie*
*'David is very *ja* a zombie.'

To account for this inability, it has been suggested (Coniglio 2011) that MPs are degenerate or *weak* adverbials, in analogy to so-called weak pronouns (Cardinaletti and Starke 1999). Even if this seems like an ad hoc solution, it at least takes seriously the problems of both a head-analysis and an analysis as maximal projections, as both make wrong empirical predictions. However, I do not actually take a stand in this discussion here, as both analyses are compatible with the semantic approach I will develop. In fact, analysing MPs in hybrid semantics will lift some of the burden from the syntactic analysis of MPs, since, as I will show in §6.4, it is able to explain some of their syntactic properties on purely semantic grounds.

A second property of modal particles that is connected to their projectional status is that they cannot be coordinated (6.3f), again in contrast to adverbs, which can (just as all other ordinary XPs can).

(6.7) *Peter hat **ja** und/oder **doch** sein Exam bestanden.
Peter has MP *and/or* MP *his exam passed*
*'Peter has *ja* and/or *doch* passed his exam.'
(Autenrieth 2002: 31)

(6.8) Peter hat **leider** oder **glücklicherweise** sein Exam
Peter has unfortunately or luckily his exam
bestanden — wie man's nimmt.
passed how you it take
'Unfortunately or luckily, Peter has passed his exam—depending how you look at it.' (Autenrieth 2002: 31)

Regarding this restriction I will too argue for a purely semantic explanation once the semantic analysis is in place.

6.2.2 *The semantics of modal particles*

The semantics of modal particles is not only very special, but can be presumed to distinguish them from almost all other expressions found in German. For sure, all their semantic features are related to each other, as they come down to their non-truth-conditionality. The semantic data presented here will provide the basis on which to build my formal account later on.

6.2.2.1 Non-truth-conditionality The most distinguishing feature of MPs is that they do not contribute to the truth-conditional content of an utterance:

(6.9) Hein ist **ja/wohl/doch** auf See.
Hein is MP *at sea*
'Hein is *ja/wohl/doch* at sea.' (M. Zimmermann 2004b: 543)

Whatever the concrete contribution of the MPs in (6.9) is, the whole utterance is true if Hein is at sea. This behavior clearly tells them apart from other non-modal particles which contribute to the truth-conditional content of an utterance:

(6.10) Hein kommt **vielleicht** nachher kurz vorbei.
Hein comes perhaps later shortly over
'Perhaps Hein will drop by later on.'

(6.11) Hein verehrt **nur** Wittgenstein.
Hein admires only Wittgenstein
'Hein only admires Wittgenstein.'

In (6.10) the adverb *vielleicht* 'perhaps' expresses the speaker's attitude towards the likeliness of Hein dropping in. It contributes to the truth-conditional content ("TC" henceforth), as it can be true if it turns out that Hein does not drop in. Similarily, if we omit the focus particle *nur* from (6.11), the resulting sentence would be true even if Hein were "polyphilosophile" as long as he admires Wittgenstein—while for (6.11) to be true, Hein has to admire no other philosopher besides him. Hence, non-truth-conditionality seems to be a good criterion for distinguishing MPs from other particles.

6.2.2.2 Negation and scope Modal particles cannot be negated (6.3i). There is no reading in which a negation takes scope over an MP:

(6.12) Hein ist **ja** nicht zuhause.
Hein is MP *not at home*
'Hein is *ja* not at home.'
a. **ja** [¬[Hein is at home]]
b. *¬[**ja** [Hein is at home]]

Furthermore, MPs cannot even be within the scope of narrow constituent negation:

(6.13) *Hein ist nicht **ja** auf See.
Hein is not MP *at sea*
*¬[**ja**][Hein is at home]]

Thus, MPs cannot be negated by any ordinary negation.[2] This contrasts with both adverbs and focus particles:

(6.14) a. Hein ist nicht **allein** auf See.
Hein is not alone at see
'Hein is not alone at sea.'

b. Hein verehrt nicht **nur** Wittgenstein.
Hein admires not only Wittgenstein
'Hein only admires Wittgenstein.'

There is more than one possible explanation available for this behavior. On the one hand, there could be syntactic reasons for this restriction. For instance, if MPs are not constituents, constituent negation cannot apply to them in the first place (Meibauer 1994: 30). However, I will follow the agenda already sketched and look for a semantic explanation based on their non-truth-conditional semantics.

That MPs cannot be negated is a special instance of the more general pattern that they never appear in the scope of other operators. This holds for quantifiers, question-forming, conditionalization, and even modals:

(6.15) Alle Linguisten sollten **ja** Grice gelesen haben.
all linguistis should MP *Grice read have*
'All linguists *ja* should have read Grice.'
a. **ja**[∀ [linguists should have read Grice]]
b. *∀[**ja** [linguists should have read Grice]]

[2] For a detailed presentation of the data concerning MPs and negation, cf. e.g. Thurmair (1989): §1.4. As always, metalinguistic negation (Horn 1989) may be an exception (Autenrieth 2002: 23).

(6.16) Ist Hein **wohl** auf See?
is Hein MP *at sea*
'Is Hein *wohl* at sea?'
a. **wohl** [?[Hein is at sea]]
b. * ?[**wohl** [Hein is at sea]]

(6.17) Wenn Hein auf See ist, dann kann er **ja** nicht zu
If Hein at sea is then can he MP *not to*
unserer Party kommen.
our party come
'If Hein is at sea, then he *ja* cannot come to our party.'
a. **ja** [Hein is at sea → Hein cannot come to our party]
b. *Hein is at sea → **ja** [Hein cannot come to our party]

(6.18) David ist vielleicht **ja** ein zombie.
David is possibly MP *a zombie*
'Possibly, David is *ja* a zombie.'
a. **ja** [◇[David is a zombie]]
b. *◇[**ja** [David is a zombie]]

Due to this behavior, it is commonly assumed that MPs always have sentential scope (6.3k), but following Potts (2005: 42), I prefer to speak of them as being *scopeless*, as they do not interact with any operator that takes sentential scope.

Two further points are directly connected to the scopelessness of modal particles. First, MPs cannot be questioned, which follows directly from being scopeless, as they cannot be in the scope of a question operator. Second, MPs cannot be focused. By "cannot be focused", I do not mean that they cannot be "focused" phonologically, i.e. receive main stress, since at least some can be stressed (e.g. *ja*, *bloß*, *denn*, *wohl*, see Meibauer 1994). What I mean is that they cannot be interpreted semantically as being focused—that is, they cannot evoke alternatives or structured propositions (Kratzer 1991; von Stechow 1991). For instance, focus particles like *nur* 'only' cannot associate with modal particles. Although it is quite clear what a sentence like (6.19) is supposed to mean, such a reading is not available.

(6.19) *David ist nur **wohl** ein Zombie.
David is only MP *a zombie*
*'David is only *wohl* a zombie.'

All these facts suggest that MPs behave very differently from ordinary semantic expressions. Later in this chapter, I will examine how different approaches to the meaning of MPs can account for this behavior. Before that, however, I will first review their close relation to sentence mood.

6.2.3 Modal particles and sentence mood

While the properties discussed in the last sections apply to modal particles in general, the ones I now turn to are specific for each MP. However, if formulated more abstractly, they can be considered as general properties. Almost every MP is restricted to a certain set of sentence types, and interacts with the sentence mood of the sentences in which it occurs. This is interconnected. Since sentence mood is calculated from sentence types, we can thus say that MPs are restricted to specific kinds of sentence mood, which in turn imposes constraints on the possible syntactic sentence types in which an MP can occur.

6.2.3.1 Intersentential distribution For the discussion of the intersentential distribution of MPs, I restrict myself to *ja*, *denn*, and *wohl*. I can thus keep the discussion concise but comprehensive enough to provide an empirical basis for the remainder of this chapter. These three MPs are among the best-described particles, both syntactically and semantically, and are very different in their intersentential distribution. I will also focus on just the three major sentence types—declaratives, interrogatives, imperatives—as they are directly accounted for by formal apparatus developed in the previous chapter.[3]

In the following discussion, I will look in particular at the question of what kind the constraints on intersentential distributions are, i.e., whether they are syntactic, semantic, or pragmatic restrictions.

The distribution of *ja* The modal particle *ja* is mainly restricted to verb-second (V2) declarative sentences, that is sentences with the main verb in C° that are not marked as [+*wh*] and that have an element in the specifier position of CP:

(6.20) Anna fährt **ja** morgen nach Hause.
Anna drives MP *tomorrow to home*
'Anna drives *ja* home tomorrow.'

[3] That is, I will not deal with exclamatives (Castroviejo Miró 2006; d'Avis 2001; Rett 2008; Rosengren 1992; Zanuttini and Portner 2000, 2003) and optatives (Grosz 2012; Rosengren 1993) in this book.

In almost every other sentence type, *ja* is illicit. First of all, this strictly holds for interrogative sentences, regardless of whether it is a *yes/no-* (6.21a) or a *wh*-question (6.21b).

(6.21) a. *Ist Peter **ja** gekommen?
is Peter MP *come*
*'Has Peter *ja* come?' (M. Zimmermann 2012: 2025)

b. *Wer kommt **ja** nach Tübingen?
who comes MP *to Tübingen*
*'Who is *ja* coming to Tübingen?' (Meibauer 1994: 134)

Similarly, *ja* is prohibited in imperatives (6.22a). The same holds for root *dass*-clauses, which also have an imperative-like mood, as we saw in the previous chapter (cf. also Altmann 1993).[4]

(6.22) a. *Geh **ja** nicht zum Museumsball!
go MP *not to-the museum-ball*
*'Do not *ja* go to the museum ball!' (Meibauer 1994: 134)

b. *Dass du **ja** nicht dein ganzes Geld ausgibst!
that you MP *not your entire money spend*
*'Do not spend all your money!'
(lit.: 'That you do not spend all your money!')

Thus, regarding the three main sentence types—declaratives, interrogatives, and imperatives—*ja* can occur in the former but is not licensed in the latter two (cf. Thurmair 1989: 9; Kwon 2005: 40):

(6.23)

sentence type	ja
declaratives	✓
interrogatives	✗
imperatives	✗

Given these restrictions, we can ask where they stem from. A first possibility is purely syntactic: for instance, that *ja* is somehow incompatible with the [+*wh*]-feature of interrogatives or the absence of any [*wh*]-feature in imperatives. The other position would be that the restrictions

[4] Note that the stressed variant of *ja* can occur in such sentences. Actually, the distribution of *JA* is quite different from that of unstressed *ja*; cf. Kwon (2005: 183) and Meibauer (1994: §5.2). I will not say much about stressed MPs in this book, but I suggested in Gutzmann (2010b) that stressed MPs are not really stressed themselves but merely carry the stress for the realization of so-called verum focus. See also Blühdorn (2012); Egg and Zimmermann (2012); Sudhoff (2012) for similar ideas.

derive from the meaning of *ja*, either from its semantics or from mere pragmatic considerations.

Some evidence against purely syntactic constraints is that in subordinated clauses, the acceptability of *ja* depends on how the clause is embedded. For instance, compare (6.24a) with (6.24b), which differ only regarding the presence of negation *nicht* 'not' in the matrix clause:

(6.24) a. Zum zweiten **glaube** ich, daß wir **ja** noch einige
to-the second believe I that we MP *still some*
Hürden bezüglich Herrn H. zu nehmen haben.
hurdles regarding Mr H. to take have
'Secondly, I believe that we *ja* still have to take some hurdles regarding Mr H.' (Kwon 2005: 43)

b. *Zum zweiten **glaube** ich **nicht**, daß wir **ja** noch einige Hürden bezüglich Herrn H. zu nehmen haben.
*'Secondly, I do not believe that we *ja* still have to take some hurdles regarding Mr H.'

Although the embedded sentence containing *ja* is identical, only (6.24a) is acceptable. It is implausible to assume that negation in the matrix clause changes the syntactic status of the embedded clause. Furthermore, it is not the negation itself that rules out *ja* in (6.24b), since substituting *bezweifle ich* 'I doubt' for *glaube ich* 'I believe' reverses the judgments:

(6.25) a. *Zum zweiten **bezweifle** ich, daß wir **ja** noch einige Hürden bezüglich Herrn H. zu nehmen haben.
*'Secondly, I doubt that we *ja* still have to take some hurdles regarding Mr H.'

b. Zum zweiten **bezweifle** ich **nicht**, daß wir **ja** noch einige Hürden bezüglich Herrn H. zu nehmen haben.
'Secondly, I do not doubt that we *ja* still have to take some hurdles regarding Mr H.'

The distribution of *ja* thus does not seem to depend on syntax alone. Instead, as I will argue in more detail in §6.5.2, the restrictions are always connected to the meaning of MPs. But since sentence mood is calculated from the syntax of a sentence, there is a connection between syntax and the licensing conditions for *ja*, even if it is merely indirect.

If it is the meaning of *ja* that restricts it to particular sentence types, the question remains whether this is due to the semantics of *ja* or to pragmatic effects. Evidence for semantic reasons is that the restriction to declaratives cannot be circumvented by pragmatic factors. This can be illustrated with so-called check-questions, that have the form of simple declarative clauses but are used as questions, often but not always with rising intonation (Gunlogson 2001). If the prohibition of *ja* in interrogative sentences were caused by a pragmatic incompatibility between *ja* and asking a question, one would expect *ja* to be illicit in raising declaratives. However, *ja* is perfectly acceptable in check-questions:

(6.26) Du kommst **ja** morgen um zehn?
you come MP *tomorrow at ten*
'You are *ja* coming tomorrow at ten?'

This argument also holds the other way around. In rhetorical questions that are used to make assertions (Meibauer 1986), the use of *ja* is not allowed:

(6.27) *Wer will das Spiel **ja** nicht gewinnen?
Who want the game MP *not win*
*'Who does not want *ja* to win the game?'

The restrictions hence do not derive from pragmatic factors. Since the acceptability of *ja* in such examples also does not vary with the performed speech act, the semantic notion of sentence mood seems to be the level on which the constraints should be formulated.

The distribution of *denn* In many respects, *denn* seems to be the interrogative counterpart of *ja*. While, as we have seen, *ja* is restricted to declarative sentences, *denn* occurs only in interrogative sentences, both in *yes/no*-questions and in *wh*-questions:

(6.28) a. Hast du **denn** ein Auto?
have you MP *a car*
'Do you *denn* have a car?' (Helbig 1988: 106)

b. Warum lachst du **denn**?
why laugh you MP
'Why are you laughing *denn*?' (Kwon 2005: 302)

In other sentence types, *denn* is not possible: neither in declaratives, nor in imperatives or *dass*-VL clauses, as the following examples illustrate:

(6.29) *Peter ist **denn** ein Philosoph.
Peter is MP *a philosopher*
*'Peter is *denn* a philosopher.'

(6.30) *Lass mich **denn** nicht alleine!
let me MP *not alone*
*'Do not *denn* leave me alone!'

(6.31) *Dass du **denn** pünktlich nach Hause **kommst**!
that you MP *on time to home come*
*'You must *denn* get home on time!'
(lit.: That you get home on time!)

That it is again the semantic mood and not the speech act performed that matters is shown by the fact that *denn* is prohibited in check-questions, but allowed in rhetorical questions.

(6.32) *Du kommst **denn** morgen um zehn?
you come MP *tomorrow at ten*
'You are **denn* coming tomorrow at ten?'

(6.33) Wer will das Spiel **denn** nicht gewinnen?
Who want the game MP *not win*
'Who does not want to win the game?'

The following table summarizes the intersentential distribution of *denn*.

(6.34)

sentence type	denn
declaratives	✗
interrogatives	✓
imperatives	✗

The distribution of *wohl* In contrast to *ja* and *denn*, *wohl* can occur in more than one 'functional type' (Altmann 1987). Whereas *ja* and *denn* are restricted to declaratives or interrogatives respectively, *wohl* is licit in both of them.

(6.35) Hein ist **wohl** auf See.
Hein is MP *at sea*
'Hein is *wohl* at sea.' (M. Zimmermann 2004b: 543)

(6.36) Ist Hein **wohl** auf See?
is Hein MP *at sea*
'Is Hein *wohl* at sea?' (M. Zimmermann 2004b: 550)

In imperatives and root-*dass*-clauses, *wohl* is illicit, just like *ja* and *denn*:

(6.37) a. *Komm **wohl** pünktlich nach Hause!
come MP *on time* *to* *home*
*'Come *wohl* home on time!'

b. *Dass du **wohl** pünktlich nach Hause **kommst**!
that you MP *on time* *to* *home* *come*
*'You must *wohl* get home on time!'
(lit.: 'That you get home on time!')

For *wohl*, our semantics-vs-pragmatics test reveals as well that these restrictions have to be formulated on the semantic, not on the pragmatic level. On the one hand, *wohl* can still be used in interrogatives even if they are used as a request, as in the following examples:

(6.38) Bist du **wohl** still?
are you MP *quiet*
'*Will you* wohl *be quiet!*' (M. Zimmermann 2004b: 561)

(6.39) Könnst du mir **wohl** das Salz reichen?
could you me MP *the salt pass*
'Could you *wohl* pass me the salt?'

The use of *wohl* in such indirect requests can—depending on the context—render it both more polite as in (6.39) but also more powerful as in (6.38). The presence of *wohl* may even play a crucial role in triggering such an indirect interpretation.[5]

On the other hand, *wohl* is illicit in rhetorical requests like (6.40) that actually make an assertion (Meibauer 1986: 171). As (6.41) demonstrates, *wohl* cannot occur in such cases:

(6.40) Zeigen Sie mir den Journalisten, der Gehaltseinbußen hinnimmt, um einem der vielen hundert Bewerber den Weg in eine Redaktion zu ebnen.
'Show me the journalist who'll take a salary cut in order to pave the way for one of the many hundred applicants to an editorial department.' (Meibauer 1986: 281)

(6.41) *Zeigen Sie mir **wohl** den Journalisten, der Gehaltseinbußen hinnimmt, um einem der vielen hundert Bewerber den Weg in eine Redaktion zu ebnen.

[5] For pragmatic inferences based on the use of *wohl*, cf. M. Zimmermann (2004b: 562), or the short overview I give in Gutzmann (2008: 180–2).

The following table summarizes our discussion of the intersentential distribution of *wohl*.

(6.42)

sentence type	wohl
declaratives	✓
interrogatives	✓
imperatives	✗

6.2.3.2 Interaction with sentence mood One of the main approaches to the semantics of modal particles is to assume that they are operators on the illocutionary type of the utterance in which they occur: that is, they modify the illocutionary type according to their conventional meaning (Jacobs 1991c; Karagjosova 2004). The following data are supposed to support such an analysis:

(6.43) a. Geh weg!
'Go away!'
(request)

b. Geh **JA** weg!
'Go *JA* away!'
(threat)

(6.44) a. Komm rein!
'Come in!'
(request)

b. Komm **ruhig** rein.
'Come *ruhig* in.'
(offer)

The MP *JA* in (6.43) seems to change the request to a threat, while the request in (6.44) is changed to an offer by the presence of *ruhig*. However, I think it is better not to attribute this change in the speech act that is performed by an utterance directly to the particle. Instead it seems more adequate to me to think that modal particles somehow modify the mood of the sentence in which they occur. The data displayed above supports this view.

The basic idea then is the following. Modal particles introduce something to the semantic content of a sentence and this contribution interacts with the mood of that sentence. And since sentence mood determines, or at least constrains, the speech acts that can be performed by an utterance, a change in sentence mood may lead to different speech acts. Some empirical support for this view on the relation between MPs, sentence mood, and illocutionary force is provided by the behavior of *wohl* in interrogatives that are used to perform requests, as in (6.38) and (6.39), where it seems that *wohl* can make a polite as well as a brusque request. However, this effect seems to arise from the semantics of *wohl*, that introduces some degree of tolerance for uncertainty into the epistemic component of the interrogative sentence mood. As shown in the previous chapter, the sentence mood of an interrogative can be paraphrased roughly as *The speaker wants to know the answer to the question* and hence the use of *wohl*, may change it to something like *The speaker wants to know what the hearer assumes to be the answer to the question* (M. Zimmermann 2004a,b). When a speech act of request is then derived on the basis of this sentence mood, the uncertainty aspect introduced by *wohl* may shape the request as stronger or weaker, depending on how the indirect request is understood within the context. Similar considerations apply to other MPs. For instance, *ja* somehow modifies the declarative mood by introducing some reference to common knowledge or uncontroversial facts. How this interaction between MPs and sentence mood can be spelled out formally will be discussed in detail in §6.5.

6.2.4 Interim summary

To conclude this descriptive overview of the behavior of modal particles, let me briefly take stock before I move on to investigate the nature of modal particle meaning. So far, I have presented the data that provide the empirical basis for the rest of this chapter. Needless to say, my presentation is far from being exhaustive in all interesting or even relevant aspects. The empirical data with regard to modal particles are highly complex and rich, so it has been necessary to choose material that can provide the point of departure for the development of a formal account of the semantics of these particles. Of course, the selection of data I have presented here determines the scope of the formal framework that I will develop in the remainder of this chapter, as well as the problems and questions I will try to tackle.

The main objective of this chapter is to provide a formal account of the meaning of modal particles. The most important feature of modal particles for me thus lies in their non-truth-conditionality. Their other semantic features are nevertheless of interest for my enterprise, as they hint at how the meaning of modal particles should be treated compositionally. A nice outcome of the way I treat modal particles is that many of their syntactic properties directly follow from their semantics. Hence, I do not have to take a stand regarding the rather complicated question of their syntactic status.

6.3 Hybrid semantics for modal particles

Having presented the properties of German MPs, I will now employ the tools developed in Chapter 4 in order to provide a formal analysis of how they contribute to the overall meaning of a sentence. This will involve three main questions.

(i) How do MPs contribute to the overall meaning profile of a sentence?
(ii) How is their behavior determined by their semantics?
(iii) How do MPs interact with the contribution of sentence mood?

I will first flesh out how MPs can be analysed in $\mathcal{L}_{\mathrm{TU}}$ in order to properly deal with their use-conditional nature. Let me stress that I am not going to present an adequate semantic translation for each of the two dozen MPs found in German. This would go way beyond the scope of this book, as the meaning of every single particle is highly complex, often only differing in very subtle detail from a number of other MPs. Instead, my focus lies on the way in which MPs contribute to the meaning profile of an utterance and how this contribution is calculated. As for the second question, I will show that a lot of their special properties directly fall out from their semantics without any special assumptions about their syntax.[6]

In this section, I will show how their use-conditional nature can be reflected by their semantic type and how the fact that they cannot be negated follows from the way in which they contribute to the meaning of a sentence, as well as why they cannot end up within the scope of higher operators like quantifiers or conditionals. In §6.4, I will then show how certain of their syntactic properties follow from their semantics.

In the final part of this chapter, I will tackle the interaction between modal particles and sentence mood, by putting together the analyses of the two phenomena. As we will see, this examination will show that the field of MPs is not as homogeneous as it is commonly treated as being, and that we cannot even assign the same semantic type to all MPs. For the moment, however, it is convenient to set these issues aside

[6] This is *not* meant to implicate that there is nothing special about the syntax of modal particles. There are many interesting facts that I do not even touch upon. For detailed studies of the particular syntax of MPs, see, for instance, Bayer and Obenauer (2011); Coniglio (2007, 2011); Grosz (2005); Struckmeier (2014). However, if I am right that much of how MPs behave syntactically is a direct reflection of their use-conditional nature, then accounts of MP syntax are freed from the need to address these properties.

and merely to give a provisional but unified formalization of modal particles and their combinatorics. This simplification will however make no difference to the argumentation that I will present subsequently.

6.3.1 Modal particles as use-conditional items

As should be obvious by now, the basic idea of my approach is to analyse MPs as UCIs. In the discussion in Chapter 2, pages 33–4, I argued that MPs are functional expletive UCIs, that is, they are [+*functional*], but [−*2-dimensional*] and [−*resource-sensitive*]. They must be functional, because they always express some kind of attitude towards the propositional content of an utterance and do not express *u*-propositions by themselves. They are not two-dimensional, because they do not add anything to the descriptive content of the sentence, and they are not resource-sensitive, because they pass back their argument unmodified instead of shunting it to the use-conditional dimension, which is shown by the fact that an MP sentence has the same *t*-content as its MP-free counterpart. As a first approximation, we can give generic MP semantics as follows, where *MP* is a metavariable over natural language modal particles, while **MP** ranges over their respective translations into $\mathcal{L}_{\mathrm{TU}}$:

(6.45) $MP \rightsquigarrow \mathbf{MP}{:}\langle\langle s,t\rangle,u\rangle \Rightarrow I_{\langle s,t\rangle} : \langle\langle s,t\rangle,\langle s,t\rangle\rangle \blacklozenge \mathbf{MP} : \langle\langle s,t\rangle,u\rangle \bullet U$

This schema states that an MP is translated into a functional expletive UCI which takes a propositional argument, returns it in the first dimension, expresses whichever attitude the specific MP expresses towards the propositional argument in the use-conditional dimension, and starts with a trivial third dimension. Admittedly, this is rather rough and does not tell us anything interesting about the specific meaning of any MP, nor is it able to account for the interaction between MPs and sentence mood. For present purposes, however, such a schematic lexical entry can be used to demonstrate how the specific semantic features of MPs follow from their semantic type and the combinatorics of $\mathcal{L}_{\mathrm{TU}}$, without any specific assumption regarding the lexical semantics of a single MP. In the following, I will use it to illustrate, in a general way, how the semantic features of MPs mentioned in (6.3) are accounted for by a lexical entry along the lines of (6.45).

6.3.2 Non-truth-conditionality

As shown in §6.2.2.1, MPs do not have any influence on the truth-conditional content of an utterance. This is maybe their most characteristic feature and puts them into the empirical domain of use-conditional meaning in the first place. This property is directly captured by their semantic translation in $\mathcal{L}_{\mathrm{TU}}$. According to (6.45), MPs yield a type *u* expression in their second dimension when applied to their argument, but do not add anything to the truth-conditional first dimension, which is modeled by an identity function. And since there is no way to put content from the second in the first dimension, the content of an MP can never become part of an utterance's truth conditions. It can, however, make an utterance infelicitous, as the use conditions are given by the third meaning dimension in which the contribution of the MP will be stored.

That the attitude conveyed by an MP will indeed never be part of the truth-conditional dimension of a multidimensional expression is ensured by the combinatoric system of $\mathcal{L}_{\mathrm{TU}}$, more precisely by the proof rules that were defined in §4.4.1. The rule that applies first to MPs is *multidimensional application* as given by (4.46) on page 128. For convenience, I repeat it here in the simplified $\blacklozenge$-$\bullet$-notation in (6.46). This rule involves pointwise application in the first two dimensions. That is, the first dimension of the functional expression applies to the first dimension of the argument expression; analogously for the second dimension. Finally, completed *u*-propositions that may reside in the third dimension are merged.

(6.46) *Multidimensional application*

$$\dfrac{\alpha_1 : \langle \sigma, \tau \rangle \blacklozenge \alpha_2 : \langle \rho, \nu \rangle \bullet \alpha_3 \qquad \beta_1 : \sigma \blacklozenge \beta_2 : \rho \bullet \beta_3}{\alpha_1(\beta_1) : \tau \blacklozenge \alpha_2(\beta_2) : \nu \bullet \alpha_3 \odot \beta_3}\,\mathrm{MA}$$

Filling up this proof rule with content, we can give an illustration of how the use-conditional content of an MP applies to its *t*-propositional argument.

(6.47) David schläft ja. ('David sleeps *ja*.')

$$\dfrac{\dfrac{\dfrac{\dfrac{\textit{David}}{\mathbf{d} : e \blacklozenge \mathbf{d} : e \bullet U}\,\mathrm{LxL} \qquad \dfrac{\textit{sleeps}}{\mathbf{sleep}_i : \langle e, t\rangle \blacklozenge \mathbf{sleep}_i : \langle e, t\rangle \bullet U}\,\mathrm{LxL}}{\mathbf{sleep}_i(\mathbf{d}) : t \blacklozenge \mathbf{sleep}_i(\mathbf{d}) : t \bullet U}\,\mathrm{MA}}{\lambda i.\mathbf{sleep}_i(\mathbf{d}) : \langle s, t\rangle \blacklozenge \lambda i.\mathbf{sleep}_i(\mathbf{d}) : \langle s, t\rangle \bullet U}\,\lambda i \qquad \dfrac{\textit{ja}}{\begin{array}{c}\bullet U \\ \blacklozenge\ \mathbf{ja} : \langle\langle s, t\rangle, u\rangle \\ I_{\langle s,t\rangle} : \langle\langle s, t\rangle, \langle s, t\rangle\rangle\end{array}}\,\mathrm{LxL}}{\lambda i.\mathbf{sleep}_i(\mathbf{d}) : \langle s, t\rangle \blacklozenge \mathbf{ja}(\lambda i.\mathbf{sleep}_i(\mathbf{d})) : u \bullet U}\,\mathrm{MA}$$

Next, the outcome of the application of the MP to the *t*-proposition in the second dimension is shifted to the third dimension by the proof rule for use-conditional elimination. There it becomes stored and inaccessible for further modification:

$$\text{(6.48)}\quad \frac{\lambda i.\mathbf{sleep}_i(\mathbf{d}) : \langle s,t\rangle \blacklozenge \mathbf{ja}(\lambda i.\mathbf{sleep}_i(\mathbf{d})) : u \bullet U}{\lambda i.\mathbf{sleep}_i(\mathbf{d}) : \langle s,t\rangle \blacklozenge \lambda i.\mathbf{sleep}_i(\mathbf{d}) : t \bullet \mathbf{ja}(\lambda i.\mathbf{sleep}_i(\mathbf{d})) : u}\,\text{UE}$$

Whatever the concrete contribution of *ja* is (roughly 'as you may know'), the sentence in (6.47) has the truth conditions that David sleeps, while also expressing the use condition (in the third dimension) that the attitude expressed by *ja* towards the *t*-propositional content holds. Only the later is affected by *ja*. If the MP is dropped, the use condition that the addressee may already know that David sleeps disappears.

(6.49) David schläft. ('David sleeps.')

$$\dfrac{\dfrac{\textit{David}}{\mathbf{d} : e \blacklozenge \mathbf{d} : e \bullet U}\,\text{LxL} \qquad \dfrac{\textit{sleeps}}{\mathbf{d} : e \blacklozenge \mathbf{d} : e \bullet U}\,\text{LxL}}{\mathbf{sleep}(\mathbf{d}) : t \blacklozenge \mathbf{sleep}(\mathbf{d}) : t \bullet U}\,\text{MA}$$

Note that there are no meaningful use conditions in (6.49), as the third dimension consists solely of the neutral element U which will be interpreted as the set of all contexts, so that the current context will always be an element of the use-conditional proposition and (6.49) will be felicitous. This is, however, only a temporary simplification, because, as we saw in the previous chapter, sentence mood at least will introduce non-trivial use-conditional content into the derivation. I will come back to it when I discuss the interaction between modal particles and sentence mood in §6.5.

6.3.3 Negation

One notable semantic feature of MPs discussed above is that they always take widest scope, or are scopeless (Potts 2005). Some of the relevant data are repeated here:

(6.50) Hein ist **ja** nicht zu Hause.
Hein is MP *not at home*
'Hein isn't *ja* at home.'

The interesting observation is that there is no ambiguity in (6.50) regarding the scope of the negation. It can only have a reading in which *ja* scopes over the entire proposition, including the negation. There is no reading in which the negation operates over the VP plus the particle. That is, the negation only targets the truth-conditional proposition but leaves the use-conditional content untouched. Example (6.50) thus gets interpreted along the lines of (6.51), while a reading like (6.52) is not available.

(6.51) $\|(6.50)\|^{t} = [\![\neg\mathbf{at\text{-}home}_i\ (\mathbf{hein})]\!]$
$\|(6.50)\|^{u} = [\![\mathbf{ja}(\lambda i.\neg\mathbf{at\text{-}home}_i\ (\mathbf{hein}))]\!]$

(6.52) $\|(6.50)\|^{t} \neq [\![\mathbf{at\text{-}home}_i\ (\mathbf{hein})]\!]$
$\|(6.50)\|^{u} \neq [\![\neg\mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i\ (\mathbf{hein}))]\!]$

That the latter reading is not available becomes obvious as soon as we build the semantic proof for (6.50):[7]

(6.53)
$$\dfrac{\dfrac{\dfrac{\textit{ja}}{\mathbf{ja} : \langle\langle s,t\rangle,u\rangle}\,\text{LxL} \qquad \dfrac{\dfrac{\dfrac{\textit{nicht}}{\lambda p.\mathbf{neg}(p) : \langle t,t\rangle}\,\text{LxL} \quad \dfrac{\dfrac{\textit{Hein}}{\mathbf{h} : e}\,\text{LxL} \quad \dfrac{\textit{zu Hause ist}}{\mathbf{at\text{-}home}_i : \langle e,t\rangle}\,\text{LxL}}{\mathbf{at\text{-}home}_i(\mathbf{h}) : t}\,\text{MA}}{\neg\mathbf{at\text{-}home}_i(\mathbf{h}) : t}\,\text{MA}}{\lambda i.\neg\mathbf{at\text{-}home}_i(\mathbf{h}) : \langle s,t\rangle}\,\lambda i}{\lambda i.\neg\mathbf{at\text{-}home}_i(\mathbf{h}) : \langle s,t\rangle \blacklozenge \mathbf{ja}(\lambda i.\neg\mathbf{at\text{-}home}_i(\mathbf{h})) : u}\,\text{MA}}{\lambda i.\neg\mathbf{at\text{-}home}_i(\mathbf{h}) : \langle s,t\rangle \bullet \mathbf{ja}(\lambda i.\neg\mathbf{at\text{-}home}_i(\mathbf{h})) : u}\,\text{UE}$$

This is a proof for the reading in (6.51), in which the MP has widest scope. It matches the intuition that *Hein ist ja zu Hause* is true just iff Hein is at home, just like the sentence without *ja*. However, *ja* can make an utterance of (6.50) infelicitous if the use conditions for *ja*—I will discuss these in some detail later on—do not hold.

However, let us try to set up a proof for the reading (6.52). We first apply the modal particle to the VP and thereby get a t-proposition in the first and a u-proposition in the second dimension:

(6.54)
$$\dfrac{\begin{array}{c}\bullet\, U \\ \blacklozenge\ \mathbf{ja} : \langle\langle s,t\rangle\,,u\rangle \\ I_{\langle s,t\rangle} : \langle\langle s,t\rangle, \langle s,t\rangle\rangle\end{array} \qquad \begin{array}{c}\bullet\, U \\ \blacklozenge\ \lambda i.\mathbf{at\text{-}home}_i(\mathbf{h}) : \langle s,t\rangle \\ \lambda i.\mathbf{at\text{-}home}_i(\mathbf{h}) : \langle s,t\rangle\end{array}}{\begin{array}{c}\bullet\, U \\ \blacklozenge\ \mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : u \\ \mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : \langle s,t\rangle\end{array}}\,\text{MA}$$

After this, we try to apply the negation to the use-conditional proposition. This does not work, however, because the types do not fit. This problem still prevails even if we use propositional negation, as the s-dimension would still not have the right type:

[7] I make use of the abbreviations established in §4.4.3. I also ignore the complexities of German word order, so the proofs are not meant to mirror the linear order of the sentence. In order to get the word order right, one has to assume either movement (Heim and Kratzer 1998) or more complex type shifters and combinators (Steedman 2000). This doesn't matter for the point being made here though.

(6.55)

$$\dfrac{\begin{array}{c}\bullet\ U\\ \blacklozenge\ \lambda p.\neg p : \langle t,t\rangle\\ \lambda p.\neg p : \langle t,t\rangle\end{array}\qquad\begin{array}{c}\bullet\ U\\ \blacklozenge\ \mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : u\\ \lambda i.\mathbf{at\text{-}home}_i(\mathbf{h}) : \langle s,t\rangle\end{array}}{\lightning}\ \text{✗}$$

We cannot even plug in the world argument, as this requires a slot in both dimensions, whereas only the *t*-dimension has one:

(6.56)

$$\dfrac{\begin{array}{c}\bullet\ U\\ \blacklozenge\ \mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : u\\ \lambda i.\mathbf{at\text{-}home}_i(\mathbf{h}) : \langle s,t\rangle\end{array}\qquad\begin{array}{c}\bullet\ U\\ \blacklozenge\ i : s\\ i : s\end{array}}{\lightning}\ \text{✗}$$

In order to get a well-formed proof, the use-conditional proposition must first be stored in the third dimension, whereby the second dimension becomes a copy of the first dimension. The second dimension then contains a *t*-propositional element again, such that the world argument can be fed in and the negation can finally be applied:

(6.57)

$$\dfrac{\begin{array}{c}\bullet\ U\\ \blacklozenge\ \lambda p.\neg p : \langle t,t\rangle\\ \lambda p.\neg p : \langle t,t\rangle\end{array}\qquad \dfrac{\dfrac{\begin{array}{c}\bullet\ U\\ \blacklozenge\ \mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : u\\ \lambda i.\mathbf{at\text{-}home}_i(\mathbf{h}) : \langle s,t\rangle\end{array}}{\begin{array}{c}\bullet\ \mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : u\\ \blacklozenge\ \lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : \langle s,t\rangle\\ \lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : \langle s,t\rangle\end{array}}\,\mathrm{UE}\qquad\begin{array}{c}\bullet\ U\\ \blacklozenge\ i : s\\ i : s\end{array}}{\begin{array}{c}\bullet\ \mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : u\\ \blacklozenge\ \mathbf{at\text{-}home}_i(\mathbf{h})) : t\\ \mathbf{at\text{-}home}_i(\mathbf{h})) : t\end{array}}\,\mathrm{MA}}{\begin{array}{c}\bullet\ \mathbf{ja}(\lambda i.\mathbf{at\text{-}home}_i(\mathbf{h})) : u\\ \blacklozenge\ \neg\mathbf{at\text{-}home}_i(\mathbf{h}) : t\\ \neg\mathbf{at\text{-}home}_i(\mathbf{h}) : t\end{array}}\,\mathrm{MA}$$

Crucially, this does not equal the reading in (6.52), because the negation does not end up in the use-conditional layer, but still appends to the *t*-propositional context. The difference between this proof and that for the wide-scope reading in (6.53) is just that the negation is part of the argument of *ja* in (6.53), whereas it is not in (6.57). Although this reading can be derived by the compositional system, it is not a reasonable reading of (6.50). For semantic reasons, such a reading does not make sense. Since *ja*—roughly paraphrasable as 'as you may already know'—presupposes the truth of its argument, (6.57) could never be true and felicitous simultaneously.[8] In addition, there may be syntactic constraints against the reading represented by (6.57). It seems as if the MP position is always above the position where negation is adjoined to the VP. This is supported by the surface position of MPs and negation in German. While the order *MP* $\prec$ *nicht* is grammatical as shown in (6.50) on page 234, the reversed order is not:

(6.58) *Hein ist nicht **ja** zu Hause.
hein is not MP *at home*
*'Hein is not *ja* at home.'

However, a serious and detailed investigation of this topic would go well beyond the scope of this chapter. For an extensive analysis of the syntax of MPs, I refer the reader again to Bayer and Obenauer (2011), Grosz (2005), Struckmeier (2014), and the work by Coniglio (2007, 2011).

One may rightfully object that the attempt to build a proof for the narrow-scope reading of the MP as in (6.52) is flawed in the first place, because a type $\langle t, t\rangle$-negation will never be able to apply to a u-proposition anyway. If I used a mixed negation like (6.59), the composition could work, where "$\urcorner$" is intended as a use-conditional negation:

(6.59) $nicht_u \rightsquigarrow I_t : \langle t, t\rangle \blacklozenge \lambda v. \urcorner v : \langle u, u\rangle$

This, however, does not work either. The problem is that there is no lexical extension rule (LER) for languages like German that would extend such a two-dimensional expression into an adequate three-dimensional one, and hence it cannot be used in the derivation. As discussed in Chapter 4 (pp. 134–6), it is an empirical question whether all or only some languages prohibit such use-conditional operators. For German, at least, the evidence suggests that it does not exhibit them and accordingly, there is no LER that extends expressions like (6.59) into forms that can actually be used in derivations.

6.3.4 Scope

Regarding the relative scope of MPs and other operators, considerations similar to those regarding negation apply. Recall that MPs always scope out higher operators like quantifiers, modals, or question operators. Here are some new examples akin to the ones presented above:

[8] For more on the meaning of *ja*, see pp. 261–3.

(6.60) Alle Linguisten schnarchen **ja**.
all linguists snore MP
'All linguists snore *ja*.'

As with negation, there is no scope ambiguity in (6.60). Thus, the sole reading for (6.60) is one in which there is a plain quantificational formula on the truth-conditional part, whereas *ja* takes the entire quantified VP as its argument in the use-conditional dimension. The proof for this is straightforward:

(6.61)
$$
\begin{prooftree}
\AxiomC{\textit{Alle Linguisten}}
\RightLabel{LxL}
\UnaryInfC{$\mathbf{all}(\mathbf{linguist}_i) : \langle\langle e,t\rangle, t\rangle$}
\AxiomC{\textit{schnarchen}}
\RightLabel{LxL}
\UnaryInfC{$\mathbf{snore}_i : \langle e,t\rangle$}
\RightLabel{MA}
\BinaryInfC{$\mathbf{all}(\mathbf{linguist}_i)(\mathbf{snore}_i) : t$}
\RightLabel{λi}
\UnaryInfC{$\lambda i.\mathbf{all}(\mathbf{linguist}_i)(\mathbf{snore}_i) : \langle s,t\rangle$}
\AxiomC{\textit{ja}}
\RightLabel{LxL}
\UnaryInfC{$\mathbf{ja} : \langle\langle s,t\rangle, u\rangle$}
\RightLabel{MA}
\BinaryInfC{$\begin{array}{c} \blacklozenge\ \mathbf{ja}(\lambda i.\mathbf{all}(\mathbf{linguist}_i)(\mathbf{snore}_i)) : u \\ \lambda i.\mathbf{all}(\mathbf{linguist}_i)(\mathbf{snore}_i) : \langle s,t\rangle \end{array}$}
\RightLabel{UE}
\UnaryInfC{$\begin{array}{c} \bullet\ \mathbf{ja}(\lambda i.\mathbf{all}(\mathbf{linguist}_i)(\mathbf{snore}_i)) : u \\ \lambda i.\mathbf{all}(\mathbf{linguist}_i)(\mathbf{snore}_i) : \langle s,t\rangle \end{array}$}
\end{prooftree}
$$

From this proof, we can extract the following truth and use conditions for (6.60):

(6.62) a. $\|\text{Alle Linguisten schnarchen ja}\|^t = [\![\lambda i.\mathbf{all}(\mathbf{linguist}_i)(\mathbf{snore}_i)]\!]$

b. $\|\text{Alle Linguisten schnarchen ja}\|^u = [\![\mathbf{ja}(\lambda i.\mathbf{all}(\mathbf{linguist}_i)(\mathbf{snore}_i))]\!]$

This gets the meaning of the example right. An utterance of (6.60) is true in a world *w* if all linguists snore and is felicitously used in a context *c* if the speaker of *c* assumes that the hearer of *c* may already have known that all linguists snore.

But why can't there be an inverted reading in which the quantifier scopes over the MP? In Chapter 4 we saw that, in the case of functional mixed UCIs, it is possible for a quantifier to scope over use-conditional content (see §4.5.2.2). The reason why such a possibility is lacking for MPs is that they need a propositional, i.e. intensional, argument. However, $\mathcal{L}_{\text{TU}}$ only has a type shift operator for extensional quantifiers. Therefore, the shifted quantifier will not match the type of the *s*-dimension, after *ja* has been applied to its propositional argument. The following failed proof illustrates this:

(6.63)

$$
\cfrac{
\cfrac{\textit{Alle Linguisten}}{\begin{array}{c}\blacklozenge\ \text{☆}\mathbf{all}(\mathbf{linguist}_i) : \langle\langle e,u\rangle,u\rangle \\ \mathbf{all}(\mathbf{linguist}_i) : \langle\langle e,t\rangle,t\rangle\end{array}}\,\text{LxL+☆}
\qquad
\cfrac{
\cfrac{
\cfrac{
\cfrac{
\cfrac{\textit{schnarchen}}{\mathbf{snore}_i : \langle e,t\rangle}\,\text{LxL} \quad x : e
}{\mathbf{snore}_i(x) : t}\,\text{MA}
}{\lambda i.\mathbf{snore}_i(x) : \langle s,t\rangle}\,\lambda w
\quad
\cfrac{\textit{ja}}{\mathbf{ja} : \langle t,u\rangle}\,\text{LxL}
}{\begin{array}{c}\blacklozenge\ \mathbf{ja}(\lambda i.\mathbf{snore}_i(x)) : u \\ \lambda i.\mathbf{snore}_i(x) : \langle s,t\rangle\end{array}}\,\text{MA}
}{\begin{array}{c}\blacklozenge\ \mathbf{ja}(\lambda i.\mathbf{snore}_i(x)) : \langle e,u\rangle \\ \lambda x.\lambda i.\mathbf{snore}_i(x) : \langle e,\langle s,t\rangle\rangle\end{array}}\,\lambda x
}{\lightning}\,\text{✗}
$$

That is, even if $\mathcal{L}_{\text{TU}}$ allows for quantifying over the s-dimension, this is only possible if we can quantify over both dimensions in the same way. This is not the case for the intended inverted scoped reading of (6.60). Therefore, the unavailability of such a reading can be explained by a type clash.

For other higher operators like conditionalization and question formation, things are even more straightforward, as these operators are always located somewhere higher in the semantic structure anyway, so there is no danger that they could target the use-conditional proposition in the first place.

6.4 Deriving syntax from semantics

As the previous section illustrated, hybrid semantics as implemented by $\mathcal{L}_{\text{TU}}$ can account for the use-conditional character of modal particles and their semantic behavior. As I want to illustrate in this section, their semantics can also be used to get a grip on many of their particular *syntactic* features 'for free', by which I mean that no specific assumptions about MPs have to be made in order to do so. The following list repeats those syntactic particularities from (6.3) on page 217 that I will address:

(6.64) a. MPs cannot be expanded.
b. MPs cannot be coordinated.
c. MPs cannot be focused.
d. MPs cannot be questioned.
e. MPs cannot be fronted.

In most cases, this behavior can be explained within the hybrid framework by reference to their semantic type(s) and the combinatoric rules of $\mathcal{L}_{\text{TU}}$. It all comes down to the fact that MPs are removed from the second dimension to become isolated in the third dimension at some point in the proof construction, such that they are not available for other expressions to modify them or otherwise interact with them in a meaningful manner. Many of the arguments in the following discussion are directly inspired by the work of Markus Steinbach (1998, 2002), who tackles the syntactic peculiarities of non-argument reflexives as they show up, for instance, in German middle constructions. As I will do for modal particles, he explains their syntactic behavior mainly on semantic grounds. Thanks to the fact that his non-argument reflexives share the syntactic properties in (6.64), I can adopt his strategy for the present case study. However, his argument cannot be directly transferred, because from a semantic point of view MPs and non-argument reflexives are completely different, the latter being ordinary truth-conditional expressions whereas the former are expletive UCIs. In the following, I will therefore adapt Steinbach's argumentation and see how far purely semantic reasoning can help to explain the properties in (6.64).

6.4.1 Projectional behavior

The first syntactic property I discuss is that modal particles do not project—that is, they can neither be modified nor otherwise expanded. Here is an example:

(6.65) Peter ist *{sehr/sogar/nur} **ja** Veganer.
Peter is very even only MP *vegan*
'Peter is *{very/even/only} *ja* a vegan.'

This behavior can easily be explained if we have a closer look at the assumed modifiers. They are just of the wrong type. Recall that the type of the meaningful part in the second dimension of MPs like *ja* is $\langle\langle s,t\rangle, u\rangle$, a functional type from t-propositions to u-propositions. In order for an expression to modify this dimension of an MP, it has to be a use-conditional modifier. However, there are empirical arguments that modifiers like *sehr* 'very' and focus particles like *nur* 'only' and *sogar* 'even' cannot modify use-conditional content in general, since they cannot modify other use-conditional expressions like derogative epithets and expressive adjectives (6.66), swear words (6.67), or interjections like *ouch* (6.68).

(6.66) Der *{sehr/sogar/nur} **Idiot** Hein hat sein
The very even only idiot Hein has his
*{sehr/sogar/nur} **verficktes** Radio wieder die ganze lang
very even only fucking radio again the whole long
Nacht laufen!
night running
'That *{very/even/only} idiot Hein has his *{very/even/only} fucking radio running again the whole night long!'

(6.67) *{Sehr/sogar/nur} **Scheiße**, ich hab die Karten vergessen!
very even only shit I have the tickets forgotten
*'Very/even/only shit, I forgot the tickets!'

(6.68) *Sehr/sogar/nur **aua**, ich hab mich verletzt.
very even only ouch I have myself hurt
*'{Very/even/only} ouch, I have hurt myself.'

This illustrates that such modifiers cannot apply to UCIs at all. And since such expressions are the only ones that could plausibly be used to modify MPs from a semantic point of view, there are no expressions that can act upon modal particles.

6.4.2 Coordination

When it comes to coordination, there are both empirical and theoretical angles to explain why MPs cannot be coordinated, neither with each other nor with other expressions:

(6.69) *Penny ist **ja und halt/ vermutlich** Politiker.
Penny is MP *and* MP *presumably politician*
*'Penny is *ja* and *halt* a politician.'

Crucially however, the conjunction *und* 'and' in German does not seem to have the correct type for such a coordination. In truth-conditional terms, it is often assumed that conjunction is not just a connective for truth values or propositions, but that it is polymorphically defined for all Boolean types.

(6.70) a. [It is raining]$_t$ and [it is cold]$_t$.
b. Francis [sleeps]$_{\langle e,t\rangle}$ and [snores]$_{\langle e,t\rangle}$.
c. [Phil]$_{\langle\langle e,t\rangle,t\rangle}$ and [every girl]$_{\langle\langle e,t\rangle,t\rangle}$ went to the beach.

That is, ordinary Boolean conjunction is of type $\langle\sigma,\langle\sigma,\sigma\rangle\rangle$, where σ is a Boolean type. A type is said to be Boolean if $\sigma = t$ or if $\sigma = \langle\rho,\tau\rangle$, where τ is a Boolean type. Now, in order to coordinate two MPs, the conjunction must also be allowed to take the form $\langle\langle\langle s,t\rangle,u\rangle,\langle\langle\langle s,t\rangle,u\rangle,\langle\langle s,t\rangle,u\rangle\rangle\rangle$, which is not a Boolean type in $\mathcal{L}_{\mathrm{TU}}$.[9]

We must therefore ask whether there is also a use-conditional equivalent to Boolean conjunction: that is, whether there is a conjunction

[9] This is because type u is opaque for the logic. That is, even if type u is interpreted as if it were equal to type $\langle c,t\rangle$, it is not a Boolean type for $\mathcal{L}_{\mathrm{TU}}$ due to this intransparency.

of type $\langle \nu, \langle \nu, \nu \rangle \rangle$, where either $\nu = u$ or $\nu = \langle \rho, \tau \rangle$, where τ is a use-conditional type. There are both empirical and theory-internal arguments against such an expression. First, observe that many other UCIs cannot be coordinated either:

(6.71) ***Mann und verdammt**, ist es heiß hier drin!
man and damn is it hot here in-the
*'Man and damn, it is hot in here!'

(6.72) ***Aua und oje/ verdammt/ scheiße**, ich hab mich verletzt!
ouch and oh/ damn/ shit I have myself hurt
*'Ouch and oh/ damn/ shit, I hurt myself!'

(6.73) ***Dieser Idiot und dieser Bastard** Hein hat mich verraten!
that idiot and that bastard Hein has me betrayed
*'That idiot and bastard Hein has betrayed me!'

This illustrates that *und* does not seem to be able to coordinate use-conditional expressions, irrespective of their type. If this is true, the fact that MPs cannot be coordinated is not a special feature of themselves, but a special feature of the coordinating expression, at least in German.

Another argument, more driven by predictions made by the theoretical framework, is that there is no lexical extension rule that could extend an assumed use-conditional coordination into a three-dimensional meaning profile. To see why, first note that this coordination—let us call it **und*—must be a use-conditional modifier, since it has use-conditional input and output. The relevant LER is (4.67) on page 142, which I repeat here for convenience.

(4.61) *LER for generalized modification*
$\alpha \Rightarrow \langle I_{\sigma^n}, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle^n}$, where σ is a truth-conditional type and τ is a use-conditional type.

Crucially, this LER cannot be used for our hypothetical **und*, because α is only defined for non-modifiers and symmetrical modifiers, but not for two-place modifiers such as **und* would be. Therefore, given the logical framework, it is to be expected that there is no use-conditional coordination. To be sure, I do not want this to be taken as evidence, which would come dangerously close to being circular, but instead take it as further indication that the set of LERs in (4.71), which is independently motived from the issue of use-conditional coordination, is on the right track, as it seems to be backed up by additional empirical data.

6.4.3 Focus

Even if there are some putative exceptions (Gutzmann 2010a; Meibauer 1994), the vast majority of MPs simply cannot be focused:

(6.74) *Peter schnarcht HALT.
Peter snores MP

I have subsumed this under the syntactic properties of MPs instead of under their semantic or phonological characteristics, because with *focus*—a label used in different ways at various levels of linguistic analysis—I want to refer to a feature of syntactic phrases. This F-feature correlates with a specific semantic interpretation effect and is, in languages like German or English, typically realized phonologically by a prominent pitch accent on the focused phrase:[10]

(6.75) $[\text{MARY}]_{F}$ likes Sue.

What is important for our purposes is that it is the phonological realization of focus at which the common assumption that modal particles cannot be stressed is aimed. Apparent exceptions to the no-stress constraint may be due to one of the many other functions that stress can play. But if it is understood as "MPs cannot be stressed to realize focus", it seems to be a valid observation, since even the stressable MPs cannot be focused by other means like cleft constructions:

(6.76) *Es ist **ja**, wie Peter ein Philsoph ist.
it is MP *how Peter a philosopher is*

Even though there may well be plain syntactic reasons for the impossibility of (76), it nevertheless supports the intuition that MPs generally cannot be focused. The fact that they cannot be questioned or narrowly negated either—discussed in §6.3.3 and §6.4.4 respectively—also backs up this observation, as both are closely connected to focus.[11] The fact that

[10] Cross-linguistically, the expression of focus may be realized by different means, and even in English or German other strategies are available like cleft constructions. For an overview, see e.g. Büring (2010).

[11] For the connection between focus and question, see e.g. Büring (1997); Rooth (1992, 1996); for narrow negation, Jacobs (1982, 1991b).

MPs cannot be stressed thus leads to the question of why they cannot be focused.

In order to explain this fact, I first have to make a short excursion into the formal semantic analysis of focus. To be sure, this book is not the place to discuss the (dis)advantages of all the different accounts of the semantics of focus that are available (cf. Beaver and Clark 2008 for a nice survey). For the purposes of the following discussion, I thus just adopt Rooth's (1992) *alternative semantics* for focus. The basic idea of his theory of focus interpretation is to take literally the intuition that focus induces reference to a set of salient alternatives to the focused expression. So, if we have, for example, an utterance of (6.77), different alternative persons who may like Sue are made salient by the focus on *Mary*:

(6.77) $[\text{MARY}]_{\text{F}}$ likes Sue.

Focus on an expression in itself does not seem to be truth-conditionally relevant, even if it may render an utterance infelicitous, as illustrated by the following example:[12]

(6.78) A: Nobody seems to like Sue. At least, Hein obviously doesn't.
B: MARY likes Sue.
B′: #Mary likes SUE.

In (6.78), A establishes a context in which the question of who may like or not like Sue is currently under discussion. In this context, focus on *Mary* is fine, whereas focus on *Sue* is infelicitous, as there are no alternative persons who are liked by Mary salient in this short discourse. Focusing the wrong constituent, however, does not render the sentence false. Only in the presence of particles associating with the focus do the focus alternatives become truth-conditionally relevant:

(6.79) Only MARY likes Sue.

The meaning of *only* imports the focus alternatives into the truth-conditional dimension by requiring that Mary be the only person from the set of alternative Sue-likers who actually likes her in order for (6.79) to be true.

[12] See also the brief discussion of focus in §2.2.3. Since free focus only imposes use conditions without a truth-conditional effect, it may seem to be suitable for a hybrid semantic treatment as well. See Gutzmann (2012: §8.3) for a formalization.

The alternatives invoked by focus are accounted for in alternative semantics by the introduction of a new interpretation function $[\![\cdot]\!]^f$ that delivers the set of alternatives for the focused constituent. Since the way in which the set of alternatives are semantically or contextually constrained are not of interest here, I follow Büring's (1997: 38) "trick" and assume that the focus interpretation function "comes with a built-in restriction of that kind"; that is, it serves us a ready-to-use set of alternatives (Büring 1997: §2.5).

The following examples give a flavor of how the focus interpretation function works from a compositional point of view. First, we translate the natural language expressions from our example in (6.77) into some logical language, as in (6.80a). When doing so, it is important that the F-feature is retained with its expression. Then we can provide the focus value for each expression, as in (6.80b)–(6.80d). Note that if an expression is not focused at all, its focus value is just the singleton set that contains the ordinary interpretation of that expression, as in (6.80b) and (6.80c). If an expression is focused, however, then $[\![\cdot]\!]^f$ delivers the set of alternatives for that expression: cf. (6.80d). Accordingly, when such a set is composed with another set (whether singleton or not), as in (6.80e), we again gain a set.[13]

(6.80) a. [Mary]$_{\text{F}}$ likes Sue. $\rightsquigarrow$ $\mathbf{like}_i(\mathbf{sue})(\mathbf{mary}_{\mathbf{F}})$

b. $[\![\mathbf{like}_i]\!]^f = \{[\![\mathbf{like}_i]\!]^o\}$

c. $[\![\mathbf{sue}]\!]^f = \{[\![\mathbf{sue}]\!]^o\}$

d. $[\![\mathbf{mary}_{\mathbf{F}}]\!]^f$
$= \{x \in D_e\colon\ x \text{ is a contextually relevant alternative for } [\![\mathbf{mary}]\!]^o\}$
$= \{\text{Mary, Peter, Hein}\}$

e. $[\![\mathbf{like}_i(\mathbf{sue})(\mathbf{mary}_{\mathbf{F}})]\!]^f$

$$
\begin{aligned}
&= \big\{f(x)(y)\colon\ f \in [\![\mathbf{like}_i]\!]^f \wedge x \in [\![\mathbf{sue}]\!]^f \wedge y \in [\![\mathbf{mary}_{\mathbf{F}}]\!]^f\big\}\\
&= \big\{f(x)(y)\colon\ f \in \{[\![\mathbf{like}_i]\!]^o\} \wedge x \in \{[\![\mathbf{sue}]\!]^o\} \wedge\\
&\qquad\qquad y \in \{[\![\mathbf{mary}]\!]^o, [\![\mathbf{peter}]\!]^{\circ}, [\![\mathbf{hein}]\!]^{\circ}\}\big\}\\
&= \big\{[\![\mathbf{like}_i]\!]^o([\![\mathbf{sue}]\!]^o)(y)\colon\ y \in \{[\![\mathbf{mary}]\!]^o, [\![\mathbf{peter}]\!]^o, [\![\mathbf{hein}]\!]^o, \}\big\}\\
&= \big\{[\![\mathbf{like}_i]\!]^o([\![\mathbf{sue}]\!]^o)([\![\mathbf{mary}]\!]^o), [\![\mathbf{like}_i]\!]^o([\![\mathbf{sue}]\!]^o)([\![\mathbf{peter}]\!]^o),\\
&\qquad [\![\mathbf{like}_i]\!]^o([\![\mathbf{sue}]\!]^o)([\![\mathbf{hein}]\!]^o)\big\}\\
&= \big\{\text{Mary likes Sue, Peter likes Sue, Hein likes Sue}\big\}
\end{aligned}
$$

[13] $[\![\cdot]\!]^o$ is the ordinary interpretation function. In the following, I will often drop the superscribed o to avoid an abundance of superscripts.

The mere calculation of sets of alternatives as focus denotations does not, however, lead towards a semantic effect. In order to turn the focus value into a felicity constraint, Rooth (1992) assumes that (i) the focus value enfolds its semantic effect at a particular constituent by a special covert focus interpretation operator "∼" which can modify any expression in the logical form and which (ii) introduces a free variable C; and that (iii) the value of this variable C has to be assigned contextually, but, crucially, gets restricted by the focus value of the expression to which the focus interpretation operator applies (Geilfuß-Wolfgang 1996). Furthermore, Rooth introduces a focus interpretation rule that restricts the possible values for C by means of a threefold presupposition (Rooth 1996: 279):

(6.81) *Focus interpretation rule*
Where ϕ is a syntactic phrase and C is a syntactically covert semantic variable, $\phi \sim C$ introduces the presupposition that C is a subset of $[\![\phi]\!]^f$ containing $[\![\phi]\!]^o$ and at least one other element.

Let me illustrate how this rule derives constraints (in the form of presuppositions) on the contexts in which an utterance can be felicitously used, depending on the focus value. Ignoring the issue of multidimensionality for a moment—I will come back to it very shortly—the simple semantic structure for our example may look as follows:

(6.82)
$$\dfrac{\dfrac{\dfrac{\textit{Mary}_F}{\mathbf{mary}_{\mathbf{F}}}\,\text{Lx} \qquad \dfrac{\textit{likes Sue}}{\mathbf{like}_i(\mathbf{sue})}\,\text{Lx}}{\mathbf{like}_i(\mathbf{sue})(\mathbf{mary}_{\mathbf{F}})} \qquad \dfrac{}{\sim C_5}}{[\mathbf{like}_i(\mathbf{sue})(\mathbf{mary}_{\mathbf{F}})] \sim C_5}$$

The expression derived by this proof now gets interpreted according to the focus interpretation rule (6.81). Substituting $\mathbf{like}(\mathbf{sue})(\mathbf{mary}_{\mathbf{F}})$ for ϕ in (6.81), we get the following three presuppositions:

(6.83) $[\mathbf{like}_i(\mathbf{sue})(\mathbf{mary}_{\mathbf{F}})] \sim C_5$ presupposes that
a. C_5 is a subset of $[\![\mathbf{like}_i(\mathbf{sue})(\mathbf{mary}_{\mathbf{F}})^f]\!]$
b. containing $[\![\mathbf{like}_i(\mathbf{sue})(\mathbf{mary}_{\mathbf{F}})^o]\!]$ and
c. at least one other element.

If the contextually given value for C_5 is such that other people liking or not liking Sue are salient, the set denoted by C_5 contains these propositions as well. That is, in a context like (6.78), we may have $C_5 =$ {Mary likes Sue, Hein likes Sue}. Then, if the focus values for (6.82) are as in (6.80), C_5 is a subset of $[\![\mathbf{like}(\mathbf{sue})(\mathbf{mary_F})^f]\!]$, since {Mary likes Sue, Hein likes Sue} $\subset$ {Mary likes Sue, Peter likes Sue, Hein likes Sue}. The second condition is also satisfied, since $[\![\mathbf{like}(\mathbf{sue})(\mathbf{mary_F})^\circ]\!]$ is an element of C_5, because {Mary likes Sue} $\in$ {Mary likes Sue, Hein likes Sue}. Finally, C_5 contains at least one additional element that is different from $[\![\mathbf{like}(\mathbf{sue})(\mathbf{mary_F})^\circ]\!]$, i.e. some other proposition than the proposition that Mary likes Sue. The threefold presupposition introduced by the focus interpretation operator $\sim$ is therefore fulfilled.

In contrast, in a context in which the variable C_5 receives a value that is not a subset of the focus value of the expression to which the operator applies, or in which it does not contain an additional element besides the ordinary value of the focused expression, the presupposition is not fulfilled and the utterance becomes inappropriate. Consider, for instance, the context in (6.84):

(6.84) A: Mary is such a misanthrope. She doesn't seem to like anybody.
B: #MARY likes Sue.

In this case, the value of the variable C_5 is a set of propositions like {Mary likes Sue, Mary likes Jessy, Mary likes Joan}. In such a context, focus on *Mary* is infelicitous. This is derived by the focus interpretation rule, because the triggered presuppositions are not satisfied in that context. The focus value still is the same as in (6.80e). Crucially, the new value for C_5 is not a subset of that focus value (even if it contains the ordinary value).

(6.85) {Mary likes Sue, Mary likes Jessy, Mary likes Joan} $\not\subset$
{Mary likes Sue, Peter likes Sue, Hein likes Sue}

Therefore, the presupposition that is triggered by the focus on *Mary* is not satisfied and hence the infelicity of (6.84) is correctly predicted.

Given this way of thinking about the interpretation of focus in alternative semantics, we can now explain why focus on an MP and, by the same token, stressing it, is impossible. In order to see why, we first have to make some assumptions about how Rooth's (1996) focus operator can be transferred to the multidimensional framework used in this book. Let us, for the purpose of this chapter, consider two options. Either the focus operator is a purely truth-conditional item, or it can also be a use-conditional modifier. Let me begin with the assumption that the focus operator is a simple, but polymorphic, truth-conditional operator that can attached to constituents of any complexity:

(6.86) $\lambda x_\sigma.[x] \sim C_n : \langle \sigma, \sigma \rangle$ where σ is a truth-conditional type

Since it is a simple truth-conditional expression, this lexical entry gets extended into a three-dimensional object by the corresponding lexical extension rule (4.55) for pure truth-conditional expressions:

(6.87) $\lambda x_\sigma.[x] \sim C_n : \langle \sigma, \sigma \rangle \Rightarrow \lambda x_\sigma.[x] \sim C_n : \langle \sigma, \sigma \rangle \blacklozenge \lambda x_\sigma.[x] \sim C_n : \langle \sigma, \sigma \rangle \bullet U$

With this three-dimensional version of Rooth's operator, we can now try to build a proof for a sentence containing a stressed modal particle, like (6.74) on page 243. I make heavy use of the abbreviation conventions detailed in §4.4.3 and provide just the non-trivial dimensions for each expression.

(6.88) *Paul schnarcht HALT. (*'Paul snores *HALT*.')

$$
\dfrac{
\dfrac{
\dfrac{\dfrac{\dfrac{\textit{Paul}}{\mathbf{p} : e}\,\text{LxL} \quad \dfrac{\textit{schnarcht}}{\mathbf{snore}_i : \langle e, t \rangle}\,\text{LxL}}{\mathbf{snore}_i(\mathbf{p}) : t}\,\text{MA}}{\lambda i.\mathbf{snore}_i(\mathbf{p}) : \langle s, t \rangle}\,\lambda i
\quad
\dfrac{\textit{HALT}}{\mathbf{halt}_{\mathrm{F}} : \langle \langle s, t \rangle, u \rangle}\,\text{LxL}
}{
\begin{array}{c}\blacklozenge\ \mathbf{halt}_{\mathrm{F}}(\lambda i.\mathbf{snore}_i(\mathbf{p})) : u \\ \lambda i.\mathbf{snore}_i(\mathbf{p}) : \langle s, t \rangle\end{array}
}\,\text{MA}
}{
\begin{array}{c}\bullet\ \mathbf{halt}_{\mathrm{F}}(\lambda i.\mathbf{snore}_i(\mathbf{p})) : u \\ \lambda i.\mathbf{snore}_i(\mathbf{p}) : \langle s, t \rangle\end{array}
}\,\text{UE}
\quad
\dfrac{}{\lambda p.[p] \sim C_2 : \langle \langle s, t \rangle, \langle s, t \rangle \rangle}\,\text{LxL}
}{
\begin{array}{c}\bullet\ \mathbf{halt}_{\mathrm{F}}(\lambda i.\mathbf{snore}_i(\mathbf{p})) : u \\ [\lambda i.\mathbf{snore}_i(\mathbf{p})] \sim C_2 : \langle s, t \rangle\end{array}
}\,\text{MA}
$$

This is sufficient to illustrate how the combinatoric system of $\mathcal{L}_{\mathrm{TU}}$ can explain why MPs are expected to be unfocusable. In this derivation, the only possibility for the focus operator to attach to the rest of the sentence is after use-conditional elimination has taken place. That is, the *u*-proposition which is expressed by the particle together with its argument must first be stored in the *u*-dimension making room for the *s*-dimension to be filled again by the truth-conditional content. The reason why the $\sim$-operator can only apply after this is that, otherwise, its *s*-dimensions would not match the type of its argument's *s*-dimension.

Now, the problem is that the focus operator and the focused modal particle end up in different dimensions, and therefore the $\sim$-operator gets attached to the content of the *t*-dimension that does not contain any focused expression. Applying the focus interpretation rule (6.81) to this first dimension, we get the following presuppositions:

(6.89) $[\mathbf{snore}(\mathbf{p})] \sim C_2$ presupposes that
a. $C_2 \subset [\![\mathbf{snore}(p)]\!]^f$
b. $[\![\mathbf{snore}(\mathbf{p})]\!]^o \in C_2$
c. C_2 contains at least one additional element.

Note that because there is no focus feature present at **snore(p)**, its focus value is just the singleton set of its ordinary value. That is, it holds that $[\![\mathbf{snore}(\mathbf{p})]\!]^f = \{[\![\mathbf{snore}(\mathbf{p})]\!]^o\}$. Now, if we substitute this into (6.89), we end up with the following presuppositions:

(6.90) $[\mathbf{snore}(\mathbf{p})] \sim C_2$ presupposes that
a. $C_2 \subset \left\{[\![\mathbf{snore}(\mathbf{p})]\!]^o\right\}$
b. $[\![\mathbf{snore}(\mathbf{peter})]\!]^o \in C_2$
c. C_2 contains at least one additional element.

Crucially, taken together, these three presuppositions are inconsistent. There is no set that is a subset of a singleton set while also containing an additional element. If C_2 is a subset of $\{[\![\mathbf{snore}(\mathbf{peter})]\!]^o\}$ then it cannot contain any further element, and if C_2 contains at least one additional element distinct from $[\![\mathbf{snore}(\mathbf{peter})]\!]^o$, then it is not a subset of $\{[\![\mathbf{snore}(\mathbf{peter})]\!]^o\}$. The three presuppositions in (6.90) hence cannot all be satisfied. Note that all this holds without any assumption about the value of C_2. Thus there is no possible value for C_2 and so no context that fulfills the presupposition of the focus interpretation rule. Stressing a modal particle automatically leads to inconsistent presuppositions, and it can therefore be explained why it is not expected to be possible.

Now let us consider the second possibility, namely that there is (also) a use-conditional variant of Rooth's (1996) focus interpretation operator. Given the assumptions made for $\mathcal{L}_{\mathrm{TU}}$, this is not a valid option either. In order for this hypothetical u-focus operator to attach to the constituent containing the focused particle before it is stored into the u-dimension, it must be of a u-propositional modifier of type $\langle u, u\rangle$. However, the problem is (again) that such an expression cannot enter the compositional system of $\mathcal{L}_{\mathrm{TU}}$, as there is no LER that could extend it into an adequate three-dimensional representation. Therefore, there should be no stressed modal particles for the same reason that there is no u-propositional negation.[14]

[14] Here, the same caveat applies as on page 243. Since $\mathcal{L}_{\mathrm{TU}}$ is set up to account for the empirical observation that there are no u-propositional modifiers, it should not be used as an "explanation" that MPs cannot be stressed; that would be circular. However, the unstressability of MPs fits perfectly into the data that motivated this restriction in the first place and can be understood as further supporting it.

To sum up, given the principles of alternative semantics for focus and an interpretation rule for focus along the lines of Rooth (1992, 1996), the impossibility of stressing modal particles to realize focus is a direct consequence of their use-conditional semantics. We can distinguish two possibilities. First, there is only a truth-conditional version of the focus interpretation operator. Then the unavailability of MP focus follows from the fact that the focus operator is separated from the focused MP during the derivation, which leads to inconsistent presuppositions in all contexts and hence always renders the utterance infelicitous. The alternative of a use-conditional variant of the focus operator does not present an option either, as there is no LER that could render such an expression into a three-dimensional object suitable for derivations in $\mathcal{L}_{TU}$. That is, either way, modal particles cannot be stressed for expressing focus.

There are two syntactic features of MPs that remain unaddressed, namely that they can neither be questioned nor occur in the so-called prefield. As we will see, both properties are closely connected to the (non-)interaction between MPs and focus. I begin with the problem of questions, before addressing the prohibition against occurrence in the prefield.

6.4.4 Questions

Given the inability of MPs to bear focus, there is only a small step towards an explanation of why they cannot be questioned. Focus and questions are connected not only by the linguistic theories developed to account for them, but foremost by the well-known congruence between focus and questions (Büring 1997: 41):

(6.91) A: Who threw the baseball?
B: [JOHN]$_F$ threw the baseball.
B′: #John threw [the BASEball]$_F$.

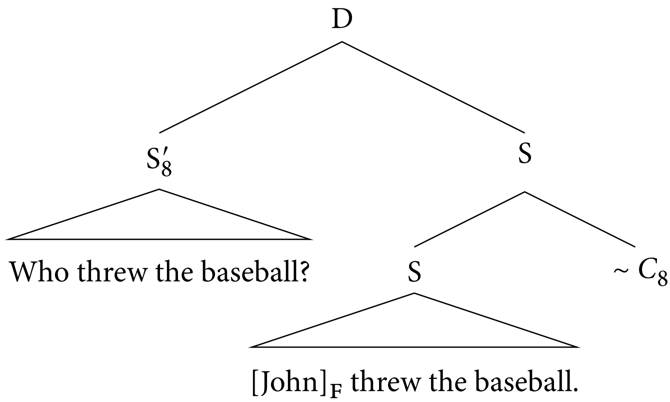
(6.92) A: What did John throw?
B: #[JOHN]$_F$ threw the baseball.
B′: John threw [the BASEball]$_F$.

(6.93) A: Which baseball did John throw?
B: John threw the [OLD]$_F$ baseball.
B′: #John threw [the old BASEball]$_F$.

As these examples show, the question only determines which constituent must include the focus, but also determines the right size of the focused phrase (Büring 1997: 41).

The correlation between focus and questions is captured in Rooth's (1996) alternative semantics as well. Asssuming a discourse node *D* that connects a pair of utterances, the focus relations in a question–answer pair like (6.91) can be modeled by the following structure (cf. Rooth 1992: 88; 1996: 279), which (except for the *D*-node) involves just the same ingredients as the intersentential focus relation from the last section.

(6.94)



The crucial point about this discourse tree is that the focus is related to a variable *C* that is introduced along with the focus operator $\sim$ and which has to be assigned a value. In contrast to the free focus discussed in the previous section, however, the variable in the discourse tree gets coindexed with the question—that is, the question binds the variable and thereby fixes its value so that we must look no further into the context to find a suitable assignment for *C*. Note, furthermore, that according to a simple Hamblin-style semantics, questions denote sets of propositions, namely those propositions that are possible answers to the question (Hamblin 1973). In case of the question in (6.94), this amounts to a set of propositions of the form $\{x : x \text{ threw the baseball}\}$. Furthermore, recall that [John$_F$ threw the baseball]$\sim C_8$ introduces the presupposition that the value of C_8 is a subset of the focus value for [John$_F$ threw the baseball]. This is also a set of propositions of the form *x threw the baseball*. And since C_8 is indexed with the question, the induced presupposition will therefore be satisfied as long as the question denotation is a subset of the focus value of the answer. If the focus feature happens to be on the constituent that is abstracted over in the question, the presuppositions will be satisfied. If, however, the variable is bound by a different question, say the one in (6.92), the presupposition that C_8 is a subset of the focus value will not be satisfied.

This short sketch of how question–answer congruence is handled in alternative semantics is sufficient to provide a semantic rationale for the observation that MPs cannot be questioned (besides possible syntactic reasons). Consider, for instance, the following infelicitous question–answer pair:

(6.95) A: #Wie schläft Paul?
how sleeps Paul
'How does Paul sleep?'

B: *Paul schläft **HALT**$_F$.
Paul sleeps MP
'Paul sleeps *HALT*'

Targeting an MP with a question is bad due to the use-conditional nature of modal particles. Recall from the preceding section that a focus feature on MPs leads to an inconsistent presupposition so that an utterance involving a stressed MP will be infelicitous. This hold is irrespective of the contextual value of *C* and hence also if the value is explicitly determined by a preceding question. Now, the problem is that, even if a question about MPs may be well-formed with respect to semantic composition (which is not clear in the first place), the answer to that question will inevitably be infelicitous. And lacking any felicitous answer is a good reason for a question to be considered infelicitous, too.

6.4.5 Fronting

The last property to be explained is that MPs cannot occur in CP^{spec}, the so-called prefield. Again, maybe there are simple syntactic reasons for this. However, I am again going to consider whether there are semantic considerations that help to explain this observation. Let me first repeat an example that illustrates that modal particles cannot be fronted:

(6.96) ***Ja/halt/doch** Peter ist Philosoph.
MP *Peter is philosopher*

In most cases, only one constituent can occur in the prefield—see Müller (2005) for exceptions—and fronting must be licensed by specific conditions. Steinbach (2002: 162) provides the following list of factors relevant for occupying the prefield in German.[15]

(6.97) *Conditions on occupying CP^{spec} in German*

a. The first argument of the unmarked word order (in the middle field) can occupy CP^{spec}.
b. The focus can occupy CP^{spec}.

[15] Expletive *es* 'it' is another expression that can occur in CP^{spec}.

c. The "topic" can occupy CP^{spec}.
d. Further conditions may depend on structuring the text or discourse.

Given this list, it can be shown that MPs cannot be fronted in German, because none the conditions in (6.97) applies to them.

Condition (6.97a) is not fulfilled, since MPs are not arguments, and hence, their position in the unmarked word order does not matter in the first place. But even if condition (6.97a) also held for non-argument expressions, MPs would not meet it, since in the unmarked word order they follow the subject:[16]

(6.98) Gestern hat Peter **ja** ein Buch gelesen.
yesterday has Peter MP *a book read*
'Yesterday, Peter read *ja* a book.' (unmarked)

(6.99) Gestern hat **ja** Peter ein Buch gelesen. (marked)

That modal particles cannot be the focus of a sentence has already been shown in detail in previous sections. Hence, condition (6.97b) is not satisfied either.

Under the term *topic* in condition (6.97c), Steinbach (2002: 164–7) understands sentence-internal topics (s-topics) as defined by Büring (1997). Here is Büring's (1997: 65) famous example illustrating an s-topic and its interaction with the focus of a sentence. The slashes "/" and "\" indicate rising and falling accents respectively.

(6.100) A: What did the pop stars wear?
B: The [/ FEMALE]$_{\text{T}}$ pop stars wore [CAFTANS\]$_{\text{F}}$.
B′: The female pop stars wore [\CAFTANS]$_{\text{T}}$.

Without going into the details of topics here—see e.g. Büring (1997, 2003); Constant (2012); Wagner (2012)—what is of interest for our purpose is that such s-topics can occur in CP^{spec}, as the following translation of the answer in (6.100) shows (borrowed from Steinbach 2002: 165):

(6.101) Die [/WEIBLICHEN]$_{\text{T}}$ Popstars trugen [KAFTANE\]$_{\text{F}}$.
the female pop-stars wore caftans
'The female pop stars wore caftans.'

[16] Why MPs exhibit this particular position in the middle field seems to be a purely syntactic constraint, which they in turn seem to have inherited through their grammaticalization history (see e.g. Abraham 1991).

The second point of interest is that, according to Büring (1997), s-topics introduce a set of alternative propositions, similar to the effect induced by focus. He models topic by use of a third interpretation function that is built on the notion of focus. The topic value of a sentence is obtained by taking its focus value and building a set that contains the focus values with different substitutions for the s-topic. This yields a set of sets of propositions. The topic is—so to speak—a meta-layer of alternatives to the focus value. For the answer in (6.100), the topic value can be given as follows (Steinbach 1998: 108):

(6.102) {{the female pop stars wore caftans, the female pop stars wore dresses, the female pop stars wore overalls, …},
{the male pop stars wore caftans, the male pop stars wore dresses, the male pop stars wore overalls, …},
{the female or male pop stars wore caftans, the female or male pop stars wore dresses, the female or male pop stars wore overalls, …},
{the Italian pop stars wore caftans, the Italian pop stars wore dresses, the Italian pop stars wore overalls, …}, …}

Crucially, since the notion of topic depends on the focus value of a sentence and since the contribution of the MP is not part of it, the same arguments that can be made against focused MPs can be made against MPs as topic.

Only one of the licensing conditions for fronting is left. However, (6.97d) is trivially not fulfilled, as MPs do not refer to any discourse referents, hence conditions on structuring the discourse do not apply to them (cf. Steinbach 2002: 162). To conclude, MPs meet none of the conditions that can license fronting to CP^{spec} in German, so that MPs cannot occur in the prefield.

6.5 Modal particles and sentence mood

Now that I have illustrated how a hybrid use-conditional analysis of modal particles can be used to derive many of their special semantic and syntactic properties, I will combine the analysis of MPs with the approach to sentence mood developed in the previous chapter, in order to gain insight into the interaction between modal particles and sentence mood. As the overview in §6.2.3 has shown, this interaction comes in two flavors. First, there are heavy selectional restrictions between sentence mood and MPs—most MPs can only occur in a small subset of sentence types. As argued above, these restrictions arise mainly from their incompatibility with the sentence mood of the sentence types from which they are restricted. In the following, however, I will show that not all incompatibilities are the same and that they have two different sources. On the one hand, an MP may be in a conflict with sentence mood regarding its contribution to an utterance's use-conditions. If the use-conditions imposed by an MP are contradictory to those expressed by a particular sentence mood, then the use of that MP in such a sentence will always render the utterance infelicitous. On the other hand, the incompatibility of an MP with a certain sentence mood may stem from a mismatch of their semantic types. As I will argue, some MPs directly modify the sentence mood operators. This holds for MPs like *wohl* which are regarded as *sentence-type modifiers* by M. Zimmermann (2004a,b).[17] Then, if an MP takes a sentence mood operator as its argument, a type mismatch between the MP and the mood operator can arise and thereby exclude some MPs from sentences with such a mood.

The other way in which MPs and sentence mood are closely connected is that many MPs interact in interesting ways with mood. Again, this can happen in two ways. One possibility is that the interaction is very direct and that an MP directly modifies sentence mood operators, as just mentioned. The other possibility is rather indirect. Many modal particles, like for instance *ja* and *doch*, do not modify sentence mood directly, but instead make an independent contribution to the use conditions of a sentence. However, since their contribution is merged with the contribution of mood in the *u*-dimension, such MPs may still give the impression of modifying sentence mood as well. For the sentence to be felicitously uttered, the attitudes expressed by sentence mood and the contribution conveyed by modal particles both have to hold.

Let me start by briefly recalling the relevant data from §6.2.3.1, where I examined the intersentential distribution of *ja*, *denn*, and *wohl*. While *ja* is licensed in declaratives it is possible neither in interrogatives nor in imperatives. For *denn*, things are similar insofar as it can only occur in one sentence mood, but contrasting with *ja*, it is only licensed in interrogatives. Finally, *wohl* can occur in both declaratives and interrogatives, but not in imperatives, unlike *ja* and *denn*. Table 6.1 summarizes this:

[17] This terminology is a little bit misleading, as it is not literally the *sentence type* that is being modified in his approach, but rather sentence mood operators that determine the denotation of a sentence. A V2-declarative is still a V2-declarative even if *wohl* is used.

TABLE 6.1 Comparison of the distribution of *ja, denn*, and *wohl*

sentence type	ja	denn	wohl
declaratives	✓	✗	✓
interrogatives	✗	✓	✓
imperatives	✗	✗	✗

A first reflection on these data delivers the following conclusion. Since *ja* can occur in declaratives but not in interrogatives, it seems unlikely that it directly modifies sentence mood operators, since in both declaratives and interrogatives, there is a deontic and an epistemic sentence mood operator. Hence it would be unclear where a type mismatch could stem from. The argument also applies to *denn*, as it occurs in interrogatives but not in declaratives. For *wohl* however, a treatment as a modifier on sentence mood operators seems more plausible, as is licensed in both declaratives and interrogatives, but not in imperatives. Since the former both involve the epistemic sentence mood operator, while the latter does not, thinking about *wohl* as modifying the epistemic operator may be on the right track. These considerations converge with M. Zimmermann's (2004a,b) observation that there seem to be two different "kinds" of MP, namely those like *wohl* that modify a component of sentence mood, and those like *ja* that are fairly free insofar as they add their own independent contribution to the overall meaning of a sentence. In terms of the kinds of UCI introduced in Chapter 2, MPs of the free-modifier kind are expletive functional UCIs, while the mood modifying MPs are use-conditional modifiers. In the following, I will first discuss the case of type mismatches as a reason for selectional restrictions, before going on to deal with the free MPs.

6.5.1 Selectional restrictions due to types

In the case of MPs of the sentence mood modifying variety, mismatches between semantic types can be held responsible for the selectional restrictions. As argued above, a plausible candidate for such an MP is *wohl*, which can occur in declaratives as well as in interrogatives, but not in imperatives. An obvious explanation for this distribution is that *wohl* modifies the epistemic mood operator, which is present in declaratives and interrogatives but absent from imperatives. Therefore, *wohl* receives a high type whose argument type fits the type of the epistemic operator (and hence not that of the deontic operator). This leads us to the following lexical entry:

(6.103) $\textbf{wohl} : \langle\langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle, \langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle\rangle$

That is, *wohl* is a higher-order modifier on use-conditional modifiers. With respect to the lexical extension rules, it is the generalized LER for use-conditional modification given in (4.67) on page 142 that equips the lexical entry with the missing two dimensions. I repeat this LER here for convenience:

(6.104) *LER for generalized use-conditional modification*
$\alpha \Rightarrow \langle I_{\sigma^n}, \alpha, U\rangle$, if $\alpha \in \textbf{Con}_{\langle\sigma,\tau\rangle^n}$, where σ is a truth-conditional type and τ is a use-conditional type.

If we let $n = 2$ and $\sigma = \langle s,t\rangle$ and $\tau = u$, then this LER fits the lexical entry in (6.103) and can therefore extend it as follows:[18]

(6.105)
$$(6.103) \Rightarrow \quad \begin{array}{c} \bullet\, U \\ \blacklozenge\ \textbf{wohl} : \langle\langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle, \langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle\rangle \\ I_{\langle\langle\langle s,t\rangle,\langle s,t\rangle\rangle,\langle\langle s,t\rangle,\langle s,t\rangle\rangle\rangle} \end{array}$$

In order to save space with these massive types, I will use $\langle s,t\rangle \leftrightsquigarrow p$ as an abbreviation convention for the type of truth-conditional propositions. The translation in (6.105) therefore reduces to the following expression:

(6.106)
$$\begin{array}{c} \bullet\, U \\ \blacklozenge\ \textbf{wohl} : \langle\langle\langle p,u\rangle, \langle p,u\rangle\rangle, \langle\langle p,u\rangle, \langle p,u\rangle\rangle\rangle \\ I_{\langle\langle p,p\rangle,\langle p,p\rangle\rangle} \end{array}$$

From this extended translation, the restriction of *wohl* to declaratives and interrogatives directly follows without any reference to the meaning of *wohl*. Recall that in imperatives and root-*dass* clauses, there is no epistemic operator and therefore no suitable argument for *wohl* to

[18] The case of *wohl*, by the way, exemplifies the ambiguity that is inherent in (6.104) regarding the way in which the rule applies to the input, which I have mentioned in footnote 21 on page 142. Note, that since **wohl** is a second-order use-conditional modifier, there are three ways in which the type of **wohl** can be constructed by means of the modifier type construction rule defined in (4.66):

(6.107) a. $\langle\langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle, \langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle\rangle^0$
b. $\langle\langle\langle s,t\rangle, u\rangle, \langle\langle s,t\rangle, u\rangle\rangle^1$
c. $\langle\langle s,t\rangle, u\rangle^2$

However, even if all these three possibilities construct the same high type, only the last one actually fulfills the side condition for (6.104), since only in this construction is the argument type a truth-conditional type.

take. Accordingly, no well-formed semantic proof can be built for an imperative containing *wohl*. The following example illustrates this:

(6.108) *Geh **wohl** weg! ('Go *wohl* away!')

$$\dfrac{\dfrac{\begin{array}{c}\bullet\, U\\ \blacklozenge\ \textsc{deont} : \langle p,u\rangle\\ I_p\end{array}\qquad \begin{array}{c}\bullet\, U\\ \blacklozenge\ \mathbf{wohl} : \langle\langle\langle p,u\rangle,\langle p,u\rangle\rangle,\langle\langle p,u\rangle,\langle p,u\rangle\rangle\rangle\\ I_{\langle\langle p,p\rangle,\langle p,p\rangle\rangle}\end{array}}{\lightning}\,\text{✗}\qquad \begin{array}{c}\vdots\\ \bullet\, U\\ \blacklozenge\ \lambda i.\mathbf{go\text{-}away}_i(c_A) : p\\ \lambda i.\mathbf{go\text{-}away}_i(c_A) : p\end{array}}{\lightning}\,?$$

The restriction against using *wohl* in sentence with a purely deontic mood can thus be directly explained by reference to its semantic type.

Let me now show how *wohl* interacts with the epistemic mood operator. I first give a semantic translation of *wohl* that is a bit more explicit than the one I gave in (6.103) with respect to its arguments.

(6.109) $wohl \rightsquigarrow \lambda E\lambda D\lambda p.\mathbf{wohl}(E)(D)(p) : \langle\langle\langle p,u\rangle,\langle p,u\rangle\rangle,\langle\langle p,u\rangle,\langle p,u\rangle\rangle\rangle$

For the moment, let us focus on just this expression which, after the extension by LER (6.104), constitutes the *s*-dimension of the three-dimensional representation of *wohl* in $\mathcal{L}_{\mathrm{TU}}$.

Regarding the concrete lexical semantics of *wohl*, I suppose—with M. Zimmermann (2004b)—that *wohl* introduces an additional epistemic operator ASSUME that scopes over the propositional content of a sentence but is itself embedded under the epistemic sentence mood operator. Since it depends on the context and the sentence mood whether ASSUME relates to the assumptions of the hearer or the speaker, it should be defined in a context-sensitive way, just like the other sentence mood operators. This operator captures the intuitive effect which *wohl* has, namely that it allows for a certain degree of uncertainty in an assertion or an answer, depending on the sentence mood. Accordingly, **wohl** can be defined as follows:

(6.110) $\lambda E\lambda D\lambda p.\mathbf{wohl}(E)(D)(p) \stackrel{\text{def}}{=} \lambda E\lambda D\lambda p.E(D)(\textsc{assume}(p))$

This definition looks a little complicated. To see how it works and that it delivers the desired results, let us have a closer look at this function and how it combines with its arguments. I have already chosen the argument variables in such a way that they give hints as to how the composition of *wohl* works. The first argument **wohl** takes is the epistemic mood operator **E**, introduced in (5.91) on page 210. It then combines with the deontic operator and finally combines with the propositional content of the sentence (abbreviated here to **prop**) to yield a *u*-proposition. Hence the composition for the *s*-dimension is given as follows:

(6.111)
$$\dfrac{\dfrac{\dfrac{\lambda E\lambda D\lambda p.\mathbf{wohl}(E)(D)(p) : \langle\langle\langle p,u\rangle,\langle p,u\rangle\rangle,\langle\langle p,u\rangle,\langle p,u\rangle\rangle\rangle \qquad \mathrm{E} : \langle\langle p,u\rangle,\langle p,u\rangle\rangle}{\lambda D\lambda p.\mathbf{wohl}(\mathrm{E})(D)(p) : \langle\langle p,u\rangle,\langle p,u\rangle\rangle} \qquad \textsc{deont} : \langle p,u\rangle}{\lambda p.\mathbf{wohl}(\mathrm{E})(\textsc{deont})(p) : \langle p,u\rangle} \qquad \mathbf{prop} : p}{\mathbf{wohl}(\mathrm{E})(\textsc{deont})(\mathbf{prop}) : u}$$

This is what happens in the *s*-dimension of a declarative sentence involving *wohl*. What happens in the truth-conditional dimensions is rather trivial, as it involves a cascade of ever-higher identity functions whose sole effect is to pass the propositional content through the proof. For the sake of completeness, I present this process in full here, where the types of the identity functions have been made explicit.

(6.112)
$$\dfrac{\dfrac{\dfrac{I_{\langle\langle p,p\rangle,\langle p,p\rangle\rangle} : \langle\langle\langle p,p\rangle,\langle p,p\rangle\rangle,\langle\langle p,p\rangle,\langle p,p\rangle\rangle\rangle \qquad I_{\langle p,p\rangle} : \langle\langle p,p\rangle,\langle p,p\rangle\rangle}{I_{\langle p,p\rangle} : \langle\langle p,p\rangle,\langle p,p\rangle\rangle} \qquad I_p : \langle p,p\rangle}{I_p : \langle p,p\rangle} \qquad \mathbf{prop} : p}{\mathbf{prop} : p}$$

Comparing the types of the identity functions with the corresponding expression in the *s*-dimension in (6.111) nicely illustrates the effect that the type construction rule for use-conditional modifiers has on the *t*-dimension. What it basically does is insert an identity function in the first dimension whose type is the same as the type of the starting expression but with all instances of type *u* substituted by the proper truth-conditional type ($\langle s,t\rangle = p$ in this case).

Finally, the *u*-dimension is even more trivial, as there is simply merging of the neutral expression *U*. Taking all these dimensions together gives us the following output of the multidimensional proof, which can then be further reduced by use-conditional elimination:

(6.113)
$$\dfrac{\mathbf{prop} : p \blacklozenge \mathbf{wohl}(\mathrm{E})(\textsc{deont})(\mathbf{prop}) : u \bullet U}{\mathbf{prop} : p \blacklozenge \mathbf{prop} : p \bullet \mathbf{wohl}(\mathrm{E})(\textsc{deont})(\mathbf{prop}) : u}\ \mathrm{UE}$$

The interpretation rules then delivers the following (schematic) truth and use conditions for a *wohl*-declarative with propositional content **prop**:

(6.114) a. S^{wohl} is true in a world w and a context c iff $w \in [\![\mathbf{prop}]\!]$.

b. S^{wohl} is felicitous in a world w and a context c iff $c \in [\![\mathbf{wohl}(\mathrm{E})(\textsc{deont})(\mathbf{prop})]\!]$.

Concerning the truth conditions in (6.114a), the $\mathcal{L}_{\mathrm{TU}}$ proof delivers the same result as if *wohl* were not present at all (nor, for that matter, the two sentence mood operators). The truth conditions are merely given by the propositional content of the sentence in which *wohl* occurs. To get the use conditions expressed by the formula in (6.114b), we first have to plug in the definition for the operators involved. Let us do this step by step. First, according to the definition of **wohl** in (6.110), the following equation holds:

(6.115) $\mathbf{wohl}(\mathrm{E})(\textsc{deont})(\mathbf{prop}) = \mathrm{E}(\textsc{deont})(\textsc{assume}(\mathbf{prop}))$

If we now apply the definition of the sentence mood operator **E** as given in (5.91) on page 210 to the right hand side of this equation, we get the following:

(6.116) $\mathrm{E}(\textsc{deont})(\textsc{assume}(\mathbf{prop})) = \textsc{deont}(\textsc{epis}(\textsc{assume}(p)))$

This seems to get the use conditions right. Using *wohl* in a declarative (or interrogative) provides a deontic/epistemic interpretation regarding the speaker's (or hearer's) assumption. Depending on what the context delivers for DEONT and ASSUME, we may get something like the truth conditions in (6.118) and the use conditions in (6.119) for the following declarative sentence with *wohl* in (6.117):

(6.117) Peter ist **wohl** ein Philosoph. 'Peter is *wohl* a philosopher.'

(6.118) "Peter ist **wohl** ein Philosoph" is true (in German) iff Peter is a philosopher.

(6.119) "Peter ist **wohl** ein Philosoph" is felicitously uttered (in German) iff the speaker **wants** the hearer **to know** that the speaker **assumes** that Peter is a philosopher.

This hybrid semantics that $\mathcal{L}_{\mathrm{TU}}$ assigns to *wohl*-declaratives is in accordance with the semantics M. Zimmermann (2004a,b) assigns to *wohl*, without committing to his claim that the assumption part is part of the sentence's truth conditions.

As this section has shown, the selectional restrictions that hold for *wohl* follow from the semantic type assigned to it, which is such a high modifier type that it can only apply to the epistemic sentence mood operator. Since this is absent in imperatives, *wohl* cannot occur there. However, as the following section will detail, such an explanation is not available for all MPs, but only for those of the sentence mood modifier type.

6.5.2 Selectional restrictions due to meaning

In contrast to *wohl*, the selectional restrictions for *ja* and *denn* cannot be derived by references to type mismatch. A simple consideration can make clear why this is impossible. Let me start with *ja*. Recall first that *ja* is only licensed in V2-declaratives (Kwon 2005: 183), but crucially not in interrogatives; and then that both declaratives and interrogatives involve the same mood operators. Therefore, no explanation that is solely based on the type of *ja* and the two operators can derive the difference in the acceptability of *ja* in these two sentence types.

We must hence look at the lexical meaning of *ja* if we want to derive its impossibility in interrogatives. So let us review various descriptions of the contribution of *ja* that can be found in the literature on German modal particles. First comes Helbig's (1988) *Lexikon deutscher Partikeln*:

> [*ja*] signals that the uttered **proposition is known by both the speaker and the hearer** ('as we both know'), or even that it is evident or universally valid. It refers to **mutual previous knowledge**, presupposes consensus (a common basis for communication) and/or appeals to agreement. The speaker presupposes the proposition as being known, but wants to ensure that it is salient (quasi recalls it).
>
> (Helbig 1988: 165, my translation and emphasis, DG)

In addition, consider how Kratzer (2004) characterizes the use-conditional meaning of *ja*, which is akin to Helbig's characterization:

> The discourse particle *ja* is commonly used to draw attention to an **obvious fact**. That fact might be one that is either **already part of shared knowledge**, or else can be verified on the spot, given the extra-linguistic evidence. (Kratzer 2004: 126, my emphasis, DG)

If this is on the right track, *ja* does not modify any mood operators, but instead flags the propositional content of a declarative sentence as already known or easily verifiable. In terms of $\mathcal{L}_{\mathrm{TU}}$, *ja* thus translates into a functional expletive UCI that takes a propositional argument:

(6.120) $ja \rightsquigarrow \lambda p.\mathbf{ja}(p) : \langle\langle s,t\rangle, u\rangle$

This expression is then extended as usual by the LER for functional expletives into a three-dimensional representation that is ready for composition:

(6.121) $\lambda p.\mathbf{ja}(p) : \langle\langle s,t\rangle, u\rangle \Rightarrow I_{\langle s,t\rangle} \blacklozenge \lambda p.\mathbf{ja}(p) : \langle\langle s,t\rangle, u\rangle \bullet U$

This, of course, helps us only to account for the composition of *ja* with the rest of the sentence. In order to derive the restrictions, we need suitable lexical semantics. I do not want to delve too deep into this issue, as the lexical semantics of all MPs are extremely subtle. I therefore use the following informal lexical semantics for *ja*, which tries to capture the basic ideas from the quotes above:

(6.122) $[\![\mathbf{ja}]\!] = \lambda p.\{c : c_S$ believes that p is common knowledge of c_S and c_H in c_W or that p is verifiable on the spot in $c_W\}$

Given this interpretation, let us consider the semantic proof for a declarative sentence containing *ja*. Again, I abbreviate the propositional content to **prop** and abbreviate $\langle s,t\rangle$ as p.

(6.123)

$$\dfrac{\dfrac{\mathbf{E} : \langle\langle p,u\rangle,\langle p,u\rangle\rangle \quad \textsc{deont} : \langle p,u\rangle}{\mathbf{E}(\textsc{deont}) : \langle p,u\rangle}\,\mathrm{MA} \qquad \dfrac{\dfrac{\mathbf{ja} : \langle p,u\rangle \quad \mathbf{prop} : p}{\begin{array}{c}\blacklozenge\ \mathbf{ja}(\mathbf{prop}) : u\\ \mathbf{prop} : p\end{array}}\,\mathrm{MA}}{\begin{array}{c}\bullet\ \mathbf{ja}(\mathbf{prop}) : u\\ \mathbf{prop} : p\end{array}}\,\mathrm{UE}}{\dfrac{\begin{array}{c}\bullet\ \mathbf{ja}(\mathbf{prop}) : u\\ \blacklozenge\ \mathbf{E}(\textsc{deont})(\mathbf{prop}) : u\\ \mathbf{prop} : p\end{array}}{\begin{array}{c}\bullet\ \mathbf{E}(\textsc{deont})(\mathbf{prop}) : u \odot \mathbf{ja}(\mathbf{prop}) : u\\ \blacklozenge\ \mathbf{prop} : p\\ \mathbf{prop} : p\end{array}}\,\mathrm{UE}}\,\mathrm{MA}$$

Given this semantic proof and the definitions of E, we end up with the hybrid interpretation in (6.125) for a *ja*-declarative like the following:

(6.124) Georg is **ja** ein Philosoph. 'Georg is *ja* a philosopher.'

(6.125) a. $\|(6.124)\|^t = [\![\mathbf{philo(g)}]\!]$
b. $\|(6.124)\|^u = [\![\textsc{deont}(\textsc{epis}(\mathbf{philo(g)})) \odot \mathbf{ja}(\mathbf{philo(g)})]\!]$

Filling these two interpretations with actual content of the meaning dimension, we arrive at the truth and use conditions in (6.126) and (6.127):

(6.126) "Georg is **ja** ein Philosoph" is true (in German) iff Georg is a philosopher.

(6.127) "Georg is **ja** ein Philosoph" is felicitously uttered (in German) iff c_S wants that c_H knows that Georg is a philosopher and c_S

believes that it is common knowledge of c_S and c_H that Georg is a philosopher or that it is verifiable on the spot.

From the use-conditional part of this hybrid semantics, the various discourse functions ascribed to *ja* can be derived. For instance, the fact that by using *ja*, the speaker often wants the hearer to recall the state of affairs in question can be regarded as the combination of the fact that the speaker wants the addressee to know that *p* with the speaker's believing at the same time that the addressee already knows that *p*. Recalling means wanting somebody to know something which you believe they already know. Furthermore, the incompatibility of *ja* with interrogatives falls out from this semantics as well. I forgo the entire semantic proof for the following interrogative and just provide its use conditions in English:

(6.128) *Ist Peter **ja** ein Philosoph?
is Peter MP *a philosopher*
*'Is Peter *ja* a philosopher?'

(6.129) "Ist Peter **ja** ein Philosoph?" is felicitously uttered (in German) iff the c_S wants to know whether Peter is a philosopher and the c_H knows whether Peter is a philospher and the speaker believes that it is common knowledge of c_S and c_H that Peter is a philosopher or that it is verifiable on the spot.

It should be clear that there is no situation in which these use conditions can be fulfilled if the speaker behaves reasonably. If the speaker believes that it is already common knowledge that Peter is a philosopher, why should she raise the question in the first place? Hence, this straightforwardly accounts for the incompatibility of *ja* with the sentence mood of interrogatives.

Having derived the selectional restrictions for *wohl* and *ja*, let us finally turn to *denn*. For *denn*, the situation is similar to that for *ja*, as it is allowed in one of the epistemic sentence moods, but not the other. Thus, a selectional restriction due to a type mismatch cannot be the solution, as it was for *wohl*. As we did for *ja*, let us first consult some descriptions of *denn*'s meaning. Helbig's (1988) particle lexicon provides the following entry:

> [*denn*] refers to something that is **known by the hearer** (or that the speaker assumes is known by the hearer), or **motivates the question from the situation** (mostly in a continuation of a dialogue). It refers to the conversation and is backward connecting [...]; it renders a question more natural and polite.
>
> (Helbig 1988: 107, my translation and emphasis, DG)

Note that Helbig (1988: 105–9) gives no less than five different entries for unstressed *denn* in interrogatives only. However, I endorse the common criticism of such proliferation of MP-senses, that most of the other meanings can either be derived from a core meaning and the context or are not contributed by *denn* at all, but are rather inferences that hold in the context which are falsely attributed to *denn* (cf. Karagjosova 2004). For further hints about how we should mount the semantics for *denn*, consider the "overall meaning" which Helbig (1988) ascribes to all the different instances of *denn*:

> Overall meaning: *denn* refers to previous [events or utterances] and **externally motivates the question** (or the exclamation) and implies some elements of **justification**. It commits the speaker to a non-assertive attitude.
>
> (Helbig 1988: 110, my translation and emphasis, DG)

For a similar description of the meaning of *denn*, consider the following characterization given by Thurmair (1989):

> Questions with *denn* always refer to the interactional context (cf. König 1977: 122); *denn* indicates that **the motivation for the question can be found in the actual context of communication** [. . .]. (Thurmair 1989: 164, my translation and emphasis, DG)

Before I define a semantics for *denn*, let me mention two things. First, I think that the reference to previous events or utterances mentioned by Helbig (1977) can be excluded from the meaning of *denn* since that would already follow from the fact that it refers to external reasons for the questions. Secondly, the condition that the question concerns something the speaker already knows can also be left out, since *denn* only occurs in *yes/no*- and *wh*-V2-interrogatives. Recall that according to Truckenbrodt (2006b), there is an additional [$-wh$]-feature present in V-in-C interrogatives that triggers a second epistemic interpretation, which conveys that the hearer knows the answer to the question. Hence, the condition that the hearer knows the answer is not communicated by *denn*, but by the sentence mood. To represent this additional epistemic condition in the semantics of V-in-C interrogatives, I used a second epistemic mood operator that carries this condition on hearer knowledge. I repeat the definition from (5.99) on page 212 here:

(6.130) $[\![\text{HKNOW}]\!] = \lambda p. \left\{c : c_A \text{ knows whether } p \text{ in } c_W\right\}$

Like *ja*, this operator is a functional expletive UCI that takes a propositional argument. I define *denn* such that it can modify this additional epistemic component, to capture the notion that *denn* can only be used in sentences in which this mood operator is present.

(6.131) *denn* $\rightsquigarrow \lambda H \lambda p.\mathbf{denn}(H)(p) : \langle\langle p,u\rangle,\langle p,u\rangle\rangle$

Again, it is the lexical extension rule for use-conditional modification (4.61) that extends this lexical entry into a three-dimensional representation:

(6.132) $\mathbf{denn} : \langle\langle p,u\rangle,\langle p,u\rangle\rangle \Rightarrow I_{\langle p,p\rangle} \blacklozenge \mathbf{denn} : \langle\langle p,u\rangle,\langle p,u\rangle\rangle \bullet U$

This works similarly as for *wohl*, except that the type is lower. Note furthermore how the type of *denn* equals the type of the epistemic sentence mood operator. Besides this combinatoric semantics, what *denn* does in terms of lexical semantics is to modify the hearer knowledge operator by adding an additional hearer knowledge condition, namely that the hearer also knows the reason why the speaker raises the question in the first place. This is the external motivation discussed above.

(6.133) $\lambda H \lambda p.\mathbf{denn}(H)(p) \overset{\text{def}}{=}$
$\lambda H \lambda p.(H(p) \odot \exists q_{\in \text{CG}}[H(\mathbf{reason}(q)(\mathbf{ask}(p)(\mathbf{the\text{-}speaker}))])$

This semantic translation for *denn* can then be applied to the hearer-knowledge operator and the propositional content to yield the use-conditional proposition that the hearer knows the answer to the question and that there is some proposition in the common ground which is known by the hearer to be the reason for the speaker to raise the question. So, *denn* simply adds reference to an external motivation for the assumption of hearer knowledge that is present in V-in-C interrogatives anyway. An example derivation for a simple V1-interrogative containing *denn* is given in (6.135). Again, I focus only on the use-conditional dimensions, as the proof is monstrous enough as it is and nothing besides the application of identity functions happens in the *t*-dimension.

(6.134) Hast du **denn** einen Führerschein? 'Do you *denn* have a driver's license?'

(6.135)

$$\dfrac{\dfrac{\mathbf{denn} : \langle\langle p,u\rangle,\langle p,u\rangle\rangle \qquad \textsc{hknow} : \langle p,u\rangle}{\mathbf{denn}(\textsc{hknow}) : \langle p,u\rangle}\,\text{MA} \qquad \dfrac{\dfrac{\dfrac{\mathbf{E} : \langle\langle p,u\rangle,\langle p,u\rangle\rangle \qquad \textsc{deont} : \langle p,u\rangle}{\mathbf{E}(\textsc{deont}) : \langle p,u\rangle}\,\text{MA} \qquad \mathbf{prop} : p}{\mathbf{E}(\textsc{deont})(\mathbf{prop}) : u}\,\text{MA}}{\mathbf{prop} : t \bullet \mathbf{E}(\textsc{deont})(\mathbf{prop}) : u}\,\text{UE}}{\dfrac{\mathbf{denn}(\textsc{hknow})(\mathbf{prop}) : u \bullet \mathbf{E}(\textsc{deont})(\mathbf{prop}) : u}{\mathbf{prop} : t \bullet \mathbf{E}(\textsc{deont})(\mathbf{prop}) : u \odot \mathbf{denn}(\textsc{hknow})(\mathbf{prop}) : u}\,\text{UE}}\,\text{MA}$$

If we substitute **E** and **denn** by their definitions, we arrive at the following *u*-content, which consists of three merged use-conditional propositions:

(6.136) $\textsc{deont}(\textsc{epis}(\mathbf{prop})) \odot \textsc{hknow}(\mathbf{prop}) \odot$
$\exists q_{\in CG}[\textsc{hknow}(\mathbf{reason}(q)(\mathbf{ask}(\mathbf{prop})(\mathbf{the\text{-}speaker})))]$

If this term gets interpreted, we end up with the following use conditions for (6.134):

(6.137) "Hast du **denn** einen Führerschein?" is felicitously uttered (in German) iff c_S wants to know whether c_H has a driver's license and c_H knows whether c_H has a driver's license and there is a proposition c_H knows to be the reason for c_S to ask whether c_H has a driver's license.

This seems to get the use conditions for that sentence right. For instance, if there is no proposition that the addressee knows to be the reason why the speaker raises the question, it is infelicitous. This complies with the observation that *denn* cannot be used discourse-initially, unless there is some extralinguistic state of affairs or event that can act as such a reason:

(6.138) *Entschuldigung, könnten Sie mir **denn** sagen, wo's
excuse could you me MP *say where-it*
hier nach Klein-Heubach geht?
here to Klein-Heubach goes
*'Excuse me, could you *denn* tell me the way to Klein-Heubach?'

(Thurmair 1989: 165)

(6.139) Was schreibst du **denn** da?
what write you MP *there*
'What are you *denn* writing (there)?' (Kwon 2005: 113)

Providing Klein-Heubach has not been the topic in the previous discourse or has otherwise become salient, the utterance (6.138) is infelicitous. In contrast, an utterance of (6.139) is felicitous if there is sufficient extralinguistic motivation for the speaker to ask the question: for instance, that she sees the addressee writing.

The way in which I have defined the semantics for *denn* is also able to explain why it can only be used in interrogatives that have the finite verb in C^0 (cf. Kwon 2005: 183). Note that *denn* translates into an expression of type $\langle\langle p, u\rangle, \langle p, u\rangle\rangle$—that is, it is a modifier on functions from *t*- to *u*-propositions. Note that sentence types other than V2- or V1-interrogatives lack the HKNOW operator, such that the only possible argument matching the input type of *denn* is the deontic sentence type operator. To see that this can be excluded, we first calculate the outcome of such an application:

(6.140)
$$\begin{aligned}&\lambda P\lambda p.\mathbf{denn}(P)(p)(\lambda r.\textsc{deont}(r))\\ &= \lambda p.\mathbf{denn}(\lambda r.\textsc{deont}(r))(p)\\ &= \lambda p.\lambda r.\textsc{deont}(r)(p)\odot\\ &\quad\exists q_{\in \mathrm{CG}}[\lambda r.\textsc{deont}(r)(\mathbf{reason}(q)(\mathbf{ask}(p)(\mathbf{the\text{-}speaker}))]\\ &= \lambda p.\textsc{deont}(p)\odot\\ &\quad\exists q_{\in \mathrm{CG}}[\textsc{deont}(\mathbf{reason}(q)(\mathbf{ask}(p)(\mathbf{the\text{-}speaker}))]\end{aligned}$$

In an imperative where there is no epistemic sentence mood operator, this expression is then applied to a propositional argument. The resulting use conditions, however, will never be fulfilled by rational interlocutors. Here is an example of an imperative with *denn* together with its use conditions.

(6.141) *Geh **denn** weg! *'Go *denn* away!'

(6.142) "Geh **denn** weg!" is felicitously uttered (in German) iff the c_S wants c_H to go away and there is a proposition such that c_S wants it to be the reason that c_S asks whether c_H goes away.

These are quite strange use conditions. The same holds for declaratives. Let me forgo the calculation for this case and just state the use conditions.

(6.143) *Peter ist **denn** ein Philosoph. *'Peter is *denn* a philosopher.'

(6.144) "Peter ist **denn** ein Philosoph" is felicitously uttered (in German) iff c_S wants c_H to know that Peter is a philosopher and there is a proposition such that c_S wants c_H to know that it is the reason why c_S asks whether Peter is a philosopher.

It should be clear that these are not attitudes rational speakers would hold. Therefore, the selectional restrictions that hold for *denn* can be derived from its interaction with the sentence mood of the utterance in which it is used.

6.6 Chapter summary

Before I conclude this chapter, allow me to say some words about what I think are the most important findings of the last two chapters. First, I hope that I have been able to demonstrate that Kaplan's (1999) idea, to employ the basic concepts of theories of meaning as use, is a very fruitful one; at least, when they are unified with rather traditional truth-conditional semantics into a, as I call it, *hybrid* semantics.

If my use-conditional analysis of modal particles and sentence mood is on the right track, then there are far more expressions that conventionally contribute to the conditions under which a sentence can be felicitously uttered than just the usual suspects like derogatives, slurs, or expressives like *ouch* or *damn*. Moreover, due to the use-conditional nature of sentence mood, every sentence has use-conditional content besides its truth conditions, and I am also sure that there are sentences that have only use conditions and no truth-conditional content, like the simple exclamation of *Hello!*, exclamatives, or the solely derogatory and truth-conditionally uninformative utterance *Peter is a fucking asshole*.

Regarding the question of what this chapter has contributed to our understanding of modal particles, let me highlight two main points. First of all, I hope I convinced the reader that a detailed look at their semantics and the way in which they contribute to the overall meaning of an utterance can not only solve many of the riddles they pose for the syntactician, but that a worked-out semantics can also help to derive the selectional restrictions that hold for MPs. This leads to the second point. Our investigation of the different sources for selectional restrictions made it clear that there is no ready-made solution that fits them all. Instead each MP needs a made-to-measure explanation of its selectional restrictions. However, this should not surprise us, given that there is no such thing as two MPs that have exactly the same distribution, as a quick glance at the table in Kwon (2005: 183) reveals. It is hard even to see common patterns. Such non-homogeneity would directly follow if there were many different reasons for selectional restrictions. This does not mean, however, that a careful analysis of those reasons may not finally reveal some underlying rules and generalizations. Thus, the search for common patterns of sources for the selectional restrictions provides an entire research program for the future.

However, modal particles and sentence mood, the subjects of the two case studies I have presented, are not the only area that provide room for further research. I believe that the general framework developed and used throughout this book can be fruitfully applied to many other phenomena. In the next, concluding, chapter I will therefore take a look beyond my discussion thus far and briefly review further phenomena that seem to be promising fields of application for hybrids semantics and $\mathcal{L}_{\mathrm{TU}}$.

7

Uncharted dimensions

7.1 Introduction

Contrary to what may be expected, I will not provide a summary of the discussion set out in this book in this concluding chapter. Instead, its purpose is to look beyond the empirical phenomena I have studied to this point, and briefly sketch further domains to which the two main concepts I have presented—use-conditional meaning and hybrid semantics—as well as their formal implementation in $\mathcal{L}_{\mathrm{TU}}$, may fruitfully be applied.

7.2 Use-conditional and non-at-issue meaning

The additional meaning dimension in hybrid semantics (beside the *s*-dimension for composition) is conceptualized as being use-conditional, because it determines whether an utterance in a given context is felicitous or not. However, there is also the dichotomy between *at-issue* and *non-at-issue* meaning, which is used in a way quite similar to my distinction between truth- and use-conditional meaning, and which is relatively prevalent in the literature, due to the influence of Potts's (2005) work. However, I think it is important to note that these two distinctions are orthogonal to each other and do not necessarily draw the same distinctions. This becomes most obvious if we consider the other major class of non-at-issue expressions that Potts (2005) deals with besides expressives, namely supplementary expressions such as non-restrictive relative clauses or nominal appositives, which I briefly discussed in §3.2, on page 45. Consider, for instance, a non-restrictive relative clause:

(7.1) Pete, **who got a PhD in philosophy**, is a supporter of animal rights.

Now, even if the fact that Pete is a Doctor of Philosophy may not be at-issue, it is clearly something that can easily be evaluated truth-conditionally. The non-restrictive relative clause, when combined with its anchor *Pete*, is true, if Pete got a PhD in philosophy. That is, we can easily have truth-conditional content that is nevertheless not at-issue, which already proves that the questions of truth-conditionality and at-issueness are not the same.

The question now is whether use-conditional meaning is a subclass of non-at-issue meaning, since Potts treats expressive UCIs, like in (7.2), as contributing non-at-issue content as well:

(7.2) That **bastard** Pete is a supporter of animal rights.

However, there are cases in which UCIs can reasonably be assumed to be at-issue. This seems to hold for functional shunting UCIs, as they do not give back any truth-conditional content that could be at-issue. For instance, some expressives can be used not only as functional expletives, but also as shutting UCIs, namely when they occur in predicative instead of attributive positions:

(7.3) Pete is a **bastard**.

When used this way, they give back only trivial truth-conditional content, as the following derivation shows:

(7.4)
$$\dfrac{\dfrac{\dfrac{\textit{Pete}}{\mathbf{pete} : e}\,\text{Lx} \qquad \dfrac{\textit{is a bastard}}{\lambda x.T \blacklozenge \mathbf{bad} : \langle e, u\rangle}\,\text{Lx}}{T \blacklozenge \mathbf{bad}(\mathbf{pete}) : u}\,\text{MA}}{T \bullet \mathbf{bad}(\mathbf{pete}) : u}\,\text{UE}$$

In such an utterance, the expression of a negative attitude towards Pete seems to be the main point, and therefore, it is very likely that it should regarded as at-issue. Interestingly, many truth-conditional expressions can behave very much the same when used attributively instead of predicatively. In (7.5a), it seems to be at-issue that Pete is a philosopher, whereas in (7.5b), this seems to be a side issue. The same holds if the predicate is used in an appositive construction, as in (7.5c).

(7.5) a. Pete is a **philosopher** and a clever guy.
b. That **philosopher** Pete is a clever guy.
c. Pete, a **philospher**, is a clever guy.

From these brief considerations, the following picture emerges. The distinction between truth-conditional and use-conditional content is independent of the question of whether it is at-issue or not. As summarized in Table 7.1, all four combinations are, arguably, attested.

TABLE 7.1 Truth-conditionality and at-issueness

	t-content	*u*-content
at-issue	Pete is a **philosopher**.	Pete is a **bastard**.
side issue	that **philosopher** Pete	that **bastard** Pete

Furthermore, there seems to be some kind of syntactic marking of at-issueness involved, because, irrespective of the mode of expression, expressions in predicative position are arguably at-issue, whereas expressions in appositive constructions tend to be non-at-issue.

However, the remarks just made should only be taken as approximations or default assumptions, because, if we take the idea of being *at-issue* seriously, it is a pragmatic concept, not a matter of conventions. After all, the question of whether something contributes to an issue is a question of the current discourse context or what the question currently under discussion (QUD) is (Ginzburg 1995a,b; Roberts 1998). That is, even if the syntactic position may mark an expression as non-at-issue, this indicates merely a tendency. Given the right contextual circumstances, even expressions in non-at-issue environments can contribute to what is at-issue. For instance, Potts (2012) discusses the following:

(7.6) a. Charlie, **a pizza delivery person**, is at the door!
b. Charlie, **an infamous axe murder**, is at the door!

Both assertions can be used to address the QUD *Who is at the door?*, in which case the appositive information in (7.6a) and (7.6b) is a side issue. However, imagine a cliché horror-movie context in which some young people, probably college students, have locked themselves into a flat, afraid of murderers strolling around their block. There is a knock at the door, and the question arises whether to open it or not. In such a context, the appositive is highly relevant for deciding whether to do so. However, we do not have to confine ourselves to such disturbing contexts. Consider, for instance, the following dialog:

(7.7) A: Why is Peter so sad these days?
B: He fell in love with Betty, **who loves Mary**.

In such a context, only the content of the matrix taken together with the content of the appositive provide an answer to A's question, so that the appositive is clearly at-issue as well (cf. also Koev 2013).

For use-conditional content, it seems harder to come up with natural-sounding examples, but they can nevertheless be found. For instance, imagine that you meet your friend Pete, who seems to be very angry, which is why you ask him why he is so upset. Now, consider the following reply:

(7.8) I met Charlie.

Suppose you do not know anything about Charlie and his relation to Pete. Then, even if (7.8) somehow answers the question, it does so in a pragmatically unsatisfactory way, as it leaves it up to the hearer to infer why meeting Charlie has upset Pete. However, if Pete answered (7.9), instead of merely (7.8), we would at least know that Pete is upset because of his negative feelings towards Charlie, even if we still have not learned anything about the exact reason for his negative emotions:

(7.9) I met that **bastard** Charlie.

Nevertheless, it seems that the negative attitude towards Charlie contributes to the issue raised by the question. The same holds for a truth-conditional variant of (7.9) involving an appositive:

(7.10) I met Charlie, **whom I dislike very much**.

To conclude, the syntactic marking of non-at-issueness does not keep content from nevertheless being at-issue, if the discourse context facilitates it. The question of exactly why some content is considered as contributing to a given issue, and how syntax and other means like focus can help to indicate this, is a huge field for investigation and has recently received some renewed interest, especially due to the question of how the criterion of being at-issue can be used to determine the projectional behavior of some content (Simons et al. 2010; Tonhauser et al. 2013). However, even if much more work needs to be done on how use-conditional content interacts with the QUD, it seems clear that the difference between truth-conditional and use-conditional content cannot plausibly be reduced to a distinction between contributing at-issue or side issue content (cf. also Barker, Bernardi, and Shan 2010). Ultimately, the former is a question of (lexical and compositional) semantics, while the latter is a question of the pragmatics of discourse and information updates.

7.3 Meaning dimensions and discourse updates

The basic idea of hybrid semantics is that the two different modes of expression—the truth-conditional and the use-conditional mode—constitute separate meaning dimensions whose contents can be independently assessed, i.e., judged as true and felicitous, respectively. However, if one utters a hybrid sentence that contains non-trivial information in both dimensions, both dimensions contribute something to the discourse context and, as shown in §2.1.3, it is possible to speak of the overall combined semantic information of a hybrid utterance.

However, what hybrid semantics does not tell us is how the different meaning dimensions work from a dynamic perspective on discourse semantics. In the previous section, I addressed the question of the relationship between use-conditional content and side issue content, which is just a special case of the more general question of how the various meaning dimensions interact with the different discourse components like common ground and question-under-discussion. As we saw, use-conditional content has a tendency to be non-at-issue, which may be traced back to the fact that the *u*-content of an utterance behaves differently from its *t*-content, for instance, in its capacity to be direct denied. Recent advances in our understanding of the various ways in which discourse can be updated (AnderBois, Brasoveanu, and Henderson 2013; Murray 2014) may therefore provide an important area for further research, in order to supplement hybrid semantics or, more generally, multidimensional semantics with a proper multidimensional discourse pragmatics.

7.4 Hybrid semantics and language change

I have taken an entirely synchronic perspective on the analysis of use-conditional meaning. That is, I took the existence of UCIs as granted and did not ask where they originated from. Nevertheless, this diachronic question may be tackled from the perspective taken in this book as well, because the formal framework I developed may also be useful for diachronic analyses.

For instance, one of the main areas of diachronic linguistics is *grammaticalization* theory.[1] This subfield studies the regular patterns according to which prototypical lexical items, like nouns, lose more and more of their lexical features by various diachronic processes, and, over time, become elements expressing grammatical categories. These pattern are

[1] There is a vast amount of literature on grammaticalization. See, amongst many others, Diewald and Wischer (2002); Hopper and Traugott (2003); Lehmann (1995); Narrog and Heine (2011); Traugott and Heine (1991a,b).

often conceptualized as proceeding along a grammaticalization scale, where the left-hand side represents a low and the right-hand side a high degree of grammaticalization (Heine 2003: 576):

(7.11) Discourse > Syntax > Morphology > Morphophonemics > Zero

Besides such a grammaticalization path, many authors assume another diachronic process which involves the development of ordinary lexical expressions not to grammatical morphemes, which are highly integrated, but to more independent pragmatic markers. This process is called *pragmaticalization* or *subjectification* (Auer and Günthner 2005; Diewald 2011; Traugott 1995, 2003):

> Subjectification is the development of a grammatically identifiable expression of speaker belief or speaker attitude to what is said. (Traugott 1995: 32)

Even if the relation between such processes and grammaticalization remains unclear, it is obvious that pragmaticalization does not proceed along the grammaticalization scale in (7.11).[2] Instead, expressions that pragmaticalize move along a semantic path (Traugott 2003: 633):

(7.12) propositional (> textual) > expressive meaning

Examples of expressions that developed along this path are plentiful and can be found for items of various lexical categories. For the purposes of this book, it is quite interesting that some of the best-studied cases of pragmaticalization are cases of pejoration such as English *boor* 'countryman, farmer' > 'crude person' (Traugott 2003: 634), and the development of German modal particles out of adjectives and adverbs (Autenrieth 2005; Wegener 2002).

For a hybrid-semantic perspective, pragmaticalization can thus be understood as the development of truth-conditional into use-conditional expressions. Formally, this means that the type of an expression shifts diachronically from a truth-conditional type to a use-conditional type. Take the aforementioned *boor*, for instance. It starts as an ordinary descriptive, truth-conditional predicate and develops into a functional expletive UCI that displays a negative expressive speaker attitude:

(7.13) $\textbf{boor} : \langle e, t \rangle > \textbf{boor}_{ex} : \langle e, u \rangle$

[2] For Traugott (2003) and Diewald (2011), pragmaticalization is one of many processes of grammaticalization, whereas Auer and Günthner (2005) question whether it can be understood in that way.

This diachronic type shift formally reflects the change from propositional to use-conditional. Of course, diachronically, such type shifts do not happen suddenly but evolve during complex processes and in contexts that support such changes (Traugott 2003). Most often, pejorations as in (7.13) start from conversational implicatures that, given a sufficiently high frequency, become conventionalized. That is, maybe the historical context invites the inference that people who are farmers are also rude. Given the right social circumstances, this implicature then may become part of the lexical meaning of *boor*. This intermediate stage then would be a functional mixed UCI. In a final stage, the original meaning may get lost such that only the negative expressive component remains from the original truth-conditional predicate, and we have an expletive functional UCI:

(7.14) $\mathbf{boor} : \langle e, t\rangle > \mathbf{boor} : \langle e, t\rangle \blacklozenge \mathbf{boor}_{ex} : \langle e, u\rangle > \mathbf{boor}_{ex} : \langle e, u\rangle$

Of course, all this is remains mere speculation so far and should be supported by real diachronic investigations of the evolution of UCIs. However, I hope that this brief sketch illustrates that hybrid semantics, and $\mathcal{L}_{\mathrm{TU}}$ in particular, provide a framework which can be used to talk about such changes in formal and precise ways, and which may prove to be useful for diachronic semantic research.[3]

7.5 Typology of use-conditional meaning

Besides its embrace of compositional multidimensionality, one of the biggest conceptual differences between $\mathcal{L}_{\mathrm{TU}}$ and its precedents $\mathcal{L}^{\star}_{\mathrm{CI}}$ is that the derivational system of $\mathcal{L}_{\mathrm{TU}}$ is fairly liberal and, by itself, does not impose many restrictions on possible expressions or combinations. While, for instance, the principle of non-interaction of use-conditional content—see page 117—is directly built into $\mathcal{L}_{\mathrm{CI}}$, the proof rules of $\mathcal{L}_{\mathrm{TU}}$ do in principle allow for the modification of use-conditional propositions. $\mathcal{L}_{\mathrm{TU}}$ rather outsources such restrictions to the interface between lexical and derivational semantics. The architecture of $\mathcal{L}_{\mathrm{TU}}$ intentionally comes with a gap. The set of lexical extension rules (LERs) ensures that the lexical semantic representations are at most two-dimensional—as expressed in hypothesis L^2 in (4.70) on page 144—while the compositional system of $\mathcal{L}_{\mathrm{TU}}$ only works for three-dimensional meaning

[3] See Davis and Gutzmann (2015) for a first attempt.

profiles. This gap is bridged by the LERs that expand the lexical expressions into the required three-dimensional format.

As discussed on page 134, one advantage of locating the desired restrictions at the lexicon–syntax interface and not in the derivational system itself is that it allows us to account for cross-linguistic variation without changing the structure of the logic. Given how little knowledge we have about cross-linguistic variability of UCIs, it may well be the case that a language does not permit certain expressions. For instance, a language may lack functional mixed expressives or all levels of use-conditional modification. According to the picture presented here, such a language would simply not possess the appropriate LERs needed to make such expressions usable in semantic derivations.

So far, our knowledge of cross-linguistic variation with regard to UCIs is almost non-existent, but the framework developed in this book provides a theoretical starting point for empirical studies on the variability of use-conditional meaning and UCIs across various languages. For instance, it is an important question which LERs manifest variation and which are universal. That is, the architecture of the theoretical framework can provide guidelines for where to look for variation when studying UCIs cross-linguistically. Furthermore, I hope that, independently of the formal and theoretical framework, the descriptive terminology and the classification of UCIs developed in Chapter 2 may be helpful for the cross-linguistic description of the inventory of UCIs. The different kinds of UCI may also give rise to questions about typological regularities. For instance, the relation between the features of the different kinds of UCI and the way they are treated by the various LERs leads me to speculate that the following implicational "laws" may hold cross-linguistically:

(7.15) a. If a language has functional mixed UCIs, it employs all other kinds of UCIs as well.
b. If a language has functional expletives or isolated mixed UCIs, it has isolated UCIs as well.

Whether or not tendencies such as these can actually be attested, I would be glad if this book can inspire cross-linguistic studies of use-conditional meaning, and if the descriptive and formal tools I developed here are of any help to such an enterprise.

Appendix: The logic $\mathcal{L}_{\mathrm{TU}}$

A.1 Types for $\mathcal{L}_{\mathrm{TU}}$

a. e, t are basic truth-conditional types for $\mathcal{L}_{\mathrm{TU}}$.
b. u is a basic use-conditional type for $\mathcal{L}_{\mathrm{TU}}$.
c. If τ is a truth-conditional type for $\mathcal{L}_{\mathrm{TU}}$,
then $\langle s, \tau \rangle$ is a truth-conditional type for $\mathcal{L}_{\mathrm{TU}}$.
d. If σ and τ are truth-conditional types for $\mathcal{L}_{\mathrm{TU}}$,
then $\langle \sigma, \tau \rangle$ is a truth-conditional type for $\mathcal{L}_{\mathrm{TU}}$.
e. If σ is a type for $\mathcal{L}_{\mathrm{TU}}$ and τ is a use-conditional type for $\mathcal{L}_{\mathrm{TU}}$,
then $\langle \sigma, \tau \rangle$ is a use-conditional type for $\mathcal{L}_{\mathrm{TU}}$.
f. The set of all types for $\mathcal{L}_{\mathrm{TU}}$, **Typ**, is the union of all truth-conditional and use-conditional types.

A.2 Vocabulary for $\mathcal{L}_{\mathrm{TU}}$

a. $\mathbf{Con}_\tau$, a collection of constants of type τ for $\mathcal{L}_{\mathrm{TU}}$.
b. $\mathbf{Var}_\tau$, a countably infinite set of variables of type τ for $\mathcal{L}_{\mathrm{TU}}$.
c. lambda abstractor: λ
d. truth-conditional connectives: $\neg, \rightarrow, \vee, \wedge$
e. use-conditional conjunction: $\odot$
f. quantifiers: $\exists, \forall$
g. identity relation: $=$
h. type shifter: $☆$
i. triviality elements: $T \in \mathbf{Con}_{\langle st \rangle}$, $U \in \mathbf{Con}_u$
j. punctuation: (,), [,], ⟨, ⟩, .

A.3 Terms for $\mathcal{L}_{\mathrm{TU}}$

The collection **Exp** of well-formed expressions for $\mathcal{L}_{\mathrm{TU}}$ is defined as follows, where $\mathbf{Exp}_\tau$ is the collection of well-formed expressions of type τ.

a. (i) $\mathbf{Con}_\tau \subseteq \mathbf{Exp}_\tau$.
(ii) $\mathbf{Var}_\tau \subseteq \mathbf{Exp}_\tau$.
b. $\alpha(\beta) \in \mathbf{Exp}_\tau$, if $\alpha \in \mathbf{Exp}_{\langle \sigma, \tau \rangle}$ and $\beta \in \mathbf{Exp}_\sigma$.
c. $\lambda v.\alpha \in \mathbf{Exp}_{\langle \sigma, \tau \rangle}$, if $v \in \mathbf{Var}_\sigma$ and $\alpha \in \mathbf{Exp}_\tau$.
d. $(\neg\phi), (\phi \wedge \psi), (\phi \vee \psi), (\phi \rightarrow \psi) \in \mathbf{Exp}_t$, if $\phi, \psi \in \mathbf{Exp}_t$.
e. $(\phi \odot \psi) \in \mathbf{Exp}_u$, if $\phi, \psi \in \mathbf{Exp}_u$.

f. $\forall \nu[\phi], \exists \nu[\phi] \in \mathbf{Exp}_t$, if $\nu \in \mathbf{Var}_\sigma$ and $\alpha \in \mathbf{Exp}_t$.
g. $\alpha = \beta \in \mathbf{Exp}_t$, if $\alpha, \beta \in \mathbf{Exp}_\tau$.
h. $☆Q \in \mathbf{Exp}_{\langle\langle e,u\rangle,u\rangle}$, if $Q \in \mathbf{Exp}_{\langle\langle e,t\rangle,t\rangle}$.
i. $\mathbf{Exp} = \cup_\tau \mathbf{Exp}_\tau$, for all types τ for $\mathcal{L}_{\mathrm{TU}}$.

A.4 Denotations for $\mathcal{L}_{\mathrm{TU}}$

D is a collection of domains for all types $\tau \in \mathbf{Typ}$, where

a. W is a set of worlds.
b. C is a set of contexts.
c. D_e, a set of entities, is the domain of type e.
d. $D_t = \{1, 0\}$, the set of truth values, is the domain of type t.
e. $D_{\langle\sigma,\tau\rangle} = D_\tau^{D_\sigma}$, the set of functions from D_σ to D_τ, is the domain for a functional type $\langle\sigma, \tau\rangle$.
f. $D_{\langle s,\tau\rangle} = D_\tau^W$, the set of functions from W to D_τ, is the domain for type $\langle s, \tau\rangle$.
g. $D_u = \wp(C)$, the powerset of the set of contexts.

A.5 Interpretation for $\mathcal{L}_{\mathrm{TU}}$

The interpretation function for $\mathcal{L}_{\mathrm{TU}}$ is given by $[\![\cdot]\!]^g$, where g is a variable assignment function, such that if $\nu \in \mathbf{Var}_\tau$, then $g(\nu) \in D_\tau$.

a. $[\![\alpha]\!]^g = \begin{cases} [\![\alpha]\!]^g \in D_\tau & \text{if } \alpha \in \mathbf{Con}_\tau \\ g(\alpha) & \text{if } \alpha \in \mathbf{Var}_\tau \end{cases}$.
b. $[\![\alpha(\beta)]\!]^g = [\![\alpha]\!]^g([\![\beta]\!]^g)$.
c. $[\![\lambda x.\alpha]\!]^g =$ the function f such that $f(\mathbf{d}) = [\![\alpha]\!]^{g[x:=\mathbf{d}]}$, where $g[x := \mathbf{d}]$ is a variable assignment, such that $g[x := \mathbf{d}](x) = x$, and $g[x := \mathbf{d}](y) = g(y)$, for all $y \neq x$.
d. (i) $[\![\neg\alpha]\!]^g = 1$, iff $[\![\alpha]\!]^g = 0$.
(ii) $[\![\alpha \wedge \beta]\!]^g = 1$, iff $[\![\alpha]\!]^g = [\![\beta]\!]^g = 1$.
(iii) $[\![\alpha \vee \beta]\!]^g = 1$, iff $[\![\alpha]\!]^g = 1$ or $[\![\beta]\!]^g = 1$.
(iv) $[\![\alpha \rightarrow \beta]\!]^g = 1$, iff $[\![\alpha]\!]^g = 0$ or $[\![\beta]\!]^g = 1$.
e. $[\![\alpha \odot \beta]\!]^g = [\![\alpha]\!]^g \cap [\![\beta]\!]^g$
f. (i) $[\![\exists x_\tau.\alpha]\!]^g = 1$, iff there is a $\mathbf{d} \in D_\tau$, such that $[\![\alpha]\!]^{g[x:=\mathbf{d}]} = 1$.
(ii) $[\![\forall x_\tau.\alpha]\!]^g = 1$, iff for all $\mathbf{d} \in D_\tau$, $[\![\alpha]\!]^{g[x:=\mathbf{d}]} = 1$.
g. $[\![\alpha = \beta]\!]^g = 1$, if $[\![\alpha]\!]^g = [\![\beta]\!]^g$.
h. $[\![☆Q]\!]^g =$ the function $f \in D_{\langle\langle e,u\rangle,u\rangle}$ such that for every $E \in D_{\langle e,u\rangle}$, $f(E) = \{c \in C : \{x \in D_e : E(x)(c) = 1\} \in [\![Q]\!]^g\}$.
i. (i) $[\![T]\!]^g = W$.
(ii) $[\![U]\!]^g = C$.

A.6 Lexical extension rules (LERs)

For every natural language L, $\mathbf{LER}_L$ is the collection of lexical extension rules (LERs), that extend one or two-dimensional expressions in $\mathbf{Exp} \cup (\mathbf{Exp} \times \mathbf{Exp})$ into three-dimensional expressions in $\mathbf{Exp} \times \mathbf{Exp} \times \mathbf{Exp}$.

For functional modifying languages, it is the smallest set, such that it contains the following LERs.

a. $\alpha \Rightarrow \langle \alpha, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_\sigma$, where $\sigma \in \mathbf{T}$.
b. $\alpha \Rightarrow \langle I_\sigma, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle}$, where $\sigma \in \mathbf{T}$ and $\tau \in \mathbf{U}$.
c. $\alpha \Rightarrow \langle T, T, \alpha \rangle$, if $\alpha \in \mathbf{Con}_u$.
d. $\langle \alpha, \beta \rangle \Rightarrow \langle \alpha, \alpha, \beta \rangle$, if $\alpha \in \mathbf{Con}_\sigma$ and $\beta \in \mathbf{Con}_u$, where $\sigma \in \mathbf{T}$.
e. $\langle \alpha, \beta \rangle \Rightarrow \langle \alpha, \beta, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle}$ and $\beta \in \mathbf{Con}_{\langle \sigma, \nu \rangle}$, where $\sigma, \tau \in \mathbf{T}$ and $\nu \in \mathbf{U}$.
f. $\langle \lambda x_\sigma.T, \alpha \rangle \Rightarrow \langle \lambda x_\sigma.T, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle}$, where $\sigma \in \mathbf{T}$ and $\tau \in \mathbf{U}$.
g. $\alpha \Rightarrow \langle I_{\sigma^n}, \alpha, U \rangle$, if $\alpha \in \mathbf{Con}_{\langle \sigma, \tau \rangle^n}$, where σ is a truth-conditional type and τ is a use-conditional type.
h. $x_\sigma \Rightarrow \langle x_\sigma, x_\sigma, U \rangle$, if $x \in \mathbf{Var}_\sigma$, where σ is a truth-conditional type.

LER (A.6 g) makes use of the following type construction rule:

Given a base type α, for each $n \geq 0$, α^n is the nth-level modifier on α, defined such that

$$\alpha^n = \begin{cases} \alpha & \text{if } n = 0 \\ \left\langle \alpha^{n-1}, \alpha^{n-1} \right\rangle & \text{if } n > 0 \end{cases}$$

A.7 Rules of proof for $\mathcal{L}_{\text{TU}}$

a. *Identity*

$$\frac{\alpha}{\alpha}\ \text{id}$$

b. *Multidimensional application*

$$\frac{\left\langle \alpha_1 : \langle \sigma, \tau \rangle, \alpha_2 : \langle \rho, \nu \rangle, \alpha_3 \right\rangle \qquad \left\langle \beta_1 : \sigma, \beta_2 : \rho, \beta_3 \right\rangle}{\left\langle \alpha_1(\beta_1) : \tau, \alpha_2(\beta_2) : \nu, \alpha_3 \odot \beta_3 \right\rangle}\ \text{MA}$$

c. *Binary use-conditional elimination*

$$\frac{\left\langle \alpha_1 : \langle \sigma, \tau \rangle, \alpha_2 : \langle \rho, u \rangle, \alpha_3 \right\rangle \qquad \left\langle \beta_1 : \sigma, \beta_2 : \rho, \beta_3 \right\rangle}{\left\langle \alpha_1(\beta_1) : \tau, \alpha_1(\beta_1) : \tau, \alpha_3 \odot \beta_3 \odot \alpha_2(\beta_2) : u \right\rangle}\ \text{UE}$$

d. *Truth-conditional abstraction*

$$\frac{\langle \alpha : \tau, \beta : \rho, \gamma \rangle}{\langle \lambda x.\alpha : \langle \sigma, \tau \rangle, \lambda x.\beta : \langle \sigma, \rho \rangle, \gamma \rangle}\ \lambda x_\sigma \text{ where } \sigma \text{ is a truth-conditional type}$$

e. *Quantifier hybridization*

$$\frac{Q : \langle\langle e, t\rangle, t\rangle \blacklozenge Q : \langle\langle e, t\rangle, t\rangle \bullet U}{Q : \langle\langle e, t\rangle, t\rangle \blacklozenge \star Q : \langle\langle e, u\rangle, u\rangle \bullet U}\ \star$$

f. *Extended lexical insertion*

$$\frac{A}{\langle \alpha_1, \alpha_2, \alpha_3 \rangle}\ \mathrm{LxL} \qquad \text{if } A \rightsquigarrow \alpha \text{ and there is a } \mathit{LER} \in \mathbf{LER}, \text{ such that } \alpha \Rightarrow \langle \alpha_1, \alpha_2, \alpha_3 \rangle.$$

A.8 Translation and interpretation

Let $\rightsquigarrow_L$ denote the translation function, that maps lexical expression of language L onto expression of $\mathcal{L}_{\mathrm{TU}}$. The translation relation $\Vdash_L$ between expressions of L and $\mathcal{L}_{\mathrm{TU}}$ then can be defined as follows.

> $E \Vdash_L \Gamma$, if E is built of expressions $e_1 \ldots e_n$, then for all i such that $1 \leq i \leq n : e_i \rightsquigarrow_L \alpha_i$ and there is a valid derivation in $\mathcal{L}_{\mathrm{TU}}$ using just LERs suitable for L with leaves $\alpha_i \ldots \alpha_n$ rooted in Γ.

Meaning of natural language expressions

$\|E\|^L$, the meaning of an expression E of language L, is defined such that if $E \Vdash_L \langle \Gamma_1, \Gamma_2, \Gamma_3 \rangle$, then $\|E\|^L = \langle [\![\Gamma_1]\!], [\![\Gamma_2]\!], [\![\Gamma_3]\!] \rangle$.

Truth and felicity of a sentence

If S is a sentence of language L, then

a. S is true in a world w and a context c, if $w \in \pi_1 \|S\|$.
b. S is felicitous in a world w and a context c, if $c \in \pi_3 \|S\|$.

A.9 Reasoning in hybrid semantics

We define an operator "$\Downarrow$" that takes a context and a context set and lowers the u-content into a truth-conditional proposition.

> If $c = \langle c_S, c_H, c_W \rangle$ is a context and $CS = \{\langle x, y, w \rangle : R(x, y, w)\}$ is a set of contexts given by a relation R, then $\Downarrow_c(CS) = \{w' : R(c_S, c_H, w')\}$

The combined semantic information of a sentence S in a context c, written as $(\!| S |\!)^c$, then can be defined as follows:

$$(\!| S |\!)^c = \|S\|^t \cap \Downarrow_c \|S\|^u$$

Depending on how liberal we want to be with respect to u-content, we can define three different versions of semantic validity as information delimitation.

Semantic validity as information delimitation (unrestricted version)

$$\{P_1, \ldots, P_n\} \vdash Q \quad \text{iff} \quad \bigcap_{1 \leq x \leq n} \llparenthesis P_x \rrparenthesis^c \subseteq \llparenthesis Q \rrparenthesis^c, \text{ for all contexts } c.$$

Semantic validity as information delimitation (one-way restricted version)

$$\begin{aligned} \{P_1, \ldots, P_n\} \vdash Q \quad \text{if} \quad & \bigcap_{1 \leq x \leq n} \llparenthesis P_x \rrparenthesis^c \subseteq \|Q\|^t \\ \text{and} \quad & \bigcap_{1 \leq x \leq n} \|P_x\|^u \subseteq \|Q\|^u, \text{ for all contexts } c. \end{aligned}$$

Semantic validity as information delimitation (strongly restricted version)

$$\begin{aligned} \{P_1, \ldots, P_n\} \vdash Q \quad \text{if} \quad & \bigcap_{1 \leq x \leq n} \|P_x\|^t \subseteq \|Q\|^t \\ \text{and} \quad & \bigcap_{1 \leq x \leq n} \|P_x\|^u \subseteq \|Q\|^u. \end{aligned}$$

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