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Factivity: Its Nature and Acquisition

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To Paul and Moritz

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Abbreviations and Conventions

$\Diamond x$	there is possibly an x
$\models$	entails
»	presupposes
[#]	incomprehensible element in the recording
2SG	second person singular
COS	complement-only strategy
CR	number of correct responses
D√	acceptability of a text
D*	inacceptability of a text
DAT	dative
DET	determiner
δ-binding	discourse-binding relative to files in a discourse frame
DH	Developmental Hypothesis
DSH	Discourse-Semantic Hypothesis
FAH_{Comp}	Factivity Acquisition Hypothesis on comprehension
FAH_{Prod}	Factivity Acquisition Hypothesis on production
f-complement	complement embedded by a p-factive matrix predicate
f-predicate	potentially factive matrix predicate
H_0	null hypothesis
indeterminate predicate	propositional or volitive matrix predicate
INF	infinitive
non-s-event	no story event
OAT	overextended affirmation tendency
ONT	overextended negation tendency
p-factive matrix predicate	potentially factive matrix predicate
predicate	verbal or adjectival predicate
PART	participle
PSP	presupposition
r-complement	complement embedded by a response stance matrix predicate
rf-complement	complement embedded by an rf-predicate
rf-predicate	potentially factive or response stance predicate
r-predicate	response stance matrix predicate
s-event	story event
SUBJ	subjunctive
TT	topic time
TT_{CC}	topic time of the complement clause
TT_{MC}	topic time of the matrix clause
$[t_{CC\leq}]$	$\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, such that t_{CC} precedes or overlaps with t_{MC}
TVJ task	truth value judgment task

It is my belief that children are full of understanding
and know as much as and more than adults,
until they are about seven,
when they suddenly become stupid, like adults.
Doris Lessing[1]

1. Introduction

Busy professors might say any of the following to an inquiring student:

(1) I forgot that I answered your e-mail.

(2) I thought that I answered your e-mail.

(3) I forgot to answer your e-mail.

In each case the implications are very different. Only the first factive statement presupposes that the speaker actually answered the student's e-mail. How does this factive reading come about? How is factivity represented semantically and syntactically? When do children acquire the ability to correctly understand and use factive structures such as (1) and distinguish them from nonfactive structures such as (2) and (3)? How and why do children advance in their understanding of the concept of factivity?

This book attempts to provide answers to both sets of questions. The issue of how to capture the phenomenon of factivity, discussed in Chapters 2, 3, and 4, should be of interest to linguists working on theoretical syntax, semantics, or pragmatics. The issue of how to characterize the acquisition of factivity should interest linguists working in the field of language acquisition and is addressed in Chapters 5, 6, and 7. I argue that satisfactory description and explanation of the phenomenon *factivity* and its acquisition can only be accomplished within a compositional approach that acknowledges the multiple dimensions of factivity. A careful analysis of the empirical data shows that factivity results from the complex interaction of lexical-semantic, syntactic, and discourse-semantic factors. My two experimental studies and my analysis of two longitudinal corpora provide evidence that this multidimensionality is mirrored in the acquisition process by a stepwise mastery of the different components of factivity.

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[1] From her autobiography *Walking in the shade* (1997), HarperCollinsPublishers.

Following Kiparsky & Kiparsky's (1971) classical definition of factivity, it has generally been assumed that a verb is factive if the complex sentence containing that verb carries the presupposition that the complement clause expresses a true proposition. Under this account, verbs like *forget* and *remember* are classified as factive (1) and verbs like *think* and *believe* as nonfactive (2). However, statements such as (3) indicate that the lexical-semantic property of belonging to a certain verb class does not suffice for yielding a factive interpretation. I argue that the phenomenon of nonfactive readings of sentences with factive verbs such as (3) is not simply due to the idiosyncratic properties of a small number of verbs, but is of a more general nature. Therefore, I propose a refinement of the Kiparskian lexical-semantic definition of factivity that takes into account the role of the complement clause in achieving a factive reading. My hypothesis is that the notion of factivity is necessarily compositional in nature, which I refer to as *semantic-syntactic factivity*. Besides a specific type of matrix predicate, which I call potentially factive (p-factive), a factive interpretation requires a specific type of complement clause, generally a tense/aspect marked complement. Thus, potentially factive predicates (e.g., *forget, remember, be surprised, find out*) can induce the presupposition that a complement clause is true if the complement clause is marked for tense/aspect. This compositional concept of factivity also accounts for the factive interpretation of tensed *wh*-complements (*John forgot why he wrote an e-mail*) and perfective gerundials (*John remembered having lost e-mails before*). Non-factive predicates, on the other hand, share the inability to induce a presupposition.

The compositional view of factivity rests on the assumption that the interaction of a p-factive matrix predicate and a specific type of complement clause invariably results in a presuppositional reading of the sentence. Thus, p-factive matrix predicates are predicted to be presupposition triggers, inducing the presuppositional reading based on the specific linguistic structure of the sentence rather than on certain context conditions. I show that this prediction is borne out within a discourse-semantic framework, which regards factive complements and definite NPs as anaphoric expressions, which require a link to some previously established referent in the discourse. Depending on intrasentential and context factors, the event variable is bound either at the top-most level of representation, yielding an actual presuppositional reading, or at an intermediate level of representation, which is equivalent to presupposition cancellation. This view of factivity also allows accounting for the characteristics of response stance predicates like *accept* and *admit*, which like factive predicates take complements that refer back to some previously mentioned event. Response stance predicates select the same type of complements as p-factive matrix predicates, but never induce a presupposition, because the embedded event variable can be linked to all but the top-most level of representation. Non-factive complements, in contrast, do not require a link to a previously mentioned event in the discourse.

The semantic-syntactic model of factivity advanced in this book predicts that factivity has repercussions at the level of syntax. This prediction is borne out for the syntactic phenomena of subject-to-subject raising, ECM infinitival complements, negation-raising, long adverbial *wh*-movement, and postposing, which are generally prohibited in factive (and response stance) sentences. I argue that the different syntactic restrictions found in factive and nonfactive sentences can be accounted for by differences between the event structures and binding mechanisms of factive and nonfactive complements. As a consequence, the syntactic restrictions that hold for f- and r-complements are claimed to depend on conditions of anaphoricity rather than on conditions of presupposition.

In the second part of the book I turn to the acquisition of factivity. I address the questions of when children acquire the ability to correctly understand and use factive structures and of how and why they advance in their understanding of the concept of factivity. To date production and comprehension studies of the acquisition of factivity have been undertaken from either a syntactic, semantic, or a pragmatic perspective, impeding a consideration of the possible interrelations of the different levels of grammatical representation. Therefore, the complexity of the acquisition task has been underestimated. Previous production studies have focused on the emergence of complex sentences in children's speech, while the acquisition of the semantic properties of complex sentences such as factivity has received little attention. Previous research into the comprehension of factive sentences has been based on the Kiparskian definition of factivity and – claiming mastery as early as 4 and as late as 14 – has remained inconclusive.

I argue that from the compositional model of factivity specific acquisition hypotheses can be derived, which take into account the finding that factivity results from the complex interaction of lexical-semantic, syntactic, and discourse-semantic factors. The overall hypothesis is that children acquire the concept of factivity stepwise and not in an all-or-nothing fashion. I present two experimental studies and an analysis of two longitudinal case studies as well as a critical review of previous production and comprehension studies. The results are discussed in light of the acquisition hypotheses and it is shown that they generally confirm the predicted stepwise acquisition pattern. Integrating the acquisition hypotheses and the findings from longitudinal and experimental studies, I suggest a developmental model that accounts for the acquisitional stages children pass through on their way to mastering factivity at around the age of 7.

In contrast to some previous studies, I conclude that mastery of the presuppositional properties of factive sentences is achieved already around age 4, at the same age at which the theory of mind develops. However, mastery of the syntactic restrictions of factivity seems to be achieved much later, around age 7 or 8. Moreover, the discourse-semantic property of *presupposition failure*, which was included in Experiment 1, is shown not to be acquired before age 7 or 8.

The organization of the book is as follows. In Chapter 2 I look at lexical-semantic and syntactic aspects of the concept of factivity and propose a refinement of Kiparsky & Kiparsky's definition of factivity. I show that their lexical-semantic approach, which regards factivity as a property of matrix predicates, cannot account for the nonfactive reading of certain types of complex sentences with factive matrix predicates. As an alternative, I present in this chapter a semantic-syntactic account of factivity, which is compositional in nature. It is based on the assumption that both a specific type of predicate and a specific type of complement clause contribute to the factive reading of the complex sentence. The predicates have to belong to the class of potentially factive (p-factive) matrix predicates, i. e. verbal or adjectival predicates that can trigger a factive interpretation of a sentence. The finite and nonfinite types of complement clauses admissible in factive sentences have to contain a specific form of tense/aspect marking, which is formulated as a restriction on the topic time relations between matrix clause and embedded clause. This restriction I refer to as the *precede/overlap condition*. I argue that p-factive predicates are generally underspecified with regard to their descriptive meaning and achieve factivity only in interaction with the right kind of complement clause.

Chapter 3 explores in detail the question of whether the inner-grammatical notion of presupposition underlying the semantic-syntactic concept of factivity can be sustained. To get a better insight into what should constitute the scope of a presupposition theory, first the concept of presupposition is compared with other semantic and pragmatic inferences including entailment, conventional implicatures, and conversational implicatures. I also briefly discuss how to determine elementary presuppositions of factive sentences in light of the general defeasibility of presuppositions. I then demonstrate that in a discourse-semantic framework (cf. Heim, 1982; van der Sandt 1989, 1992) presupposition is an inner-grammatical concept. Moreover, I argue that the analysis of p-factive matrix predicates as presupposition triggers follows automatically in a discourse-semantic presupposition theory, thereby supporting the concept of semantic-syntactic factivity. Factive complements are analyzed as anaphoric expressions that require a link between the event variable in the complement clause and a specific event file card that is already present in the discourse file. As a consequence, factive complements always have to be bound at some level of representation, causing presupposition failure otherwise. Since factive complements are complements embedded by a p-factive matrix predicate, it follows that p-factive predicates are presupposition triggers and in turn that factivity has inner-grammatical status.

Chapter 4 presents the syntactic core of the study. Making use of the notions of semantic-syntactic factivity and presupposition developed in Chapter 2 and 3, I address the questions of whether we can find syntactic repercussions of factivity and whether and how these syntactic restrictions are structurally represented. I show that among the wide range of syntactic phenomena that have been proposed to result from the factivity of the complement-taking predicate, only five stand up to this claim. Unlike nonfactive predicates, p-factive predicates in principle prohibit subject-to-subject raising, ECM infinitival complements, negation-raising, long adverbial *wh*-movement, and postposing. I argue that these restrictions are weak rather than defining properties of p-factives, since the same restrictions are also found in various types of nonfactives. Developing an account by Hegarty (1992), I propose a model of event-binding. It is shown that the different syntactic restrictions found for factive and nonfactive sentences can be accounted for by differences in the event structures and binding mechanisms of factive and nonfactive complements. Unlike nonfactive matrix predicates, p-factive matrix predicates select a complement with the event variable already bound. The embedded event variable is discourse-bound (δ-bound) by factive Comp. Furthermore, I propose that factive nonfinite complement clauses have the same event-structure and employ the same binding mechanism as finite factive complements. This accounts for the fact that nonfinite complements show the same syntactic restrictions as their finite counterparts when embedded by a p-factive matrix predicate. Finally, I extend this event-structural proposal to the class of response stance predicates, which share crucial features with the class of p-factives, but do not presuppose the truth of their complement clause. Having incorporated this verb class into the discourse-semantic model, I accordingly modify the definitions of presupposition, presupposition projection, and presupposition failure.

In Chapter 5 I relate the theoretical framework developed in the first half of the book to the question of how children acquire the lexical-semantic, syntactic, and discourse-semantic aspects of factivity. First, I formulate four specific acquisition hypotheses, which are guided by the general hypothesis of a stepwise acquisition of factivity. I present evidence from an analysis of two longitudinal case studies and from previous comprehension and production

studies, which supports the proposed stepwise acquisition pattern. Production of finite nonfactive complements precedes the production of finite factive complements, which starts around age 4. I argue that the occurrence of the first factive sentences is related to the emergence of the theory of mind, which I take to be a necessary but not sufficient prerequisite for acquiring factivity. After a developmental stage in which all complement clauses are assumed to express true propositions, adult-like comprehension of factive and nonfactive sentences gradually increases on a verb-by-verb basis. There is some evidence that this developmental step takes place as early as age 4, i.e. at the same time at which theory of mind develops. Results from studies on long adverbial *wh*-movement and negation-raising indicate that weak island effects are recognized around age 7 or 8, that is after the children may have mastered the presuppositional interpretation of factive sentences.

In Chapter 6 I turn to the questions of how factivity is acquired and how and why children advance in their understanding of the concept of factivity. In view of the fact that many language acquisition hypotheses rest on implicit processing assumptions, first a psycholinguistic dimension is added to the compositional model of factivity. I propose a developmental path towards mastery of factivity that incorporates both the acquisition hypotheses and the findings from longitudinal and experimental studies discussed in Chapter 5. It also pinpoints the factors triggering changes in the child's grammatical system. This developmental course takes seriously the assumptions that a) factivity is multidimensional in nature comprising cognitive, lexical-semantic, syntactic, and discourse-semantic aspects, and that b) acquisition of factivity proceeds stepwise and not in an all-or-nothing fashion. I also provide an account for why children at the age of about 4 seem to produce and correctly interpret factive complement clauses, while failing to recognize that factive complements are islands to extraction. I argue that this asynchrony results from a dissociation of discourse-semantic and logical form properties. Factive Comp δ-binds the embedded event variable, but – due to the multiple ambiguity of the input data – is not yet present at the level of LF.

In Chapter 7 I present evidence from two comprehension studies of 55 English speaking children between the ages of 4 and 6 for the proposed developmental path towards mastery of factivity. Unlike previous studies on the acquisition of factivity, these experiments were designed so as to examine children's comprehension of factive and nonfactive sentences in different syntactic and discourse contexts. The results from Experiment 1 and 2 show that already at age 4 children are able to correctly assign truth-values to factive and nonfactive complement clauses by taking into account the factors 'type of matrix predicate' and 'type of complement clause' and by considering the given discourse background. Experiment 1 provides evidence that preschool children are able to take into account the discourse background in calculating a sentence's interpretation, but are unable to interpret failed sentential presuppositions. This supports the assumption that after the age of 4 children are still unaware of a number of subtle differences between factive and nonfactive verbs. I speculate that children may reanalyze the complement of a p-factive verb such as *forget* as negative-implicative if the presupposition fails. The compositional approach to the acquisition of factivity thus provides a coherent explanation for a variety of findings across different studies.

Chapter 8 contains a summary of the main findings and suggestions for future topics of research, as well as some theoretical considerations regarding the observed asynchrony between discourse-semantic properties and its representation at LF.

2. Lexical-Semantic and Syntactic Aspects of Factivity

2.1 Introduction

Sentences differ in terms of their possible truth-conditions. Simple sentences such as (1) express propositions that are either true or false at a specific place and moment in time, for example in Berlin on November 28, 2002 at 2 pm.

(1) a. It is raining.
b. The sun is shining.

Complex sentences exhibit a more multifaceted pattern of truth-conditions. Sentential complements to a matrix predicate are a form of complementation common to natural languages. By embedding one clause into another we can modify a proposition by stating our attitude towards that proposition, as shown in (2).

(2) a. I think [that it is raining].
b. I claim [that it is raining].

What makes these sentences true? Intuitively speaking, their truth depends on the state of my mental model of the world at the time of uttering these sentences. When my mental model is such that I have the belief that it is raining right now, (2) is true. My mental model of the world may be distinct from your mental model of the world and of course could differ from the actual world. Even if it is false that it is raining, the entire sentence can still be true. Put differently, the truth-value of the embedded complement does not bear on the truth-condition of the complex sentence. Now consider the following statements.

(3) a. I regret [that it is raining].
b. I forgot [that it is raining].

When I regret or admit something then the complement clause is taken for granted to be true. (3a) is thus true if my mental model is such that I regret that it is raining and if the embedded proposition is true. Following Kiparsky & Kiparsky (1971), this phenomenon is referred to as factivity. It appears to be related to specific matrix predicates. Verbs such as *regret* presuppose that the embedded clause is true, while verbs of mental attitude such as *think* and verbs of reported speech such as *claim* do not presuppose the truth of their complement.

In this chapter, I will propose a refinement of Kiparsky & Kiparsky's (1971) lexical-semantic definition of factivity. Under their account, verbs like *regret* or *forget* are classified as factive and verbs like *think* and *claim* as nonfactive. However, statements such as *I forgot to water the flower* indicate that the lexical-semantic property of belonging to a certain verb class does not suffice for yielding a factive interpretation. Besides a specific type of matrix predicate, a factive interpretation requires a specific type of complement clause, generally a tense/aspect marked complement. Nonfactive predicates, on the other hand, share the inability to induce a presupposition.

The chapter is organized as follows. In Section 2.2 I present Kiparsky & Kiparsky's lexical-semantic account of factivity and draw attention to the role of complement clauses

in achieving a factive reading of a sentence. Section 2.3 summarizes the types of complement clauses that can appear in factive sentences. Section 2.4 contains my semantic-syntactic account of factivity, which is compositional in nature. In Section 2.5 it is distinguished from pragmatic factivity, which results from factors other than the matrix verb and the complement clause. Section 2.6 compares potentially factive matrix predicates, which can presuppose the truth of their complement clause, with various types of nonfactive matrix predicates that all differ regarding the truth-value of their sentential complement. Section 2.7 summarizes the results.

Before turning to the discussion of factivity, a note on terminology is in order. Although I will mainly be concerned with matrix verbs selecting various kinds of complement types, adjectives taking sentential complements will also play a role in the course of the argumentation. Assuming that verbal and adjectival predicates behave similarly as to their syntactical status and their ability to subcategorize complements, I will use the term 'predicate' when referring to both verbal and adjectival predicates.

2.2 A Lexical-Semantic Account of Factivity: Kiparsky & Kiparsky (1971)

2.2.1 Kiparsky & Kiparsky's Proposal

It is well-known that complement clauses may or may not represent a true proposition. Examples (4) and (5) below illustrate the contrast: In the (a) sentences the proposition 'it is raining' is true, whereas the (b) sentences leave open whether it is raining at the moment at which the sentences are uttered. Originating with Kiparsky & Kiparsky (1971), the (a) sentences are called factive, and the (b) sentences nonfactive.

(4) a. It is odd that it is raining.
b. It is likely that it is raining.

(5) a. I regret that it is raining.
b. I suppose that it is raining.

The question of why and how these interpretations come about constitutes the core of the study of factivity. Kiparsky & Kiparsky assume that the presupposition of complements is reflected in their syntactic deep structure. Factive predicates are claimed to subcategorize a complex complement of the form *the fact that p*, while nonfactive predicates subcategorize a simple complement *p*. They accordingly define factivity as follows:

> The first sentence in each pair (the factive sentence) carries with it the presupposition 'it is raining'. The speaker presupposes that the embedded clause expresses a true proposition, and makes some assertion about that proposition. All predicates which behave syntactically as factives have this semantic property. (Kiparsky & Kiparsky, 1971: 348)

This characterization of factive sentences contains several important notions. First, Kiparsky & Kiparsky claim that factivity is reflected in the sentence's syntactic deep structure, and thus gives rise to a number of syntactic differences between factive and nonfactive

sentences. In Chapter 4 I will discuss in detail the question of whether factivity has syntactic repercussions and if so which syntactic phenomena are involved.

Second and most important, the authors contend that the semantic property of presupposing the truth of the embedded clause is related to a special kind of predicate, i.e. factive predicates. Put differently, matrix predicates can be distinguished according to whether or not they exhibit this semantic property. Consequently, Kiparsky & Kiparsky classify complement-taking predicates as factive or nonfactive. Table 2.1 gives an overview of their inventory of factive and nonfactive predicates grouped according to the type of sentential complement they take.

Table 2.1 Factive and nonfactive predicates according to Kiparsky & Kiparsky (1971)

	Factive predicates	**Nonfactive predicates**
With object complements	*be aware (of)*	*allege*
	bear in mind	*assert*
	care (about)	*assume*
	comprehend	*believe*
	deplore	*charge*
	forget (about)	*claim*
	grasp	*conclude*
	ignore	*conjecture*
	make clear	*deem*
	mention	*fancy*
	mind	*figure*
	regret	*intimate*
	remember	*maintain*
	resent	*suppose*
	take into account	
	take into consideration	
With subject complements	*amuses*	*appears*
	bothers	*chances*
	counts	*false*
	exciting	*happens*
	makes sense	*likely*
	matters	*possible*
	odd	*seems*
	relevant	*sure*
	significant	*true*
	suffices	*turns out*
	tragic	

A third aspect of the Kiparskian definition of factivity is the concept of presupposition. In contrast to nonfactive sentences, factive sentences are claimed to carry with them the presupposition that the embedded clause expresses a true proposition. How can we determine

whether a sentence contains a presupposition? And how can the underlying concept of presupposition be characterized? The answer to the first question depends on the answer to the second, which will be addressed in Chapter 3. For our current purposes of distinguishing factive from nonfactive sentences, I will use two of the standard tests for presuppositions: constancy under negation and question. The next section serves to introduce those two most common presupposition tests informally. In connection with the discussion of presuppositions in Chapter 3, I will explain the background of these presupposition tests more carefully and also point to some of their pitfalls.

2.2.2 Presupposition Tests: Constancy under Negation and Question

It has long been noted that presuppositions – unlike assertions – remain constant under certain modifications of the containing sentence. The basic idea of all presupposition tests is that a sentence has an elementary presupposition if the supposed presupposition remains present even if the containing sentence is modified in certain aspects. As for factivity, a matrix predicate is called 'factive' if the presupposition that the embedded clause expresses a true proposition is present in the original as well as in the modified sentence. Two of the most well-known presupposition tests are constancy under negation and constancy under yes/no question, which were also used by Kiparsky & Kiparsky (1971).
The negation test, introduced by Strawson (1956), makes use of the observation that presuppositions are preserved under sentence negation. This is illustrated in (6) and (7). Both (6b) and (7b) presuppose that it is raining (where » is to be read as 'presupposes'), just like their positive counterparts (6a) and (7a). Thus, *is odd* and *regret* are classified as factive predicates.

(6) a. It is odd that it is raining. » It is raining.
b. It is not odd that it is raining. » It is raining.

(7) a. I regret that it is raining. » It is raining.
b. I do not regret that it is raining. » It is raining.

The matrix predicates *is likely* and *suppose* are classified as nonfactive, since neither the positive (a) nor the negated (b) sentences in (8) and (9) presuppose that it is raining.

(8) a. It is likely that it is raining. ¬ » It is raining.
b. It is not likely that it is raining. ¬ » It is raining.

(9) a. I suppose that it is raining. ¬ » It is raining.
b. I do not suppose that it is raining. ¬ » It is raining.

The yes/no question test, employed *inter alia* by Kiparsky & Kiparsky (1971) and Fillmore (1971), exploits the observation that yes/no questions share the presuppositions of their assertive counterparts. What is questioned in the factive sentences in (10) for example is not whether it is raining. Rather it is taken for granted that it is raining and it is questioned whether the addressee regrets it or thinks it is odd, respectively. The sentences in (11), just like their assertive counterparts (8a) and (9a), do not carry the presupposition 'it is raining' and thus provide additional evidence for the characterization of the matrix predicates *suppose* and *is likely* as nonfactive.

(10) a. Do you regret that it is raining? » It is raining.
b. Is it odd that it is raining? » It is raining.

(11) a. Do you suppose that it is raining? ¬ » It is raining.
b. Is it likely that it is raining? ¬ » It is raining.

In short, both the negation test and the yes/no question test can be used to identify the elementary presupposition of a complex sentence and thus generally suffice to determine whether a matrix predicate is factive or nonfactive in the Kiparskian sense.

2.2.3 Deficits of the Lexical-Semantic Account

Kiparsky & Kiparsky (1971) state that factivity is a property of a certain class of matrix predicates. The presupposition in factive structures, however, is carried by the complex sentence. How does this interpretation come about? Does the embedded clause contribute to the factivity of the entire sentence? Kiparsky & Kiparsky do not provide answers to these questions. And even some thirty years later, factivity is still largely regarded as a matter of classifying matrix predicates, while the role of the embedded clause in achieving a factive reading of the complex sentence has been neglected. In this section, I will show that the lexical-semantic property of belonging to a certain class of predicates does not suffice for yielding a factive interpretation. Besides a specific type of matrix predicate, a factive interpretation seems to require a specific type of complement clause, generally a tense/aspect marked complement.

The Kiparskian account implies that factivity is a property of predicates, which is independent of the type of complement clause involved. Complex sentences that contain factive matrix predicates in the Kiparskian terminology without presupposing the truth of the embedded clause thus pose a problem for this approach.

Consider first the verb *forget*. In general, *forget* means to omit or disregard something unintentionally. (12a) with a *that*-complement means that Mary actually filled the tank, but later forgot about that, and (12b) means that Mary intended to, but did not fill the tank.

(12) a. Mary$_i$ forgot that she$_i$ filled the tank. » Mary filled the tank.
b. Mary forgot to fill the tank. ¬ » Mary filled the tank.

The former sentence presupposes that Mary filled the tank, whereas the latter sentence implies the opposite, namely that Mary did not fill the tank. In other words, the factivity of *forget* is present with a *that*-clause but is absent when embedding a nonfinite complement clause. The short dialogue in (13) illustrates that the factive reading may also be absent when the matrix predicate *forget* appears without any complement.

(13) A: By the way, did you buy bread?
B: Oops, I totally forgot! (= I forgot to buy bread)

The verb *remember* exhibits a pattern similar to that of *forget*. The complex sentence receives a factive interpretation if the matrix predicate embeds a *that*-complement (14a), and a nonfactive reading if the predicate embeds a *to*-complement (14b).

(14) a. John$_i$ remembered that he$_i$ brought wine. » John brought wine.
b. John remembered to bring wine. ¬ » John brought wine.

The negation test confirms that *remember to* is nonfactive. (15) can only mean that although he had the intention to, John did not bring the wine.

(15) John didn't remember to bring wine. ¬ » John brought wine.

One could argue that the interpretation patterns of *forget* and *remember* are due to the idiosyncratic properties of these verbs. They may be ambiguous or underspecified with regard to factivity since they take both facts and events as complements (Ehrich, p.c.). However, the following examples show that the phenomenon of nonfactive readings of so-called factive predicates is of a more general nature. Consider the adjectival predicates *is tragic*, *be glad* and *be sad*, which have all been categorized as factive. Only the (a) but not the (b) sentences in (16) to (18) below presuppose the truth of the embedded proposition.

(16) a. It is tragic that Ben lost faith in linguistic theory.
» Ben lost faith in linguistic theory.
b. It is tragic to lose faith in linguistic theory
¬ » Somebody lost faith in linguistic theory.

(17) a. Sue was sad that Mary went to London. » Mary went to London
b. Mary was sad to go to London.
(But then she got sick and didn't have to go.) ¬ » Mary went to London

(18) a. Sue was glad that Mary went to London. » Mary went to London
b. Mary was glad to go to London.
(But then she got sick and couldn't go.) ¬ » Mary went to London[1]

Furthermore, some verbal predicates are not interpreted as factive when embedding gerundial complements, as illustrated in (19). Thus, the (a) but not the (b) sentences presuppose that Mary brought wine.

(19) a. Mary took into account/bore in mind/mentioned that she brought wine.
» Mary brought wine.
b. Mary took into account/bore in mind/mentioned bringing wine.
¬ » Mary brought wine.

In sum, many of the Kiparskian factive predicates are not always factive. The lexical-semantic property of belonging to a certain class of predicates does not suffice for yielding a factive interpretation of the complex sentence. Why do so-called factive matrix predicates in concert with certain complement clauses achieve a factive interpretation of the complex sentence, while other complement clauses seem to exclude a factive reading? In order to solve this puzzle we have to look more closely at the interaction between matrix predicate and complement clause in achieving factivity. The next section will therefore provide an overview of the major types of complement clauses that can be part of a factive sentence. The semantic-syntactic account of factivity ensuing from the characterization of the complement clauses in factive sentences will be presented in detail in Section 2.4.

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[1] Speaker judgment may vary. Karttunen (1971b) for example states that the similar sentence *John was glad to see his parents* presupposes that the complement clause represents a true proposition.

2.3 Complement Clauses in Factive Sentences

In this section I delineate the types of complement clauses that – if embedded by factive predicates in the Kiparskian terminology – trigger factivity of the complex sentence. First, *that*-complements trigger a factive reading of the entire sentence. They are a common form of complementation with factives and may be the default in factive sentences (20).

(20) a. Mary forgot that she bought a mobile phone.
b. Mary remembered that she bought a mobile phone.
c. Mary was sad that she bought a mobile phone.

It has been argued that the overt complementizer *that* is obligatory with factive verbs, since it has a specific semantic function. Hegarty (1992), for example, assumes that *that* binds the event θ-role of the embedded clause. If *that* is not present, the event θ-role cannot be bound, yielding a nonfactive interpretation (cf. Section 4.2).[2] Some factive predicates indeed require the overt complementizer *that* as predicted by this proposal (21).

(21) a. Mary mentioned *(that) she bought a mobile phone.
b. Mary pointed out *(that) she bought a mobile phone.
c. Mary recalled *(that) she bought a mobile phone.
d. Mary resented *(that) she bought a mobile phone.

However, the following sentences show that many factive verbs allow *that*-complements with both an overt and a non-overt complementizer.

(22) a. Mary admitted (that) she bought a mobile phone.
b. Mary forgot (that) she bought a mobile phone.
c. Mary remembered (that) she bought a mobile phone.
d. Mary knew (that) she bought a mobile phone.
e. Mary was sad (that) she bought a mobile phone.

Note that all sentences in (22) presuppose that Mary bought a mobile phone whether the complementizer *that* is present or not. Therefore, we can conclude that contrary to Hegarty's proposal, overtness of the complementizer *that* is not systematically related to the factivity of the matrix predicate. The complementizer patterns of perception verbs provide additional evidence for this conclusion. While *smell* and *taste* require the overt complementizer *that* (23), *see, hear* and *feel* also allow complements with the unrealized complementizer (24).

(23) a. John smelled *(that) the food was burned.
b. Mary tasted *(that) the food was burned.

(24) a. Mary saw (that) the food was burned.
b. Mary heard (that) the child was crying.
c. Mary felt (that) the situation was unbearable.

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[2] In a similar vein, Chierchia (1984) and Portner (1992) attribute an explicit semantic function to the complementizer *that*.

Similarly, verbs such as *quip, snort* and *rejoice* require the overt complementizer *that* (Ross, 1967), even though they are nonfactive.[3]

Moreover, tensed *wh*-complements, more specifically tensed complement clauses headed by *why*, are possible in factive sentences (25).

(25) a. John forgot why Jane was here.
b. John remembered why Jane was here.
c. John finally recalled why Jane was here.

The negation test in (26) shows that all sentences presuppose that Jane was here. While in (26b) and (26c) John does not remember the reason for Jane's late arrival, in (26a) he is aware of the motive.

(26) a. John didn't forget why Jane was here. » Jane was here
b. John didn't remember why Jane was here. » Jane was here
c. John didn't recall why Jane was here. » Jane was here

The classification of *why*-complements according to their exclamatory, interrogative or indicative mode is far from clear, [4] but this does not affect the observation that they trigger a factive interpretation when embedded by verbs such as *forget, remember,* and *recall.* Likewise, the matrix predicates *realize, find out, know, mention,* and *point out* embed tensed *why*-complements resulting in a factive reading.

Finally, besides the finite complement clauses mentioned so far certain types of nonfinite complements can occur in factive sentences as well. Consider the following examples from English, German, and Spanish, containing perfective complements ((27) to (29)), infinitival complements (30), and gerundial complements (31).

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[3] Note that *that* is also obligatory in topicalized complement clauses, cf. **(That) John bought a boat is wrong.*

[4] Exclamations (e. g., *what a fool, how tall*) can be embedded by factive but not by nonfactive verbs (cf. Grimshaw, 1979):
(i) John forgot/knew what a fool Jane was.
(ii) *John thought/wondered what a fool Jane was.
Why-complements, however, are grammatical with nonfactive as well as with factive verbs and thus cannot be exclamatory:
(iii) John forgot/wondered why Jane was late.
Interrogatives such as *whether* seem to be ungrammatical when embedded by factive verbs:
(iv) a. John wondered/asked whether Jane was upset.
b. *John forgot/remembered whether Jane was upset.
However, there are interrogatives such as *whether or not* that can be embedded by both factive and nonfactive verbs (Reis, p.c.):
(v) a. John forgot/remembered whether or not Jane suffered.
b. John wondered whether or not Jane suffered.
Thus, *why*-complements may be interrogative. An alternative explanation is offered by Lahiri (1991), who claims that *wh*-clauses such as (vi) below can be analyzed as free relatives:
(vi) I regret what John saw.
If argument and adjunct *wh*-phrases can be likened in this regard, the *why*-structures in (25) could be analyzed as free relatives as well.

(27) a. John forgot having bought roses before.
b. Mary remembered having gotten roses before.

(28) a. Er vergaß, den Wein gekauft zu haben. (Pérez-Leroux & Schulz, 1999)
he forgot the wine bought.PART to have.INF
b. Olvidó haber comprado el vino. (Pérez-Leroux & Schulz, 1999)
he.forgot to.have bought.PART the wine

(29) Bei dieser Tätigkeit vergaß Joe völlig, an den Rollstuhl gefesselt zu sein.[5]
during this activity forgot Joe totally to the wheelchair bound.PART to be

(30) a. John was surprised to meet Mary.
b. Er war überrascht, sie zu treffen. (Reis, p.c.)
he was surprised her to meet.INF
c. Bill was pleased to win the election. (Martin, 2001)
d. Er war erfreut, die Wahl zu gewinnen.
he was pleased the election to win.INF

(31) a. Mary recalled winning the race.
b. John regretted meeting Mary at the party.

The negation test shows that the sentences above are indeed factive, as illustrated in (32) through (36). Even when negated all sentences presuppose that the embedded clause expresses a true proposition.

(32) a. John didn't forget having bought roses before. » He bought roses before
b. Mary didn't remember having gotten roses before. » She got roses before

(33) Er vergaß nicht, den Wein gekauft zu haben. » He bought wine
he forgot not the wine bought.PART to have.INF

(34) Bei dieser Tätigkeit vergaß Joe nicht, an den Rollstuhl gefesselt zu sein.
during this activity forgot Joe not to the wheelchair bound.PART to be
» Joe was bound to the wheelchair

(35) a. John was not surprised to meet Mary. » John met Mary
b. Er war nicht überrascht, sie zu treffen. » He met her
'He was not surprised to meet her.'
c. Bill was not pleased to win the election. » Bill won the election

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[5] Interestingly, some speakers may accept both a factive and a negative-implicative interpretation for infinitival complements without perfective marking in German as in (i) and (ii):
(i) Joe vergaß völlig, (eigentlich) im Rollstuhl zu sitzen.
Joe forgot totally actually in.DAT wheelchair to sit
(ii) Jill vergaß ganz, in Stuttgart zu sein.
Jill forgot totally in Stuttgart to be
The possibility of a factive interpretation for these structures is related to the type of verb in the embedded clause. While stage-level predicates like the ones above may allow a factive reading, individual-level predicates (e. g., *be German*), activity verbs (e. g., *laugh*) or resultative predicates (e. g., *buy the wine*) never allow a factive interpretation. I do not have an explanation for this phenomenon.

d. Er war nicht erfreut, die Wahl zu gewinnen. » He won the election
'He was not pleased to win the election.'

(36) a. Mary didn't recall winning the race. » Mary won the race
b. John didn't regret meeting Mary at the party. » John met Mary at the party

In summary, there are several clausal complement types triggering a factive reading of the complex sentence. Besides *that*-complements, with and without overt complementizer, finite *wh*-complements, and certain nonfinite complement types (perfective, infinitival, gerundial) allow a factive interpretation of the complex sentence if embedded by a Kiparskian factive matrix predicate. It should be noted that not all matrix predicates allow all these complement types.

Do these complement types share a specific feature that could be characterized in terms of a prerequisite for factivity? Or is the relation between Kiparskian factive matrix predicate and possible type of complement clause idiosyncratic and therefore the type of complement clause not relevant for achieving factivity? As an answer to these questions, in Section 2.4 I will present a semantic-syntactic account of factivity and argue that all complement types mentioned in fact share a specific semantic-syntactic marking. A certain kind of tense/aspect marking of the complement clause (phrased as topic time relations between matrix and embedded clause) is suggested as the common feature serving as a prerequisite for factivity.

2.4 A Semantic-Syntactic Account of Factivity

The semantic-syntactic concept of factivity is compositional in nature. It starts out from the notion that both lexical-semantic factors such as a specific type of matrix predicate and semantic and syntactic properties of the specific type of complement clause contribute to a factive interpretation of a complex sentence. It can thus be regarded as a refinement of Kiparsky & Kiparsky's lexical-semantic approach that solely relied on the lexical-semantic properties of matrix predicates.

Crucially, I do not assume that there are particular complement types that always receive a factive interpretation, regardless of the matrix predicate. (37) shows that *that*-complements for example can be part of a factive as well as a nonfactive sentence.

(37) a. Sue remembered that Mary went to London » Mary went to London
b. Sue thought that Mary went to London ¬ » Mary went to London

In Grimshaw's words:

> Since *that*-complements occur with both factive and nonfactive contexts, i. e. both where their propositional content is presupposed and where it is not, there is nothing inherent to *that*-clauses that dictates whether or not they can be presupposed. (Grimshaw, 1979: 320)

Rather than attributing factivity solely to a specific type of complement clause or matrix predicate, the presence of a certain type of matrix predicate is regarded as a *conditio sine qua non* for achieving a factive interpretation in concert with a specific type of complement

clause. The members of the Kiparskian class of factive matrix predicates (cf. Table 2.1) will thus be called potentially factive (henceforth p-factive) to make clear that it is not the matrix predicate itself that achieves a factive interpretation. Rather p-factive matrix predicates have the semantic potential to achieve factivity when selecting a specific type of complement clause. This feature is part of the predicate's lexical entry. P-factive predicates can hence be characterized as follows:

(38) P-factive matrix predicate
Potentially factive matrix predicates are verbal or adjectival predicates that can trigger a factive interpretation of a sentence. Predicates such as *forget, regret, remember, be surprised, be pleased* belong to the lexical-semantic class of p-factive predicates.

When investigating the types of complement clauses that are permitted by certain types of matrix predicates two questions arise. One is the question of how to explain that matrix predicates do not freely take different kinds of complement clauses. Some predicates such as *think* only subcategorize *that*-complements, whereas other predicates such as *want* embed only *to*-complements, while still others such as *remember* take a wider range of embedded clauses, including *that*-complements, *to*-complements, *wh*-complements, and gerundial complements.[6] The second issue is the question of whether and how a factive reading is achieved given that the matrix predicate selects a certain type of complement clause. I will be mainly concerned with the second question and argue that the various complement types that – in concert with a p-factive matrix predicate – trigger the factivity of the complex sentence share a common feature. The relevant types of complements discussed so far are summarized in Table 2.2 below.

Table 2.2 Types of complement clauses allowed in factive sentences

Complement type		**Example**
Finite	overt *that*	*Mary regretted that she bought a mobile phone*
	non-overt *that*	*Mary admitted she bought a mobile phone*
	tensed *why*	*John remembered why Jane was here*
Nonfinite	perfective	*John forgot having bought red roses before*
	infinitival	*Mary was surprised to meet John there*
	gerundial	*Mary recalled winning the race*

Both finite and nonfinite complement clauses are required by the subcategorization frame of the p-factive matrix predicate. The thematic structure (or θ-grid, cf. Stowell, 1981) of the predicate determines the arguments, to which the predicate assigns a thematic role. According to the projection principle (Chomsky, 1981), the arguments are syntactically repre-

[6] See for example Grimshaw (1981) and Pesetsky (1982) for potential correspondences between semantic features of a matrix item and the possible syntactic types of the complement clause (the so-called canonical structural realization), and Karttunen (1972) for the opposite view that there is no connection between the semantic properties of the matrix verb and the syntactic type of the complement clause.

sented as NP, PP, or as a finite or nonfinite clause, depending on the specific θ-grid. Finite and nonfinite complement clauses differ, however, in a number of aspects. Informally speaking, the overt and non-overt *that*-complement clauses as well as the *why*-complements all carry tense. The fourth type of complement clause is marked for perfective aspect. The infinitival and gerundial complements seem to be marked for neither tense nor aspect. Nevertheless I will argue that a certain form of abstract tense/aspect marking constitutes the feature that is common to all complement types that trigger a factive reading of a complex sentence, if embedded by a p-factive matrix predicate. Thus, the notion of semantic-syntactic factivity can preliminarily be defined as follows: [7]

(39) Semantic-syntactic factivity (I)
Only if the complement clause is marked for a certain kind of tense and/or aspect, can p-factive predicates trigger the presupposition that the complement clause expresses a true proposition.

How can this hybrid notion of tense/aspect be defined? Klein's (1994, 1998, in prep.) tense theory offers a framework that unlike previous theories highlights the common ground of tense and aspect.[8] I will give an overview of Klein's analysis of tense (Section 2.4.1) and outline a possible extension of that analysis to subordinate clauses (Section 2.4.2), before sketching my proposal for tense-/aspect-marking in finite and nonfinite complement clauses in Sections 2.4.3 and 2.4.4, respectively.

2.4.1 Klein's Analysis of Tense

Klein (1994, 1998, in prep.) distinguishes between three time variables: the time of utterance (TU), the time of the situation (TS), and the so-called topic time (TT), i. e. the time for which an assertion is made. Crucially, topic time is involved in expressing both tense and aspect. His account of tense thus allows for a natural link between the notions of tense and aspect both of which are regarded as time-related notions.

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[7] Note that this definition is restricted to the interpretation of complex sentences. No assumption is made about NP complements, as the investigation of the interaction between p-factive and nonfactive matrix predicates and NPs is beyond the scope of this study. The following examples illustrate some of the issues relevant to interpreting NP complements.
(i) Sue regretted the trip to Tonga.
(ii) Sue envisioned the trip to Tonga.
Only in (i), the trip to Tonga is presupposed to have taken place, while one can dream about something that has or has not happened as in (ii). Note that insertion of an indefinite NP changes the picture; (iii) can only refer to a trip that has not yet taken place:
(iii) Sue envisioned a trip to Tonga.
Not all p-factive verbs behave similarly as shown in (iv) in contrast to (i):
(iv) Jim forgot the party.
Example (iv) can be uttered if either John was invited to a party but forgot about it and did not go, or John went to a party but cannot remember it afterwards.

[8] Previous theories are often based on Reichenbach's reference system (cf. Reichenbach, 1947, and Klein, 1994, for a critique).

Tense expresses the relation between topic time and the time of utterance. Tense marks whether the topic time precedes, contains, or follows the time of utterance, corresponding to the three basic choices of past tense (TT<UT), present tense (TT⊇UT), and future tense (TT>UT). Aspect, on the other hand, relates the topic time to the time of the situation. There are three basic choices. The topic time can be included in the time of the situation (TT⊂ST), expressing imperfective aspect and amounting to the view of the situation as 'ongoing'. If the topic time includes the time of the situation (TT⊇ST), perfective aspect is expressed, viewing the situation from the 'outside' or as 'completed'. Finally, if the topic time precedes the time of the situation (TT<ST), prospective aspect is expressed.

Let me illustrate the interaction of tense and aspect with the example of the English progressive. The progressive marks that the topic time is included in the time of the situation, thus expressing imperfective aspect. The topic time in turn can be in the past, present or future, corresponding to the three sentences in (40) below.

(40) a. Jane was singing.
b. Jane is singing.
c. Jane will be singing.

Let us first consider how declarative main clauses are treated in this analysis of tense. In finite main clauses, the finite component defines a time span, which can be placed somewhere on the time axis. This is the topic time, i.e. the time span for which an assertion is made. A main clause in the past tense like *Jane was here* for example makes the assertion that Jane was here about some particular time span in the past. According to Klein (1998, in prep.), in nonfinite clauses no assertion is marked, and thus there is no restriction to any particular time. A statement like (41) below for example is not marked as asserted. This does not necessarily exclude its interpretation as asserted, but then this is due to general context and world knowledge rather than to some explicit assertion marker such as finiteness.

(41) Me become a singer?!

In consequence, Klein holds that a topic time is only present in finite clauses. Using the notion of topic time in a broader sense, in Section 2.4.4 I will suggest that some nonfinite complement clauses could be argued to contain a topic time.

How are subordinate clauses treated in this account? Via definition finite subordinate clauses always contain a topic time. Whether this topic time is regarded as the time for which an assertion is made, however, depends on a number of factors such as the complementizer and the matrix verb. Klein gives the following examples (in prep: 19):

(42) a. That's the man who called.
b. Do you think that he called?

While (42a) implies that the man called, in (42b) this is not the case. Thus, finite subordinate clauses do not always involve an assertion, even though they all contain a topic time. Put briefly, Klein's solution to this puzzle is as follows (referred to as the 'direct carrier view'). The finite component initially carries both tense and an assertion component, and does so in subordinate clauses as well. Depending on the presence of other intervening factors (e.g., certain complementizers or matrix predicates), the finite component preserves or loses the initial assertion. Thus, in declarative main clauses, the assertion is generally

preserved, while in subordinate clauses the assertion is only preserved with certain complementizers and matrix predicates. Note, however, that a preserved assertion in a subordinate clause is different from an assertion in a main clause. The former can be equated with the presupposition of the complex sentence, while the latter may not involve any presupposition.

Let us now come back to the question of how to characterize the types of complement clauses that can trigger a factive interpretation. I will argue that it is a certain relation between the topic time of complement clause and matrix clause that permits a factive reading of the complex sentence if a p-factive matrix predicate is present. In the next section, I will informally describe the range of topic time relations that can in principle be found in factive sentences and arrive at a first generalization.

2.4.2 Topic Time Relations in Factive Sentences

The topic time is by definition the time span for which an assertion is made. Which relations do we find between the topic time of the embedded clause and the topic time of a matrix clause with a p-factive matrix predicate? First consider a typical factive sentence such as (43) below.

(43) John forgot that Mary bought wine.

The topic time of the matrix clause, henceforth referred to as TT_{MC}, is in the past (i.e. TT<UT), as is the topic time of the complement clause, henceforth referred to as TT_{CC}. The time for which the assertion 'Mary bought wine' is made precedes the time in which an assertion is made about John's forgetting, i.e. $TT_{CC}<TT_{MC}$. This is the case because the event of Mary buying wine, which is asserted in the complement clause, makes possible John's mental state of forgetting, which is asserted in the containing clause. Assuming that we can single out moments or parts of time spans, we can describe this relation between the two topic times as follows: $\forall t_{CC} \in TT_{CC}$ and $\forall t_{MC} \in TT_{MC}$, $t_{CC}<t_{MC}$.

Second, with certain matrix predicates the time span of the complement clause may have the same starting point as the containing clause, i. e $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC}=t_{MC}$. This is illustrated in (44).

(44) John regretted that he bought the notebook the moment he paid for it.

In the most forward reading of (44) John starts feeling regretful while he is paying for his purchase.

Third, the topic time of the complement clause can overlap with the topic time of the matrix clause, as shown in (45).

(45) John forgot that Mary lives in Berlin.

Looking at the topic times in isolation, TT_{MC} is in the past, and TT_{CC} is in the present. TT_{CC} (partly) overlaps with TT_{MC}, i. e. the time span for which it is stated that Mary lives in Berlin (partly) overlaps with the time span in which John forgot Mary's place of residence. While it is open whether Mary still lives in Berlin at the time at which John remembered that Mary lived there, there seems to be at least one moment in time for which it is asserted that Mary lives in Berlin and it is not asserted that John forgot that, i.e. $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC}<t_{MC}$.

A fourth relation between the topic time of complement clause and matrix clause is exemplified in (46).

(46) John forgot that Mary will be in Berlin.

TT_{MC} is in the past as before, but TT_{CC} is in the future. The time span for which it is asserted that Mary is in Berlin is preceded by the time span in which John forgot that, i.e. $\forall t_{CC} \in TT_{CC}$ and $\forall t_{MC} \in TT_{MC}$, $t_{CC} > t_{MC}$. Crucially, in this case the presupposition that Mary is in Berlin is absent. Rather this sentence is shorthand for something like *John forgot that Mary planned to be in Berlin.* In other words, if the complement clause carries future tense, the complex sentence is not factive.

Comparing the four basic relations between the topic time of complement clause and matrix clause, we find that only a future topic time is excluded for a factive reading. A factive interpretation then seems to require that there is at least one moment in time such that the topic time of the complement clause precedes or overlaps with the topic time of the matrix clause. Let us call this the *precede/overlap condition* for complement clauses. More formally, the precede/overlap condition can be stated as follows: $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$. This is just the condition that is fulfilled by past and present topic time relations between matrix clause and complement clause.

This hypothesis predicts that all complement types that in concert with a p-factive matrix predicate achieve a factive interpretation, exhibit the following characteristics: (a) The complement clause is specified for the topic time, and (b) the topic time fulfills the precede/overlap condition $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$. The modified definition of semantic-syntactic factivity is stated in (47) below.[9]

(47) Semantic-syntactic factivity (II)
Only if the complement clause contains a topic time that fulfills the precede/overlap condition $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$, can p-factive predicates trigger the presupposition that the complement clause expresses a true proposition.

In the next two sections, I will examine this hypothesis by reconsidering the various sentential complement types listed in Table 2.2. Finite complement clauses are discussed in Section 2.4.3, and nonfinite complement clauses are dealt with in Section 2.4.4.

2.4.3 Finite Complement Clauses

Three types of finite complement clauses occur in factive sentences: overt *that*-complements, non-overt *that*-complements, and *why*-complements. Overt *that*-complements have already been dealt with in the last section (cf. examples (43) to (45)), and it was shown that these finite *that*-complements are marked for the topic time and generally fulfill the precede/overlap condition for complement clauses. Non-overt *that*-complement clauses like (48) below can be analyzed in the same way as overt *that*-complements.

(48) a. Mary admitted she bought a mobile phone.
b. John forgot it was Mary's birthday.

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[9] For the final definition of semantic-syntactic factivity, see Section 4.3.2.

By virtue of being finite the type of complement clause is marked for the topic time, and the topic time of the embedded clause precedes (48a) or overlaps (48b) with the topic time of the matrix clause.

Moreover, the tensed *why*-complements considered here are marked for the topic time via definition. The topic time of the complement clause in (49a) overlaps with the topic time of the matrix clause, while in (49b) it precedes the time for which the assertion is made in the matrix clause.

(49) a. John remembered why Jane was here.
b. John remembered why Jane moved to Paris.

The topic time analysis of finite complement clauses then corroborates the hypothesis that all factive sentences share the property of containing a complement clause the topic time of which precedes or overlaps with the topic time of the matrix clause. The next section will investigate whether the nonfinite complement clauses also follow this pattern.

2.4.4 Nonfinite Complement Clauses

Three types of nonfinite complement clauses were found to trigger factivity when embedded by a p-factive matrix predicate: perfective complements, infinitival complements, and gerundial complements. Note that in Klein's tense theory nonfinite complements do not contain a topic time, and thus cannot mark an assertion by means of this time variable. As alluded to in Section 2.4.1, this is not to say that nonfinite clauses always lack an assertion, but that if an assertion is present it must come from an element other than the topic time. I will use the notion of topic time more broadly and will not *a priori* exclude that certain nonfinite complements may contain a topic time variable. Thus, for each of the complement types it has to be examined whether they contain a topic time that precedes or overlaps with the topic time of the matrix clause ($t_{CC} \leq t_{MC}$). Section 2.4.4.1 deals with perfective complements, Section 2.4.4.2 with infinitival complements, and Section 2.4.4.3 with gerundial complements.

2.4.4.1 Perfective Complements

Reconsider the perfective complements (27) to (29), repeated here as (50) to (52).

(50) a. John forgot having bought roses before.
b. Mary remembered having gotten roses before.

(51) a. Er vergaß, den Wein gekauft zu haben.
he forgot the wine bought.PART to have.INF
b. Olvidó haber comprado el vino.
he.forgot to.have bought.PART the wine

(52) Bei dieser Tätigkeit vergaß Joe völlig, an den Rollstuhl gefesselt zu sein
during this activity forgot Joe totally to the wheelchair bound.PART to be

The perfective gerundial complements in (50) express perfective aspect. By definition, perfective aspect relates the topic time to the time of the situation in the following way. The

time of the situation of buying or getting roses is included in the topic time for which the assertion is made that John bought or Mary got roses. This topic time of the complement clause precedes the topic time of the matrix clause, just as in the finite equivalent (43), in other words $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$. The German and Spanish examples (51) can be analyzed in the same way. The time of the situation of buying the wine precedes the topic time for which an assertion is made and the embedded verb is accordingly marked for perfective aspect.[10]

Example (52) contains an adjectival passive that expresses aspectual features as well, thus justifying an analysis in which the embedded verb is marked for a topic time (cf. Kratzer, 1993, for differences between adjectival and verbal passive). The topic time of the matrix clause is included in the topic time of the complement clause. There seems to be at least one moment in time for which it is asserted that Joe is bound to the wheelchair and it is not asserted that he forgot that, with $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} < t_{MC}$.

Thus, we can conclude that perfective complements are marked for the topic time and generally fulfill the precede/overlap condition for complement clauses. What is more, selection of a perfective complement is not an idiosyncratic property of a few verbs. It is possible for many of the p-factive matrix predicates including *forget, remember, mention, admit, ignore, regret, resent, recall,* and *confess* and always results in the factivity of the complex sentence.

2.4.4.2 Infinitival Complements

Factive sentences with an infinitival complement were given in (30), repeated here as (53) and (54) together with their German equivalents.

(53) a. Mary was surprised to meet John.
b. Mary war überrascht, John zu treffen. (Reis, p.c.)
Mary was surprised John to meet.INF

(54) a. Bill was pleased to win the election. (Martin, 2001)
b. Bill war erfreut, die Wahl zu gewinnen.
Bill was pleased the election to win.INF

Infinitival complements are not overtly marked for tense or aspect. At first sight then, it is not clear how these complement clauses could contain a topic time that fulfills the precede/overlap condition $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$. However, lack of an overt tense feature is not necessarily equivalent to lack of a tense operator. Stowell (1982), for example, observes that infinitival complements differ with regard to their temporal properties. In contrast to raising infinitives control infinitives possess a tense feature that generally expresses 'possible future' with respect to the tense of the matrix clause. Stowell argues that the different temporal properties of control and raising infinitives can be attributed to the presence or absence of the Comp position. Only control infinitives are said to contain a Comp position, which is specified for Tense, while raising infinitives are classified as IP

[10] Note that in English a perfective infinitive is ungrammatical (**He forgot to have bought the wine*). I do not have an explanation for this difference between German, Spanish, and English.

(cf. also Chomsky & Lasnik, 1991; Hegarty, 1992). In short, the argumentation is as follows: The raising verb has to govern the trace of the raised subject. As government would be blocked by the presence of CP, these structures are assumed to not contain Comp, i.e. to be IPs. In control infinitives, however, the implicit subject PRO must not be governed, according to the PRO Theorem. With CP being a barrier to government (cf. Chomsky, 1986), control infinitives then have to be CP. More recently, it has been suggested that the differences between these infinitival complements can be accounted for without reverting to structural distinctions. According to Boskovich (1997) for example, control and raising infinitives differ in their specification of the feature [±tense], with control infinitives being marked as [+tense] and raising infinitives as [-tense]. For the sake of convenience, in the present work it is assumed that infinitival complements can be CP or IP, depending on the type of matrix predicate.

The 'possible future' reading in control infinitives is illustrated in (55) below, where the act of remembering, promising, and wanting precedes the event denoted by the respective infinitival complement.

(55) a. John$_i$ remembered [PRO$_i$ to bring the wine].
b. Bill$_i$ promised Mary [PRO$_i$ to go to the hairdresser's].
c. Mary$_i$ wanted [PRO$_i$ to buy a new TV].

The temporal interpretation of control infinitives as possible future is especially clear in comparison to gerundial and finite complements.

(56) a. John$_i$ remembered [PRO$_i$ to bring the wine].
b. John$_i$ remembered [PRO$_i$ bringing the wine].
c. John$_i$ remembered [that he$_i$ brought the wine].

In (56a) remembering precedes wine-bringing. In other words, (56a) asserts that at some time t_i John remembered to bring the wine at some time t_j, with $t_i < t_j$. By contrast, in (56b) and (56c) bringing the wine precedes John's remembering he did so. According to Stowell (1982), raising infinitives (involving raising of the embedded subject to the subject or, in case of the so-called ECM verbs, to the object position) are interpreted differently. They do not have an internally specified tense feature. Instead, the understood tense of these complements is identical to or simultaneous with that of the matrix clause, as illustrated in (57) and (58).

(57) a. Jill$_i$ appears [t_i to like soccer].
b. John$_i$ seems [t_i to hate body-building].

(58) a. John believed Sue$_j$ [t_j to be the smartest].
b. John considered Sue$_j$ [t_j to be the perfect wife].

What is asserted in the subject-raising structure (57a), for example, is that at some time t_i it appears that Jill likes soccer at t_i. It cannot mean that Jill appears now to like soccer at some time in the future or the past. Likewise, the object-raising structure (58a) asserts that John believed at some time t_i that Sue was the smartest at t_i.

The different temporal properties of control and raising infinitives have been argued to account for further syntactic and semantic distinctions between the two complement types that were previously not well understood (cf. Stowell, 1982; Boskovich, 1997; Martin, 2001). Martin makes use of the tense distinction to explain the distribution of empty and

lexical subjects[11], the possibility of eventive predicates, and the occurrence of VP-ellipsis in nonfinite complements.

I claim that factivity is a further feature distinguishing control from raising infinitives, based on their different temporal properties. According to the hypothesis formulated above, all factive complements share the property of being marked for the topic time, with the topic time fulfilling the precede/overlap condition $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$. Regarding control and raising infinitives, this hypothesis predicts that raising infinitives prohibit a factive interpretation, while control infinitives allow a factive reading of the complex sentence.

First, consider the case of raising infinitives. Given that raising infinitives do not have an internally specified tense feature, they do not possess an inherent topic time and thus should not induce a factive interpretation. The yes/no question test shows that neither the subject-raising structures (59) nor the object-raising structures (60) presuppose the truth of the embedded clause.

(59) a. Does Jill appear to like soccer? $\neg$ » Jill likes soccer.
b. Does John seem to hate body-building? $\neg$ » John hates body-building,

(60) a. Did John believe Sue to be the smartest? $\neg$ » Sue is the smartest.
b. Did John consider Sue to be the perfect wife? $\neg$ » Sue is the perfect wife

As predicted, raising infinitives embedded by *appear, seem, believe, consider* (and also by *show, expect,* and *remember+NP*) do not trigger a factive reading of the complex sentence.

Raising infinitives embedded by evaluative adjectival predicates such as *be wise, be clever, be stupid, be nice, be foolish, be smart,* and *be kind* and their German counterparts show an interesting interpretation pattern. The truth of the complement clause seems to be presupposed only when the matrix predicate is in the past tense. Consider the examples (61) and (62) below.

(61) a. Bernie$_i$ was wise [t_i to run away from the bear]. (adopted from Wilkinson, 1970)
b. Mary$_i$ war verrückt, [t_i John zu küssen]. (adopted from Reis, 1977)
Mary$_i$ was crazy t_i John to kiss.INF

(62) a. Bernie was not wise to run away from the bear.
b. Mary war nicht verrückt, John zu küssen.
Mary was not crazy John to kiss.INF

Negation of the sentences preserves the truth of the complement clause (62) (cf. Wilkinson, 1970; Reis, 1977). Notice, however, what happens when (61) is set in the present tense. The affirmative sentences imply the truth of the complement (63), while the negated sentences (64) and the yes/no structures (65) do not presuppose the truth of the embedded clause.

(63) a. Bernie is wise to run away from the bear.
b. Mary ist verrückt, John zu küssen.
Mary is crazy John to kiss.INF

[11] The restriction of PRO to control infinitives is here motivated by the assumption that PRO is marked with null case and that control infinitives are marked as [+tense]. Null case is then checked via Spec-head agreement with I [-finite, +tense] (cf. Boskovich, 1997).

(64) a. Bernie is not wise to run away from the bear.
b. Mary ist nicht verrückt, John zu küssen.
Mary is not crazy John to kiss.INF

(65) a. Is Bernie wise to run away from the bear?
b. Ist Mary verrückt, John zu küssen?
is Mary crazy John to kiss.INF

Hence, evaluative predicates imply that the embedded event is true if the matrix predicate is specified as past, while the negated sentence and the question are ambiguous as to whether the event happened or not. As a preliminary solution I suggest that evaluative adjectival predicates belong to the class of *if*-verbs (cf. Section 2.6), which in affirmative sentences imply the truth of their complement. In sum, raising infinitives do not possess an inherent topic time and thus do not trigger a factive interpretation, as predicted.

Second, consider control infinitives. Given that they possess an internally specified tense feature, they may contain an independent topic time and thus should allow a factive interpretation of the complex sentence. The factive infinitival complements (53) and (54), repeated here as (66) and (67), indeed belong to the class of control infinitives.

(66) a. Mary$_i$ was surprised [PRO$_i$ to meet John there].
b. Mary$_i$ war überrascht, [PRO$_i$ John zu treffen].
Mary was surprised PRO John to meet.INF

(67) a. Bill$_i$ was pleased [PRO$_i$ to win the election].
b. Bill$_i$ war erfreut, [PRO$_i$ die Wahl zu gewinnen].
Bill was pleased PRO the election to win.INF

Crucially, these emotive adjectival predicates retain the factivity of the sentence when the matrix predicate is marked as present tense (68).

(68) a. Mary is (not) surprised to meet John.
b. Bill is (not) pleased to win the election.
c. Sie ist (nicht) überrascht, ihn zu treffen.
She is (not) surprised him to meet.INF
d. Bill ist (nicht) erfreut, die Wahl zu gewinnen.
Bill is (not) pleased the election to win.INF

What is the topic time relation of matrix and complement clause? In (68a) the time span for which the assertion 'Mary met John' is made begins more or less with the time span for which the speaker asserts that Mary was surprised about that meeting. In other words, the topic time of the complement clause has the same starting point as the topic time of the matrix clause, $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC}=t_{MC}$, similar to the finite structure. If this analysis is on the right track, tense in control infinitives is not invariably 'possible future' but can also be 'past'.[12] In other words, control infinitives contain a topic time and – depending on the matrix predicate – fulfill the precede/overlap condition. While nonfactive matrix predicates such as *promise* and *want* assign to their infinitival control complement 'possible future', control infinitives embedded by p-factive matrix predicates such as *be*

[12] See also Karttunen (1971a), who argues that factive complements express past tense.

surprised and *be pleased* fulfill the precede/overlap condition.[13] Likewise, semantically related predicates such as *be astonished, be amazed, be astounded, be stunned,* and *be satisfied, be delighted, be thrilled, be disgusted, be enchanted* belong to the class of p-factive predicates that embed control infinitives the topic time of which precedes or overlaps with the topic time of the matrix clause.

This analysis of infinitival complements accounts both for the fact that raising infinitives never receive a factive interpretation and for the observation that control infinitives embedded by p-factive matrix predicates can trigger a factive interpretation of the complex sentence. Note that the matrix predicates embedding factive control infinitives all belong to the class of emotive adjectival predicates. Matrix predicates such as *be surprised* and *be pleased* may have a special status, because they are not only adjectival, but the adjective is participial. Owing to their perfect participle marking, these predicates may have a particular semantic structure allowing them to trigger factivity even if the topic time is not overtly marked. This would explain why certain p-factive matrix predicates including *remember, forget, be glad,* and *be sad* in concert with control infinitives are not interpreted as factive. These predicates may be underspecified with regard to factivity. That is, the complement clause may have to be overtly marked with the right kind of topic time in order to achieve factivity.[14] Perfective and tensed complements contain an overt topic time marked as $t_{CC} \leq t_{MC}$ and thus allow a factive reading of the entire sentence. Control infinitives, on the other hand, are not overtly marked for the topic time and thus get a 'possible future' interpretation.

In sum, control infinitives – unlike raising infinitives – can trigger a factive interpretation of the complex sentence, since they possibly contain an independent topic time, which is not simultaneous with that of the matrix clause and which can fulfill the precede/overlap condition $t_{CC} \leq t_{MC}$. Hence, emotive adjectival predicates such as *be surprised, be pleased* (and their German counterparts *überrascht sein, erfreut sein*) in concert with an infinitival complement achieve a factive interpretation of the complex sentence, while evaluative adjectival predicates such as *be wise* or *be stupid* that embed raising infinitives do not trigger factivity.

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[13] Cf. Martin (2001) for an alternative view. He argues that tense in control infinitives is invariably a modal element, close to *would* or *should*, rather than expressing pure tense. Factive and nonfactive complements then differ as to whether they are better paraphrased with *would* or with *should*.

[14] The assumption that verbs like *forget* differ from predicates like *be pleased* is further supported by the diverging pattern of possible complement verbs. While *be pleased* licenses complement clauses with individual- and stage-level predicates (ia) as well as with activity and resultative verbs (ib), the former predicates seem only marginally possible with *forget* (ii).

(i) a. Joe was pleased to be German/live in Berlin.
b. Joe was pleased to sing/meet Suzie.

(ii) a. Jill forgot to *be German/??live in Berlin.
b. Jill forgot to sing/meet Suzie.

Interestingly, the German equivalent of (iia), given in (iii), behaves rather differently. If (iii) is accepted as grammatical, native German speakers clearly favor a factive over a negative-implicative interpretation.

(iii) Jill vergaß, Deutsche zu sein/in Berlin zu leben.

These data points to the fact that the type of embedded verb contributes (in a highly language-specific way) to the interpretation of the complex sentence. A further investigation of this topic is beyond the scope of the present work.

2.4.4.3 Gerundial Complements

Turning finally to factive gerundial complements, the crucial question is whether these complements contain a topic time that precedes or overlaps with the topic time of the matrix clause. Let us reconsider the examples given in Section 2.4, repeated below as (69).

(69) a. Mary$_i$ recalled [PRO$_i$ winning the race].
b. John$_i$ regretted [PRO$_i$ meeting Mary at the party].

Recall and *regret* belong to the class of emotive verbal predicates that along with *resent* and *confess* take not only finite complements but also so-called PRO-ing gerundial complements, resulting in a factive reading of the complex sentence. Following Martin (2001) I assume that (PRO-ing) gerunds carry an independent tense feature that is specified as past, present or future/unrealized depending on the matrix predicate. (70) for example asserts that at some time t_{MC} Mary tried to lock the door where locking the door is situated at some time t_{CC}, with $t_{MC} < t_{CC}$.

(70) Mary$_i$ tried [PRO$_i$ locking the door].

In line with the discussion of the infinitival complements above, we can conclude that PRO-ing gerunds may contain a non-overt topic time. Do factive gerunds then contain a topic time that fulfills the precede/overlap condition $t_{CC} \leq t_{MC}$? In (69a) the time for which the assertion 'Mary won the race' is made precedes the time in which an assertion is made about Mary's recalling that event. Similarly, in (69b) the time span for which the assertion is made 'John met Mary' begins with or shortly before the time span for which the speaker asserts that John regretted that meeting. As a result the prediction that factive gerundial complements contain a topic time that precedes or overlaps with the topic time of the matrix clause can be upheld.[15]

It should be noted that the verbs *regret, resent, recall,* and *confess*, which participate in this construction, belong – except for *recall* – to the class of emotive verbal predicates. Similar to the emotive adjectival predicates (cf. Section 2.4.4.2), these emotive verbal predicates may have a particular semantic structure allowing them to trigger factivity even if the topic time of the gerundial complement is not overtly marked. This would account for the fact that many p-factive predicates including *forget, realize, be aware, know, find out, point out, be surprised,* and *be glad* do not embed simple gerundial complements.[16] Furthermore, some p-factive verbs including *remember, mention, admit,* and *bear in mind* embed gerundial complements, but do not trigger a factive reading with gerunds. On a par with the analysis of infinitival complements, I assume that these p-factive predicates are

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[15] For an alternative explanation of factive gerunds, cf. Hegarty (1992: 76). He assumes that PRO-ing gerunds are specified as IP and that I is marked as [0tense, +N]. The [+N] feature is argued to act as a binder for the event role, yielding factive interpretations if the gerund is selected by the right matrix verbs.

[16] Jorgensen (1990) notes that *forget* + gerund, while not unattested, is extremely rare. He cites the following example, taken from a novel: *Maybe he had forgotten teaching me how to drive.* Some of the verbs allow gerunds headed by prepositions such as *of* (i) or *about* (ii):
(i) He was aware of becoming older.
(ii) She was glad about winning the race.

underspecified with regard to factivity. They need a complement clause that is overtly marked for a topic time with $t_{CC} \leq t_{MC}$ in order to achieve a factive interpretation of the entire sentence. PRO-ing gerundial complements are not overtly marked for the topic time and thus do not get a factive interpretation.

In sum, PRO-ing gerundial complements can trigger a factive interpretation of the complex sentence, since they possibly contain an independent topic time, which is not simultaneous with that of the matrix clause and which can fulfill the precede/overlap condition $t_{CC} \leq t_{MC}$. Emotive verbal predicates such as *regret, resent, recall,* and *confess* in concert with a PRO-ing gerundial complement achieve a factive interpretation of the complex sentence, while many other p-factive matrix predicates either do not allow gerundial complements or embed gerundial complements without triggering a factive reading of the entire sentence.

2.4.5 Summary

Refining Kiparsky & Kiparsky's (1971) lexical-semantic account of factivity, in this section I proposed a semantic-syntactic approach to the concept of factivity. According to this compositional approach both lexical-semantic factors such as a specific type of matrix predicate and semantic and syntactic factors regarding the specific type of complement clause have to interact in order to achieve a factive interpretation of a complex sentence. In other words, factivity is regarded as the predicate's lexical restriction on the selection of certain complement types. The class of Kiparskian factive matrix predicates was consequently reanalyzed as potentially factive (p-factive), since the predicates trigger factivity only in concert with a certain type of complement clause.

I then examined the types of clausal complements that are possible in factive sentences to determine whether these various complement types share a specific property allowing them to trigger factivity if embedded by a p-factive matrix predicate. As for finite complements, the relevant complement types were overt *that*-complements, non-overt *that*-complements, and *why*-complements. Regarding nonfinite complements, the pertinent complement types were perfective gerunds (in English), and perfective infinitives (in German and Spanish) as well as certain cases of infinitival and PRO-ing gerundial complements. Extending Klein's analysis of tense and topic time to subordinate clauses, I delineated the topic time relations between complement clause and containing clause. All factive sentences involving finite complements were found to have a subordinate clause containing a topic time that precedes or overlaps with the topic time of the matrix clause. This I called the precede/overlap condition, formulated as $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$.

The findings for nonfinite complements were more diverse. Perfective complements, which are possible with many of the p-factive matrix predicates, were shown to fulfill the precede/overlap condition just like finite complements. As for infinitival complements, I argued that inherent topic time marking is very restricted. It is possible only for control infinitives, which unlike raising infinitives can trigger a factive interpretation of the complex sentence, since they contain an independent topic time. Furthermore, only a very restricted class of matrix predicates, i.e. emotive adjectival predicates such as *be surprised* and *be pleased*, was found to embed control infinitives that actually fulfill the precede/overlap condition $t_{CC} \leq t_{MC}$. I conjectured that due to their perfect participle marking these predicates may have a particular semantic structure allowing them to trigger factivity

even if the topic time is not overtly marked. Finally, PRO-ing gerundial complements were claimed to contain an independent topic time. Similar to the case of factive infinitives, only very few matrix predicates were found to take PRO-ing gerunds with their topic time actually overlapping with or preceding the topic time of the containing clause. The few matrix predicates that can trigger factivity with gerundial complements mostly belong to the class of emotive predicates (e.g., *regret* and *resent*). Their ability to trigger factivity even if the topic time of the gerundial complement is not overtly marked was attributed to a particular semantic structure distinguishing them from other p-factive matrix predicates that either do not allow gerundial complements or embed gerundial complements without triggering a factive reading of the entire sentence.

Summarizing these findings regarding the kinds of complement clauses possible in factive sentences, I concluded that complex sentences with p-factive matrix predicates are interpreted as factive only if the complement clause contains a certain type of tense or aspect marking. This requirement was formulated in terms of the topic time relations between complement clause and matrix clause, referred to as the precede/overlap condition. With the possible exception of emotive participial and verbal predicates, p-factive predicates are thus underspecified with regard to their descriptive meaning and achieve factivity only in interaction with the right kind of complement clause.[17] Henceforth, the term 'factivity' is always understood in this compositional sense. Likewise, the term 'factive complement' refers to a complement of a p-factive matrix predicate, and the term 'factive sentence' refers to a complex sentence consisting of a p-factive matrix predicate and one of the above-mentioned types of complement. Furthermore, note that in the remainder of this book the expression 'a factive predicate triggers a presupposition' is shorthand for 'a potentially factive matrix predicate in concert with a certain type of complement clause triggers a presupposition'.

The notion of semantic-syntactic factivity proposed here does not exclude that there may be other means by which a complex sentence under certain pragmatic or structural conditions can receive a factive reading. The next section briefly sketches the main differences between semantic-syntactic factivity and what could be called 'pragmatic factivity'.

2.5 Semantic-Syntactic versus Pragmatic Factivity

In this section, I outline how contextual means of achieving a factive reading of a sentence can be distinguished from semantic-syntactic factivity. According to the definition of semantic-syntactic factivity, the interaction of a p-factive matrix predicate and a specific type of complement clause invariably results in a sentence that carries the presupposition that the complement clause expresses a true proposition. Intuitively speaking, the complex sentence is factive without depending on other sentence-internal and context related factors. Constructions that suggest a factive reading without containing a p-factive matrix predicate do so only under certain circumstances. Following Rullmann (1991), I call a factive reading

[17] The fact that emotive participial and verbal predicates do not play a role in the first stages of language acquisition may be related to this finding (cf. Chapter 5).

that is dependent on factors other than the type of complement clause and the specific properties of the matrix predicate *pragmatic factivity*.[18] Consider the following examples:

(71) I would not have thought that John's wife had an affair.

(72) Only "The Nation" reported it/the fact that John's wife had an affair.

(73) I can't believe that John's wife had an affair. (adopted from Grimshaw, 1979)

(74) He didn't TELL[19] me that John's wife had an affair.

(75) John did not suspect that his wife had an affair. (adopted from Rullmann, 1991)

(76) That John's wife had an affair was announced in the news. (adopted from Ehrich, p.c.)

Hearing these sentences, the listener is likely to infer that John's wife really had an affair. In other words, the sentences above seem to carry the presupposition that the embedded proposition is true. However, none of the matrix predicates is p-factive. If a subject *thinks, reports, believes, tells, suspects,* or *announces* that q, then q can be true or false, as demonstrated in the following examples.

(77) John thought/reported/accepted/believed/suspected/announced that his wife had an affair. He didn't really know, but she was gone all night every Thursday.

(78) Sue told her lover John that his wife had an affair. She didn't really know, but she wanted to make John feel less guilty about their affair.

Thus, the factive reading of sentences (71) through (76) results not from the matrix predicate in combination with a specific complement clause, but from other factors, including modality in (71), presence of an object expletive or the NP *the fact* in (72), negation in (73) and (75), emphatic stress in (74), and topicalization in (76). When applying the yes/no question test to the sentence bases, as illustrated in (79) to (84), it is evident that the sentences do not presuppose the truth of the complement clause.

(79) Did/Do you think that John's wife had an affair?

(80) Did the "The Nation" report that John's wife had an affair?

(81) Can/Do you believe that John's wife had an affair?

(82) Did he tell me that John's wife had an affair?

(83) Did John suspect that his wife had an affair?

(84) Did the news announce that John's wife had an affair?

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[18] The pragmatic factivity effect is attributed to considerations regarding the informational content of a sentence. More specifically, Rullmann (1991) claims that if a sentence is ambiguous between two readings, i. e. a factive and a nonfactive reading, the hearer prefers the reading that is highest in informational content. In other words, the hearer chooses the interpretation that leads to the greatest cutdown of the context set (for the notion of context see Section 3.3). The factive reading is the preferred reading, as it is higher in informational content and allows more worlds to be excluded from the context set.

[19] Capitalized letters indicate stress.

By contrast, semantic-syntactic factivity is unaffected by factors such as presence or absence of topicalization (85) or of the NP *the fact* (86). Both the (a) and (b) sentences below presuppose that John's wife had an affair.

(85) a. That John's wife had an affair was regretted by Jane.
b. Jane regretted that John's wife had an affair.

(86) a. Jane regretted the fact that John's wife had an affair.
b. Jane regretted that John's wife had an affair.

The focus of the present work is factivity in the semantic-syntactic sense proposed above. Thus I will have nothing to say about sentences in which the factive reading comes about as a result of factors other than the matrix predicate and the complement clause. I will also leave open whether and how pragmatic factivity is reflected in the grammar. However, the question of whether and how semantic-syntactic factivity is reflected in the grammar is crucial for this compositional approach. Recall that semantic-syntactically factive sentences are defined as carrying the presupposition that the complement clause is true.[20] As a *conditio sine qua non* for a compositional concept of semantic-syntactic factivity, sentences with a factive predicate should therefore invariably carry the presupposition ϕ. In other words, only if the factivity of a sentence remains constant under variations of the context can an inner-grammatical status be assigned to factivity. In turn, syntactic consequences of factivity are only expected if factivity is reflected in the grammar (cf. Chapter 4). It should be clear that in addressing these issues the concept of presupposition plays an important role. Depending on the theory of presupposition one adopts, the role of the context and therefore the notion of factivity may differ. In Chapter 3 I will take a close look at the notion of presupposition and argue that only a discourse-semantic approach to presupposition is compatible with the concept of semantic-syntactic factivity. Moreover, the compositional concept of factivity advanced here rests on the assumption that p-factive matrix predicates constitute a verb class that can be distinguished from the class of nonfactive matrix predicates. How can these nonfactive verbs be characterized, apart from the fact that via definition they do not presuppose the truth of their complement clause? This question is addressed in the next section.

2.6 P-factive and Nonfactive Matrix Predicates

The classification of verbal and adjectival predicates according to the feature [p-factive] implies the existence of a class of predicates that is *nonfactive*, i. e. that does not presuppose the truth of the complement clause. In studies on factivity a wide range of nonfactive predicates has been used to illustrate the syntactic and semantic contrasts to p-factive matrix predicates. Kiparsky & Kiparsky (1971) subsume predicates such as *believe, assume, is likely* and *think* as well as *happen* and *turn out* under the class of nonfactives. In the line of Karttunen (1972), I suggest a more fine-grained classification of nonfactive matrix predi-

[20] Note that presuppositions arise not only in relation with certain matrix predicates, but also due to other lexical items such as definite NPs (cf. also Chapter 3).

cates, based on the truth-values that their complements receive in affirmative and negated clauses. The following nonfactive predicate classes will be distinguished: propositional, volitive, positive-implicative, negative-implicative, if-predicates, negative if-predicates, only-if-predicates, and negative only-if-predicates.

Most of the predicates characterized by Kiparsky & Kiparsky (1971) as nonfactive belong to what Hegarty (1992) calls the class of propositional predicates. In contrast to factive predicates (87), they do not determine the truth-value of the complement clause (88).

(87) Sue regrets/forgets that Germany won the soccer game.

(88) Sue thinks/believes/assumes that Germany won the soccer game.

Only (87) presupposes that Germany won the soccer game, whereas (88) is open as to whether Germany lost or won the game. Negation of a propositional predicate does not alter the indeterminate truth-value of the complement clause (89).

(89) Sue did not think/believe/assume that Germany won the soccer game.

Like propositional verbs, *volitive* predicates including *tell to, ask to, want to*, and *wish to* do not determine the truth-value of the complement clause. Neither (90a) nor (90b) presuppose that Mary did the dishes. Instead the truth-value of the proposition is indeterminate.

(90) a. Bert told/asked/wanted Mary to do the dishes.
b. Bert didn't tell/ask/want Mary to do the dishes.

The reason for the indeterminate truth-value, however, differs for both predicate classes. In (88), the embedded proposition 'Germany won the soccer game' is either true or false at the moment of uttering the sentence, but Sue does not know which. In (90) the truth-value is indeterminate since the complement expresses a command or a wish. For that reason, these infinitives have also been termed *irrealis* (cf. Hegarty, 1992, and references therein). Consequently, even though volitive predicates cannot be distinguished from propositional predicates by determining the truth-value of the complement clause, their characteristics differ. When focusing on their truth-value, I will class propositional and volitive predicates together and refer to them as *indeterminate predicates*.

Now compare the propositional predicates above to positive-implicative predicates such as *happen, turn out, manage*, and *remember to*, which in an affirmative sentence entail the truth of the complement clause.

(91) It turns out that Germany won the soccer game.

The above sentence indicates that Germany won the game, but this proposition is asserted rather than presupposed. The difference between what is asserted and what is presupposed can be seen when the matrix predicate is negated. Negating (87) and (91), we arrive at the following sentences:

(92) Sue did not regret/forget that Germany won the soccer game.

(93) It did not turn out that Germany won the soccer game.

Under negation, the factive sentence (92) still presupposes that Germany won the soccer game, while no such presupposition is present in the positive-implicative sentence (93). On the contrary, the negated sentence entails that Germany lost the game.

The class of negative-implicative predicates includes verbs such as *forget to, refuse to,* and *avoid to.* They exhibit the reverse interpretation pattern of positive-implicative verbs. The affirmative matrix predicate entails the negation of the complement clause, and the negated matrix predicate entails the truth of the complement clause (Karttunen, 1972). Thus, (94a) below implies that John did not buy the wine, while negated (94b) implies that John bought the wine.

(94) a. John forgot to buy the wine.
b. John did not forget to buy the wine.

The remaining four predicate classes discussed by Karttunen (1972) have played a less important role both in studies on factivity and in language acquisition research and are sketched only briefly. If-predicates like causative *force* and *make sure* imply the truth of the complement clause only if the matrix predicate is affirmative (95a); in the negative case, the truth-value is indeterminate (95b).

(95) a. Mary forced John to clean the apartment.
b. Mary did not force John to clean the apartment.

Negative if-predicates including *prevent* and *keep from* exhibit the reverse pattern. That is, they imply that the complement clause is false if the matrix predicate is affirmative (96a); if it is negated nothing is said about the truth-value of the embedded clause (96b).

(96) a. John prevented Mary from cleaning the apartment.
b. John did not prevent Mary from cleaning the apartment.

Only-if predicates such as *be able* and *be possible* imply that the complement clause is false if the matrix predicate is negated (97b); otherwise the truth-value is indeterminate (97a).

(97) a. John is able to clean the apartment.
b. John is not able to clean the apartment.

Finally, negative only-if predicates like *hesitate* show a pattern opposite to the only-if predicates in that the truth of the complement clause is implied if the matrix predicate is negated (98b), otherwise the truth-value is indeterminate (98a).

(98) a. John hesitated to clean the apartment.
b. John did not hesitate to clean the apartment.

Table 2.3 below summarizes the classes of matrix predicates discussed in this section. Each class is listed with the truth-value that their complement clause receives when the matrix clause is affirmative and/or negated. Note that not all of the predicates listed below are equally representative of the semantic predicate classes. Focusing on predicates that have featured in previous language acquisition studies as well as in the two experimental studies presented in Chapter 7, I will illustrate some of the differences between members within the same semantic class.[21] As for factives, the verbs *realize* and *find out* differ from verbs such as *regret* when embedded under a conditional (Karttunen, 1972: 249).

[21] The verbs I used in Experiment 1 were *forget to, forget that, tell to, tell that* and in Experiment 2 *forget to, refuse to, forget that, find out that, think that, ask to.*

Table 2.3 Semantic predicate classes classified by the truth-value of the complement clause

Predicate class	Matrix clause	Complement clause	Examples
P-factive predicates	+/¬[a]	+[b]	*be aware, find out, forget, ignore, know, make clear, make sense, be odd, realize, recognize, regret, remember, resent, be pleased, be significant, be surprised, be tragic*
Propositional predicates	+/¬	α[c]	*assert, assume, believe, claim, figure, be likely, be possible, say, suppose, tell that, think*
Volitive predicates	+/¬	α	*ask to, desire, hope, promise, tell to, try, want to, wish to*
Positive-implicative predicates	α	α	*bother, care, happen, manage, be true, remember to, turn out*
Negative-implicative predicates	α	¬ α	*avoid, decline, fail, be false, forget to, neglect, refuse, refrain*
If-predicates	+	+	*bring about, cause, force, have, make, make sure, be wise*
Negative if-predicates	+	¬[d]	*discourage, dissuade, keep from, prevent, pretend*
Only-if-predicates	¬	¬	*be able, can, be in the position, be possible*
Negative only-if-predicates	¬	+	*hesitate*

[a] true or false sentence, [b] true sentence, [c] value '+' or '¬', [d] false sentence

(99) a. If I realize/find out later that I have not told the truth, I will confess it to everyone.
b. If I regret later that I have not told the truth, I will confess it to everyone.

Only the latter sentence presupposes the truth of the complement clause. Therefore, Karttunen regards *realize and find out* as semi-factive. Similarly, *be aware* and *recognize* are semi-factive. What is more, the widely used verb *know* possesses semi-factive properties as well (cf. Kiparsky & Kiparsky, 1971: 349; Levinson, 1983: 186).

(100) a. Bill knows that John kissed Mary.
b. Bill does not know that John kissed Mary.

(101) a. I know that John kissed Mary.
b. I do not know that John kissed Mary.

While in (100) the truth of the complement clause is presupposed independently of the negation, in (101b) due to the first person subject, negation of the matrix verb leads to the cancellation of the presupposition. Finally, emotive factive predicates including *regret* and *be sorry* lose their factive status when used as a *Verbum Dicendi* (Reis, 1977: 150), given that the complement clause is marked as subjunctive. This is more apparent in the German translation (102b).

(102) a. Kissinger regretted (to say) that the parties involved exhibited so little interest in negotiating.
b. Kissinger bedauerte, dass sich die Betroffenen so wenig verhandlungsbereit gezeigt hätten.

As for the class of propositionals, the class is not homogeneous either. While predicates such as *think, be possible, assume* are open as to the likelihood of the truth or falsity of the complement clause, other predicates including *be likely* seem to suggest more readily the truth of the complement clause. Furthermore, *believe*, which is often used as a nonfactive verb in experimental studies, has two distinct readings, one being comparable to Latin *putare* (*guess, think;* German *glauben*), the other comparable to Latin *credere* (*hold as true;* German *jemandem glauben*) (Reis, p.c.). *Believe* belongs to the class of propositionals proper only in the former reading, since in the meaning of *credere*, *believe* is an instance of a response stance verb.[22] Furthermore, report-of-speech verbs such as *tell* and *say*, while not presupposing the truth of the complement, cause the complement clause to be interpreted as quotative.

(103) Bill told John$_i$ that John's$_i$ wife is having an affair.

In order to utter the sentence above, the speaker must have heard Bill say to John 'Your wife is having an affair'. Whether this statement is true or false depends on whether Bill lied or spoke the truth. This differs from true propositionals, which express uncertainty about the truth-value of the complement clause.

As for implicatives, note that the predicates *be true* and *be false* are classified as positive-implicative and negative-implicative, respectively, since they pattern on verbs like *manage* and *fail*, as illustrated below (cf. Karttunen, 1972: 255).

(104) a. Sue managed to leave the country.
b. It is true that Sue left the country.

(105) a. Sue failed to leave the country.
b. It is false that Sue left the country.

Both sentences in (104) imply that Sue left the country, and the sentences in (105) both imply that Sue did not leave the country.

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[22] For a discussion of response stance verbs, see Section 4.5.

In sum, given that presupposition is the defining property of factive predicates, the class of factives can be distinguished from various classes of nonfactives, among them the class of propositionals, volitives and the class of negative-implicatives. When referring to specific members of a verb class, it should be borne in mind that not all verbs belonging to a verb class share exactly the same properties. In the remainder of the book, the term *nonfactive* refers to the whole range of verbs that do not presuppose the truth of the proposition expressed in the complement clause. Where necessary, references to specific classes are made.

2.7 Conclusion

In this chapter I discussed lexical-semantic and syntactic aspects of the concept of factivity. The semantic-syntactic account of factivity I propose can be regarded as a refinement of the initial definition of factivity by Kiparsky & Kiparsky (1971) according to which a verb is factive if the complex sentence containing that verb carries the presupposition that the complement clause expresses a true proposition.

Contrary to this lexical-semantic approach, I showed that factivity is not a property of the matrix predicate alone. The type of complement clause embedded by a factive matrix predicate is important in achieving factivity. Many matrix predicates that are factive in the Kiparskian classification such as *forget* and *remember* do not trigger a factive reading of the entire sentence when embedding nonfinite complement clauses. The following complement types were found to trigger a factive reading of the complex sentence if embedded by a Kiparskian factive matrix predicate: overt and non-overt *that*-complements, finite *wh*-complements, and a limited range of nonfinite complement types (perfectives, control infinitives, PRO-ing gerunds). The resulting semantic-syntactic account of factivity is compositional in nature. It is based on the assumption that both a specific type of predicate and a specific type of complement clause contribute to the factive reading of the entire sentence. The predicates have to belong to the class of what I have called potentially factive (p-factive) matrix predicates, i.e. verbal or adjectival predicates that can trigger a factive interpretation of a sentence. The types of complement clauses admissible in factive sentences have to contain a certain form of tense/aspect marking. Semantic-syntactic factivity is hence defined as follows. Only if the complement clause is marked for a certain kind of tense/aspect feature can p-factive predicates induce the presupposition that the complement clause expresses a true proposition. Extending Klein's (1994, 1998, in prep.) analysis of tense to subordinate clauses, I stated the restriction on tense/aspect marking as a restriction on the topic time relation between matrix and embedded clause. I put forward the hypothesis that all relevant complement clauses mentioned above contain a topic time that precedes or overlaps with the topic time of the matrix clause. If this precede/overlap requirement is not met, the complement clause cannot be part of a factive sentence. Put differently, p-factive predicates are generally underspecified with regard to their descriptive meaning and achieve factivity only in interaction with the right kind of complement clause, the possible exception being emotive participial and verbal predicates such as *be surprised* and *regret* that allow a wider range of complement types without losing the factive reading.

It was argued that this semantic-syntactic account of factivity is different from the notion of pragmatic factivity that comes about by means of contextual or specific structural conditions, which go beyond the interaction of a specific matrix predicate and a specific type of complement clause.

P-factive matrix predicates, which induce a presuppositional reading of a complement clause, differ from nonfactive matrix predicates, which do not presuppose the truth of their complement clause. Based on the truth-values of their respective complement clauses, several classes of nonfactive predicates can be distinguished, *inter alia* propositional, volitive, positive-implicative, and negative-implicative predicates.

The compositional view of factivity advanced in this chapter rests on the assumption that the interaction of a p-factive matrix predicate and a specific type of complement clause *invariably* results in a sentence that carries the presupposition that the complement expresses a true proposition. More precisely, it is assumed that the factive presupposition arises as a result of the specific linguistic structure of the sentence – let us call this assumption the inner-grammatical notion of presupposition – and not as a result of uttering this sentence in certain contexts. Is the concept of presupposition indeed inner-grammatical? And do p-factive predicates give rise to a presupposition independently of specific contexts, i. e. are they presupposition triggers? These questions will be addressed in Chapter 3.

3. Presupposition and Factivity

3.1 Introduction

Two questions were raised at the end of Chapter 2: Is the concept of presupposition indeed inner-grammatical? And do p-factive predicates give rise to a presupposition independently of specific contexts, i.e. are p-factive predicates presupposition triggers? In this chapter I will demonstrate that in a discourse-semantic framework presupposition is an inner-grammatical concept. Moreover, it will be shown that the analysis of p-factive predicates as presupposition triggers follows automatically in a discourse-semantic presupposition theory, thereby supporting the concept of semantic-syntactic factivity.

Note that this chapter focuses on factive presuppositions, i.e. presuppositions triggered by p-factive matrix predicates. The claims and arguments made here, however, should carry over to other presupposition triggers such as definite descriptions, iteratives, and cleft sentences.

Presupposition (with the Latin root *supponere*: *put underneath,* and *praesupponere*: *take for granted*) refers to specific kinds of inferences that seem to be systematically related to linguistic expressions and which can be isolated using specific linguistic tests. Suppose I tell you the following:

(1) You know what – Jill really regrets that she and Bill moved to New York.

The main information I want to relate to you is not that Jill and Bill moved to New York but rather Jill's feelings about that move and I assume that you are aware that such a move has taken place. The proposition (2) stated in the embedded clause is hence taken for granted or backgrounded.

(2) Jill and Bill moved to New York.

The backgroundedness of (2) becomes especially clear when imagining possible responses to (1). Whether you react with *Really?* or *That doesn't surprise me at all*, in their most forward reading both responses refer to the assertion that Jill regretted that move and not to the statement that they moved. (2) is called the presupposition of (1). Now assume that it is not true that Jill and Bill moved to New York. In this case it seems rather odd to utter a sentence like (1). Depending on the type of presupposition theory, (1) would either be judged false or infelicitous.

Presuppositions seem to function as a precondition not only for the truth but also for the falsity of a statement. Assume that my statement about Jill's feelings in (1) is false, prompting a response like (3).

(3) Jill certainly doesn't regret that she and Bill moved to New York. She got a fantastic job there.

The presupposition (2) is still present in the negated sentence above. Consequently, as mentioned before, a prominent property of presuppositions is that they are constant under negation. More generally speaking, changes in the carrier sentence of a presupposition do

not seem to affect the presence of the presupposition. Even if I rephrase my statement by embedding it under a nonfactive verb such as *think* (4), the presupposition (2) is still present.

(4) Do you think that Jill regrets that she and Bill moved to New York?

On the other hand, in the following modified carrier sentences the presupposition is absent.

(5) a. Did you dream that Jill regrets that she and Bill moved to New York?
b. Of course, Jill doesn't regret that she and Bill moved to New York, because in the end they didn't move there.

These and similar presupposition phenomena have been studied from a linguistic perspective extensively for more than three decades. The notion 'presupposition' has been coined by Strawson (1952, 1956); the debate about the nature of presuppositions itself, however, has a long philosophical tradition, in recent times dating back to Frege and Russell.

The question that has been guiding the bulk of linguistic work in this area is whether presupposition is a semantic or a pragmatic phenomenon. Semantic approaches to presupposition (e.g., Keenan, 1971; van Fraasen, 1968, 1969, 1971; Herzberger, 1973) hold that presuppositions arise in a systematic way and are therefore a logical phenomenon that can be understood by making use of truth-conditions and entailment relations only. Pragmatic approaches (e.g., Stalnaker, 1974; Karttunen & Peters, 1979; Gazdar, 1979) emphasize the sensitivity of presupposition to contextual factors. Consequently, in pragmatic theories presupposition is defined in terms of contextual factors or by means of the belief of speaker and hearer. Put differently, in semantic but not in pragmatic theories, presuppositions are part of the truth-conditional domain of meaning. A careful evaluation and comparison of these approaches (cf. Levinson, 1983; van der Sandt, 1988; Seuren, 1991; Beaver, 1997; Schulz, 1999) suggests that presuppositions belong to neither of the fields proper, while exhibiting properties of both. Therefore I will restrict myself to discussing two discourse-semantic approaches to presupposition – Heim's file change semantics (1982, 1992) and van der Sandt's presupposition theory (1982, 1988, 1989, 1992) – that avoid most of the problems that purely semantic or pragmatic approaches face. I will argue that under this type of hybrid theory, the concept of presupposition is indeed inner-grammatical.

The chapter is organized as follows. In Section 3.2 the concept of presupposition is compared with other semantic and pragmatic inferences including entailment, conventional implicatures, and conversational implicatures, to get a better insight into what should constitute the scope of a presupposition theory. Section 3.3 discusses how to determine elementary presuppositions of factive sentences in light of the general defeasibility of presuppositions. Section 3.4 presents Heim's and van der Sandt's discourse-semantic approach to presupposition. Section 3.5 concludes that in a discourse-semantic framework presupposition is an inner-grammatical notion and that p-factive matrix predicates are presupposition triggers.

3.2 Semantic and Pragmatic Inferences

For expository purposes, let us assume that a presupposition is a proposition the truth of which is generally taken for granted. Can we find properties that clearly distinguish presup-

positions from other semantic and pragmatic inferences? In this section, I will review four major types of verbal inferences. Section 3.2.1 contains a comparison of presuppositions and entailments. In Section 3.2.2 I briefly sketch conventional implicatures and in Section 3.2.3 generalized conversational implicatures (cf. Levinson, 1983, for a detailed account of these inferences). The following features are used for characterizing these inferences: defeasibility (cancellability), detachability, constancy under negation, and truth-conditionality. Section 3.2.4 summarizes the finding that presuppositions differ from other semantic and pragmatic inferences in at least one feature.

3.2.1 Presupposition versus Entailment

Presuppositions differ from entailments in a number of respects. Intuitively, a sentence φ entails a sentence ψ if and only if whenever φ is true, ψ also is. Or, more formally:

(6) S entails S' (relative to analyses Δ_S and $\Delta_{S'}$, respectively) iff for every situation v, if $[\Delta_S]^v = 1$, then $[\Delta_{S'}]^v = 1$. (with: If A is a category and a is a lexical entry or a lexical category and $\Delta = [_A a]$, then $[\Delta]^v = [a]^v$) (Chierchia & McConnell-Ginet, ^{2}1991: 72) [1]

Sentence (7a) entails (8), i.e. if it is true that John bought three books yesterday it is true that John bought two books yesterday. Put differently, entailment is truth-conditional. The negated sentence in (7b) does not entail (8). The sentence is not true, and therefore nothing can be concluded about the entailment.

(7) a. John bought three books yesterday.
b. It is not the case that John bought three books yesterday.

(8) John bought two books yesterday

Compare this pattern to that of a presuppositional sentence (9).

(9) a. John forgot that the cat is on the mat.[2]
b. John did not forget that the cat is on the mat.

(10) The cat is on the mat.

Note that (10) is entailed by (9a) but not by (9b), whereas (10) is presupposed by both the positive and the negated sentence. In an affirmative sentence, the presupposition is thus indistinguishable from its entailment. To properly assess the notion of presupposition, it is therefore necessary to take into consideration the behavior in affirmative as well as in negated sentences.

An important property of entailments is that they are not *defeasible* (or *cancellable*), i.e. it is not possible to cancel the entailment by adding some additional premises to the original

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[1] Note that the definition of entailment may differ according to whether only Modus Ponens holds as stated here or whether Modus Tollens is valid as well (for p→q: if ¬p then ¬q). I follow Bußmann (1990: 326) in assuming that the more 'liberal' definition without Modus Tollens holds for semantic entailment, i.e. generally for linguistic entailment relations.

[2] These and similar sentences are modeled after the famous Moore Paradox *The cat is on the mat, but I don't believe it.*

ones (Grice, 1975). The entailment of (7), for example, cannot be cancelled by adding *but John didn't buy two books yesterday*, as illustrated in (11).

(11) D* John bought three books yesterday, but John didn't buy two books yesterday.

In contrast, presuppositions are defeasible as shown in (5), repeated here as (12), though not in affirmative statements (13).

(12) a. Did you dream that Jill regrets that she and Bill moved to New York?
b. Of course, Jill doesn't regret that she and Bill moved to New York, because in the end they didn't move there at all.

(13) D* John forgot that the cat is on the mat, but the cat is not on the mat.

Furthermore, entailments are not *detachable*. That is, the entailment cannot be detached from an utterance by replacing some words of the utterance with synonyms without changing the truth-value of the utterance (cf. Levinson, 1983: 116). (14) is a synonym of (7a) and indeed also entails (8).

(14) John purchased three books yesterday.

Presuppositions are not detachable in either affirmative or negated sentences. (15) presupposes (14) just as the related statement in (16). Similarly, the negated sentence (17) presupposes (14) just as the synonymous statement in (18).

(15) John was sad that he purchased three books yesterday.

(16) John was sorry that he purchased three books yesterday.

(17) John was not sad that he purchased three books yesterday.

(18) John was not sorry that he purchased three books yesterday.

In sum, entailments are truth-conditional, not cancellable, not detachable and not present under negation, while presuppositions are generally cancellable and are preserved under negation.

3.2.2 Conventional Implicature

Conventional implicatures are assigned on the basis of the conventional meaning of the words occurring in a sentence. They are attached by convention to particular lexical items, e. g. pronouns used in address in German or French. The use of these pronouns conveys the type of social relationship between speaker and addressee, but their use is not truth-conditionally relevant. Hence (19a) and (19b) share the same truth-value, but only (19a) conventionally implies (20).

(19) a. Sie sind der neue Professor.
you.formal are the new professor
b. Du bist der neue Professor.
you.informal are the new professor

(20) The addressee is socially distant or socially superior to the speaker

The paraphrase of (19a) in (19b) also shows that conventional implicatures are detachable, that is exchanging the pronoun *Du* for *Sie* gets rid of the implicature (20). Conventional implicatures are preserved under negation (21). (21) conventionally implies (20) just as the affirmative counterpart.

(21) Sie sind nicht der neue Professor.
you.formal are not the new professor

Furthermore, conventional implicatures are non-cancellable (22), because they do not rely on defeasible assumptions about the nature of the context.

(22) D* Sie sind der neue Professor – aber Sie sind mir sozial nicht überlegen.
you.formal are the new professor – but you are me socially not superior
'You are the new professor, but you are socially not superior to me.'

In summary, conventional implicatures are non-truth-conditional, detachable, preserved under negation, and not cancellable. Compare that to presuppositions, which were also found to be preserved under negation, but unlike conventional implicatures are cancellable and not detachable.

3.2.3 Generalized Conversational Implicature

Conversational implicatures are derived on the basis of conversational principles such as the co-operative principle and maxims of conversation and are thus non-truth-conditional.[3] Generalized conversational implicatures are of special interest because they occur without requiring a very specific context. Let me briefly illustrate the working of generalized implicatures with the example of clausal implicatures, i.e. implicatures that are related to embedded sentences (for details, see Horn, 1972, and Gazdar, 1979). The reasoning for a clausal implicature is as follows. If the speaker uses a certain linguistic expression that fails to commit the speaker to the proposition expressed in the embedded clause, then the addressee may implicate that the speaker is not in the position to make the stronger statement. Clausal implicatures occur for example with verbs like *know* vs. *believe*. If someone utters (23) instead of (24), the addressee implicates that the speaker is not sure about whether John is married or not, in other words, the implicature is (25), where P means 'it is possible that'.

(23) I believe that John is married.

(24) I know that John is married.

(25) {P(John is married) & P ¬(John is married)}

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[3] The co-operative principle says: Make your contribution such as required, at the stage at which it occurs, by the accepted purpose or direction of the talk in which you are engaged. The Gricean maxims are as follows (for details, see Levinson, 1983):
(a) Relevance: Make your contributions relevant
(b) Quantity: Be only as informative as required for current conversational purposes
(c) Quality: Say only what you believe true and adequately supported
(d) Manner: Be perspicuous
Be brief and orderly and avoid obscurity and ambiguity

Like presuppositions, generalized conversational implicatures are defeasible, hence (26) does not implicate (25). Furthermore, they are not detachable, because it is not possible to get rid of the implicature of the utterance without changing its truth-value. (27) with a different matrix verb than (23) still has the implicature (25).

(26) I believe, well I even know that John is married.

(27) I think that John is married.

Finally, generalized clausal implicatures seem not to be preserved under negation. Possibly depending on the scope of the negation, (28) either has the implicature (25) or can mean that I am not in a state of belief about this issue but because I already know for certain that one or the other is the case.

(28) I don't think that John is married.

In sum, generalized conversational implicatures do not belong to the truth-conditional parts of meaning, and are like presuppositions cancellable and not detachable. In contrast to presuppositions, generalized conversational implicatures seem not to be present under negation.

3.2.4 Summary

In this section I briefly examined the concepts of entailment, conventional implicatures, and generalized conversational implicatures and contrasted them with the concept of presupposition. These semantic and pragmatic inferences were compared in terms of their truth-conditionality, defeasibility (cancellability), detachability, and constancy under negation. Constancy under negation, while not part of the traditional canon of properties, was shown to be crucial for evaluating the concept of presupposition. Table 3.1 below summarizes the main features of the semantic and pragmatic inferences discussed in this section. Note that presuppositions in positive and in negated statements are listed separately, as their properties are slightly different.

Table 3.1 Semantic and pragmatic inferences and their properties

Inference	**truth-conditional**	**defeasible (cancellable)**	**detachable**	**present under negation**
Entailment	yes	no	no	no
Conventional Impl.	no	no	yes	yes
G-conversational Impl.	no	yes	no	no (?)
$\text{Presupposition}_{\text{posS}}$	?	no	no	yes
$\text{Presupposition}_{\text{negS}}$	?	yes	no	yes (per def.)

This classification shows that presupposition (in positive and negated sentences) differs from all other inferences with regard to at least one feature. The properties that distinguish presuppositions from other semantic and pragmatic inferences, however, vary depending on

the specific type of inference.[4] Consequently, attempts to simply subsume presupposition under some other type of inference have to account for the differences listed above as do claims that there is one defining property of presuppositions. Note that negation plays a crucial role in the above classification. Constancy under negation refers to the observation that negating an affirmative sentence does not get rid of a presuppositional (or conventional) inference. The differentiation between presuppositions in positive and negated sentences results from the finding that their behavior at least regarding defeasibility differs. Two questions then arise. First, are there modifications of the carrier sentence other than negation in which presuppositions are preserved? In other words, are there other ways to determine the elementary presuppositions of a sentence? Second, are there other embedding contexts besides negation that may lead to cancelling the presupposition? These questions are addressed in Section 3.3 with a focus on factive predicates.

3.3 Identifying Presuppositions in Factive Complements

Comparing presuppositions with other types of inferences we found that presuppositions are sometimes preserved when other inferences are not, but also that presuppositions can be cancelled under certain conditions, when other inferences cannot. The first finding is related to the question of which tests can identify the elementary presuppositions of a sentence, say in contrast to its entailments or conversational implicatures. In Section 3.3.1 I will review standard tests such as constancy under negation and argue that only a series of tests can reliably identify an elementary presupposition for a sentence. The second finding concerns the question of how to predict correctly which elementary presuppositions are inherited and which ones are not preserved. These are referred to as the projection problem and the defeasibility problem, respectively, and will be sketched in Section 3.3.2.

3.3.1 Standard Tests for Presuppositions

The following presupposition tests are examined: test of constancy under negation, modality test, antecedent test, disjunction test, yes/no question test, and two text acceptability tests. While the former presupposition tests draw on implications between sentences, the latter two involve felicity judgments. I will argue that although each of the tests suffers from certain limitations, using a series of presupposition tests is successful in determining the elementary presupposition of a sentence.

Note that most of the criteria that are discussed in this section such as negation and disjunction will appear again in the discussion of the projection and defeasibility problem of presuppositions. It will turn out that many of the presuppositions are in fact not always preserved under negation, disjunction etc. Therefore, it is important to distinguish between the application of the presupposition tests to sentences in isolation, by which the elementary

[4] Note that truth-conditionality had to be left aside since whether presupposition has this property or not is a theoretical rather than an empirical question.

presuppositions can be determined, and the occurrence of presupposition triggers in complex sentences, where – depending on additional contextual information – projection and cancellation of the presupposition are possible (cf. van der Sandt, 1988: 40, for a similar argument).

3.3.1.1 The Test of Constancy under Negation

The negation test makes use of the observation that presuppositions are preserved under sentence negation. Both affirmative (29a) and negated (29b) carry the same presupposition.

(29) a. John forgot that he bought eggs. » John bought eggs
b. John didn't forget that he bought eggs. » John bought eggs

As mentioned before, the negation test can distinguish presuppositions from entailments, since only presuppositions are preserved under negation, but not entailments (30).

(30) a. John forgot that he bought eggs. ⊨ John bought something
b. John didn't forget that he bought eggs. ⊨ ?

The negation test seems to work well and is in fact widely used, both in theoretical and in language acquisition studies. A closer look, however, shows that this criterion is both too strong and too weak to pick out a homogeneous set of inferences. Constancy under negation is apparently too strong because it excludes the possibility that A » B does not always imply that non-A » B. Owing to the additional information given in the second clause, in (31) the presupposition of the factive sentence 'David did a Ph.D.' is not preserved.

(31) David did not regret that he did a Ph.D. He had not even finished his MA when he got a job at a computer company and was very happy about that.

Given that most negated sentences with a presupposition have such a second non-presuppositional reading[5] it seems difficult to use negation as a presupposition test, for the defining difference between these two types of negation is that one of them is presupposition-preserving and the other one is not. Furthermore, if the negation operator is indeed ambiguous between these two readings (cf. Seuren, 1985), we may expect two different negation morphemes, which we do not find.[6] On the other hand, the presupposition-preserving interpretation seems the preferred reading, since without the additional information in (31) the presupposition would be present in the negated sentence. The non-presuppositional reading of the negation is chosen only if explicit contradictory information is given and thus seems to be more marked. Constancy under negation is too weak in that it would include conventional implicatures such as (19), repeated here as (32), and (33). Recall, however, that conventional implicatures, unlike presuppositions are detachable from their carrier sentence.

(32) a. Sie sind (nicht) der Professor.
You.formal are (not) the professor
b. The addressee is socially distant or socially superior to the speaker

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[5] These two interpretations correspond to Russel's wide and narrow scope reading (1903, 1905 reprinted 1956).

[6] But see Seuren (1991: 34f.) for arguments that the negation types differ grammatically.

(33) a. Do/Don't close the door!
b. The door is open

Besides these theoretical limitations, the negation test faces some practical problems. First, there are many ways in natural language besides *not* to negate a sentence: *no, nonsense, it is not the case that, it is false that, nobody, nowhere, nothing, un-, im-, non-*, to list just a few of them (see Reis, 1977: 35, for a list of German negation morphemes). These means of negation are not all equally appropriate as a test for presupposition. Moreover, even if we restrict ourselves to the negation with *not*, the negation test becomes difficult to apply, if negative and positive polarity items are contained in the sentence under question. Sentences with negative polarity items like *mind* do not have a positive grammatical counterpart (34). Positive polarity items such as *swarm with* that are negated lose the presupposition if the scope of the negation is wide as in (35).

(34) David doesn't mind/*does mind that his theory is wrong. » His theory is wrong

(35) The place is not swarming with ants. ¬ » There are ants.

The latter sentence echoes the comment that the place is swarming with ants. Finally, complex coordinations, exemplified in (36), are difficult to negate with *not* and so are non-declarative sentences as shown in (37) and (38) (cf. Reis, 1977: 39, for German).

(36) a. Ben visits his child, and Anna visits her child.
b. Ben does not visit his child, and Anna does not visit her child.

(37) a. How tall you are!
b. *How tall you are <u>not</u>!

(38) a. Will you help me with the box?
b. ?You will not help me with the box?

In sum, the various restrictions of the negation test indicate the need of additional criteria to determine elementary presuppositions in case the sentence in question is not a simple affirmation.

3.3.1.2 Yes/No Question Test

The test of constancy under yes/no questions, already alluded to in Section 2.2.2, exploits the observation that yes/no questions generally share the presuppositions of their assertive counterparts. What is questioned in (39b), for example, is not the presupposition that John got a Ph.D. but that he regretted it, whereas the entailment of (40a) 'John got a Ph.D.' is lost in the yes/no interrogative (40b).

(39) a. John regretted that he got a Ph.D. in Linguistics.
b. Did John regret that he got a Ph.D. in Linguistics?

(40) a. John managed to get a Ph.D. in Linguistics.
b. Did John manage to get a Ph.D. in Linguistics?

Note that conversational implicatures do not seem to be preserved under yes/no questions. While (41a) conversationally implicates that the speaker does not know that it's raining, this implicature seems lost in (41b).

(41) a. I think that it is raining.
b. Do I think that it is raining?

The yes/no question test can be applied to negative polarity items (42) and complex coordinations (43), but not to exclamations (44).

(42) Doesn't David mind that his theory is wrong? » His theory is wrong

(43) Is it the case that Ben visits his child and Anna visits her child?
» There is a child of Ben's and a child of Anna's.

(44) *Are you how tall?

In short, the yes/no question test is able to identify the elementary presupposition of a sentence in isolation unless it is an exclamative.

3.3.1.3 The Modality Test

The modality test goes back to Karttunen (1971a). Analogous to the negation and the yes/no question test, presuppositions and entailments differ under modal operators. While entailments are lost under modal embedding (i.e. $\varphi \models \psi$, but not: $\Diamond \varphi \models \psi$), presuppositions survive. Consider the positive-implicative verb *manage* and the p-factive predicate *be pleased*, which entail or presuppose the embedded proposition, respectively. (47) is the entailment of (45a) and the presupposition of (46a). While (45) entails (47) only without modal embedding, in the factive sentence (46), the presupposition (47) is present in both the affirmative sentence and under modal embedding.

(45) a. John managed to leave the country.
b. It is possible that John managed to leave the country.

(46) a. John was pleased that he left the country.
b. It is possible that John was pleased that he left the country.

(47) John left the country

Unlike the negation test, the modality test allows embedding of sentences with positive and negative polarity items (48) and complex coordinations (49).

(48) It is possible that David does not mind that his theory is wrong.
» His theory is wrong

(49) It is possible that Ben visits his child and Anna visits her child.
» There is a child of Ben's and there is a child of Anna's

The modality test faces the same problems as the negation and the yes/no question test, however, with regard to non-declarative sentences:

(50) *It is possible how tall you are!

(51) *It is possible that you could help me by any chance to carry the box?

Apart from these practical problems, however, the modality test generally suffices to determine a presupposition for sentences in isolation.

3.3.1.4 The Antecedent Test

The antecedent test also dates back to Karttunen (1973), who regarded the behavior of presuppositions in *if...then* clauses as the acid test for presuppositionhood. If a sentence with a presupposition is for example put in the antecedent of a conditional (52), the presupposition survives in this conditional context, whereas an entailment does not (53).

(52) If John was pleased that he left, he will never come back. » John left.

(53) If John managed to leave, he will never come back. $\neg \models$ John left.

Similarly, if a sentence with a presupposition is put in the consequence of a conditional, generally the presupposition (54) but not the entailment (55) survives.

(54) If John comes back, Sue will regret that she invited Bill. » Sue invited Bill.

(55) If John comes back, Sue will manage to forgive him. $\neg \models$ Sue forgives him.

Furthermore, embedding sentences containing positive and negative polarity items is possible as is embedding complex coordinations. Two problems arise with the antecedent test, however. First, the presupposition can be lost under certain structural characteristics of the conditional, as illustrated below.[7]

(56) If Peter drinks he drinks at least half a bottle, and if John drinks too the bottle ends up empty.

(57) If John has a wife, then he regrets that he is married.

Owing to the complex antecedent, (56) does not presuppose that Peter is drinking, even though the lexical item *too* normally presupposes that somebody shares a certain property with the subject of the clause, i.e. that Peter drinks as well. Likewise, (57) does not presuppose that John is married, although the consequence 'he regrets that he is married' does. This results from the fact that the presupposition in the consequence is related to the proposition of the antecedent. Hence, in order for the antecedent test to be applicable, the antecedent must not be complex, and the presupposition must be in the antecedent and be independent of the consequence, as in example (52) above. Furthermore, using behavior in *if...then* clauses as a test for presuppositions turns particles such as *even, just,* etc. into presupposition triggers, which is not uncontroversial (cf. Levinson, 1983: 185).

(58) If even Harry didn't cheat, the exam must have been easy.
» ?Harry is the most likely person to cheat.

In short, the antecedent test faces a number of shortcomings that do not make it a reliable criterion for identifying elementary presuppositions if used alone.

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[7] For the possibility of presupposition cancellation due to contextual factors see Section 3.3.2.

3.3.1.5 The Disjunction Test

The behavior in *either...or* sentences is used as well to determine the presuppositions of a sentence. Similar to conditionals, presuppositions survive in these embeddings, whereas entailments get lost (cf. Karttunen, 1973). (59) presupposes (60) and entails (61).

(59) The police sergeant knows that two thieves were caught last night.

(60) Two thieves were caught last night

(61) The police sergeant knows that a thief was caught last night

The presupposition (60) remains present in the disjuncts in (62) and in (63), but the entailment (61) does not. A disjunction is *inter alia* true if the first disjunct is false and the second is true, i.e. the police sergeant does not know that the two thieves were caught last night and the policeman will lose his job. Then it cannot be inferred that (61) holds.

(62) Either the police sergeant knows that the two thieves were caught last night or the policeman will lose his job.

(63) Either the policeman will lose his job or the police sergeant knows that the two thieves were caught last night.

Similar to conditionals, however, presuppositions in disjunctions are not present if the first disjunct negates the presupposition of the second disjunct, as shown in (64).

(64) Either John does not own a mobile phone, or he will regret that he owns a mobile phone.

In sum, if used alone the disjunction test is not a reliable criterion for identifying elementary presuppositions.

3.3.1.6 Text Acceptability 1

Text acceptability is a further criterion for presuppositionhood (cf. Stalnaker, 1973, 1974; van der Sandt, 1982, 1988). The first text acceptability test states that if A presupposes B then it is true that 'B $\wedge$ A' yield an acceptable piece of text. In contrast, if A entails B, then B cannot precede A. For example, the presupposition of (65) is (67), and adding the presupposition to the sentence, as illustrated in (68), yields a natural stretch of text. In contrast, the entailment of (66) is (67) as well, but it cannot precede that sentence, as shown in (69).

(65) John was pleased that he left the country.

(66) John managed to leave the country.

(67) John left the country

(68) D$\surd$ John left the country. John was pleased that he left the country.

(69) D* John left the country. John managed to leave the country.

This text acceptability test is not sufficient, though, to determine the elementary presupposition of a sentence since propositions can also precede their carrier sentence, as illustrated in (70).

(70) D√ John left the country. Max thought that John left the country.

When generalized conversational implicatures precede their carrier sentence as in (71), the resulting stretch of text seems rather odd. It is questionable, however, whether use of this text acceptability test is appropriate in this context.

(71) D?? Mary doesn't know whether Bill is married. Mary believes that Bill is married.

In sum, this kind of text acceptability test is able to distinguish between presuppositions and entailments, but fails to differentiate presuppositions from propositions (and possibly generalized conversational implicatures).

3.3.1.7 Text Acceptability 2

The second text acceptability test states that a presupposition cannot follow the presupposition-carrying sentence (cf. van der Sandt, 1988; Haas-Spohn, 1991), whereas propositions can go after the sentence that contains that proposition. This contrast is exemplified in (72) and (73).

(72) D* He regretted that she used his mobile phone. She used his mobile phone.

(73) D√ He thought that she secretly used his mobile phone. She secretly used his mobile phone.

Note that entailments pattern with presuppositions in this regard, while generalized conversational implicatures seem to allow the presupposition to follow the carrier sentence.

(74) D* She managed to get a divorce. She got a divorce.

(75) D√ Mary believes that Bill is married. Mary doesn't know whether Bill is married.

3.3.1.8 Summary

Section 3.3.1 addressed the question of which tests can identify the elementary presuppositions of a sentence. The range of tests I reviewed is summarized in Table 3.2 below. To underline the differences between the various test results, the behavior of elementary presuppositions is compared to the behavior of entailments.

The assessment of the various presupposition tests revealed that a single test cannot reliably identify an elementary presupposition of a sentence in isolation. Instead, constancy of a presupposition under multiple variations of a sentence seems to be the necessary condition for determining a presupposition (cf. also Reis, 1977; Chierchia & McConnell-Ginet, ^{2}1991). Reis argues that constancy under yes/no questions, imperative, negation, and modality are the relevant properties. In a simliar vein, Chierchia & McConnell-Ginet contend that the affirmative sentence together with negation, yes/no question and conditional form a *sentence family test* that basically assesses which implications remain untouched when asserted, negated, questioned, and offered as a hypothetical assumption.

Following this line of reasoning, I hold that a presupposition is present in an isolated sentence if it is preserved under a variety of tests, including the two text acceptability tests.

Table 3.2 Tests for factive presuppositions of isolated sentences

Tests		Presupposition (PSP)	Entailment
Negation	$\neg S_{PSP}$	inference preserved	inference lost
Modality	$\Diamond S_{PSP}$	inference preserved	inference lost
Conditional	$S_{PSP} \rightarrow S'$	inference preserved	inference lost
Disjunction	$S'_{PSP} \vee S$	inference preserved	inference lost
Yes/no question	$?S_{PSP}$	inference preserved	inference lost
Text acceptability 1	$PSP \wedge S$	D√	D*
Text acceptability 2	$S \wedge PSP$	D*	D*

Concluding, a sentence carries a presupposition if a) the sentence retains that presupposition under the aforementioned standard intrasentential tests of negation, modality, yes/no question, antecedent, and disjunction, and if b) the criteria of text acceptability are satisfied. Generally, it will suffice to use some of the presupposition tests to determine whether a given sentence in isolation has an elementary presupposition. How can we then predict which elementary presuppositions will be preserved in more complex contexts?

3.3.2 Projection Problem and Defeasibility Problem

The projection and the defeasibility problem refer to two perspectives on the same question. How can we predict the inheritance patterns and the cancellation patterns of elementary presuppositions when they occur in specific discourse situations and when they may be part of complex sentences? As a solution to the projection problem, Langendoen & Savin (1971) suggest that presuppositions follow the compositionality principle. Hence, the set of presuppositions of a complex sentence would simply be the sum of the presuppositions of the components. As pointed out before, however, presuppositions behave in a non-monotonic way. They are defeasible in both certain discourse contexts (76) and certain intra-sentential environments (77).

(76) Context: John just finished his B.A. and got a job offer from Microsoft.
At least John won't have to regret that he did a Ph.D.

(77) Mary didn't regret that John got a Ph.D., because in fact he didn't get it at all.

Therefore, a purely compositional treatment, relying on sentence internal information only, cannot yield a solution to the presupposition problem. In what follows, I will consider five phenomena that may lead to defeasibility of a presupposition: overt denial, suspension, embedding under logical connectives, embedding under verbs of propositional attitude and reported speech, and sensitivity to background assumptions.

First, overt denial is the explicit rejection of the underlying presupposition causing the cancellation of this presupposition (cf. Levinson, 1983). As pointed out before, overt denial cannot occur in affirmative sentences (78), but for example in negative (79) and modal (80) sentences. Owing to the overt denial, the presupposition (81) is not preserved in (79b) and (80b).

(78) D* John admitted that he left Bill, because/but in fact he never left Bill.

(79) a. John was not sad that he left Bill.
b. John was not sad that he left Bill, because in fact he didn't leave Bill.

(80) a. It is possible that John regrets that he left Bill.
b. It is possible that John regrets that he left Bill, but he didn't leave Bill.

(81) a. John left Bill

In yes/no questions, overt denial is possible as well, as illustrated in the following dialogue:

(82) Judge: Do you admit that you stole the money?
Defendant: No, because I didn't steal it at all.

Only the explicit rejection of the presupposition triggered by the p-factive verb *admit* saves the defendant from agreeing to having stolen the money. Simply saying *no* would leave the presupposition untouched.

Second, besides overt denial, suspension can eliminate the presuppositions of the preceding clause (cf. Horn, 1972; see also Levinson, 1983; van der Sandt, 1988). Suspension refers to the addition of qualifying phrases, for example *if he owns one at all* in (83) below.

(83) John clearly does not regret that he owns a mobile phone, if he owns one at all.

The first clause of (83) has the elementary presupposition that John owns a mobile phone, but it does not carry over to the whole sentence. In contrast, entailments cannot be suspended (84).

(84) D* John managed to buy a mobile phone, if he bought one at all.

Suspensions can also occur in modal embeddings (85) and in yes/no questions (86). As in the case of overt denial, however, suspension cannot apply in affirmative sentences (87).

(85) It is possible that John regrets that he is married, if he is married at all.

(86) Does John regret that he got married, if he is married at all?

(87) D* John clearly regrets that he owns a mobile phone, if he owns one at all.

Third, elementary presuppositions can be blocked if the sentences are embedded under the logical connectives *either ... or, if ... then*, and *and*. That is, even though embedding under disjunction and conditionals is used as a test for elementary presuppositions, there are cases in which the presuppositions are not projected to the complex clause, thus functioning like filters (Karttunen, 1973). Consider the following statements:

(88) If John owns a mobile phone, he will regret that he owns it.

(89) John owns a mobile phone, and he will regret that he owns a mobile phone.

(90) Either John does not own a mobile phone, or he will regret that he owns a mobile phone.

(91) John owns a mobile phone

The presupposition (91) is not present in any of the connected clauses above, in spite of being embedded by the p-factive verb *regret*. In the conditional (88), the presupposition is at issue in the first clause, i.e. the clause entails (91). Therefore the presupposition of the

consequence does not carry over to the conditional. The conjunction (89) does not presuppose (91), because the presupposition is asserted in the first conjunct.[8] Finally, in the disjunction (90) the presupposition is not present, since the presupposition is negated in the first disjunct. In short, presence of logical connectives can lead to cancellation of elementary presuppositions if the presupposition is present in the second clause and if the antecedent entails the presupposition (*if...then*), if the presupposition is stated as a first conjunct (... *and* ...), or if the presupposition is entailed by a negative disjunct (*either...or*).

Fourth, presuppositions can be blocked if embedded by verbs of propositional attitude and verbs of reported speech, which Karttunen calls plugs. The presupposition 'I am German' in (92), for example, is cancelled, because dreams do not adhere to facts.

(92) I dreamed that I was German and that I regretted it. ¬ » I am German

Similarly, the presupposition in (93) that Santa Claus brought the presents is not preserved because embedding under *say* can cancel the presupposition resulting from context assumptions. That these plugs do not always block projection of the presupposition is illustrated in (94).

(93) Jane said that she didn't regret that Santa Claus brought the presents.
¬ » Santa Claus brought the presents

(94) Jane thought that she didn't regret that she was tough with her husband.
» Jane was tough with her husband

In (94), the presupposition of the complement clause of *regret* seems to be preserved even when embedded under the propositional verb *think*. In short, presuppositions embedded under verbs of propositional attitude and verbs of reported speech are preserved or cancelled due to context factors.

Finally, elementary presuppositions are sensitive to background assumptions, i.e. contextual information. Depending on the specific context, a sentence can be read as having or not having a presupposition, as shown below (cf. Karttunen, 1973):

(95) If the Vice-Chancellor invites the U.S. President to dinner, he will regret having invited a feminist to his table.

(96) If the Vice-Chancellor invites Simone de Beauvoir to dinner, he will regret having invited a feminist to his table.

(97) The Vice-Chancellor has invited a feminist to his table

Assuming that the U.S. President is not a feminist, the presupposition (97) is inherited by (95). (96) on the other hand, does not necessarily presuppose (97), despite the identical consequence. Here, the background assumptions come into play. If the listener knows or assumes that Simone de Beauvoir is a feminist, then the NP *a feminist* refers back to *Simone de Beauvoir*, and the presupposition is cancelled. If the listener, however, does not think of Simone de Beauvoir as a feminist, (96) presupposes (97). Contextual defeasibility of presuppositions occurs under many circumstances, for example, when it is common knowledge that

[8] Note that conjunction is used in the text acceptability test1 to determine the existence of the elementary presupposition of the second conjunct.

the presupposition is false. Assuming that the listener knows that John never married, but stayed single, the speaker can utter (98) without presupposing that John is married.

(98) At least John will not have to regret that he got married.

In a further instance, the context is such that evidence for the truth of the presupposition is being weighed and rejected as in the example below (cf. Levinson, 1983: 189f):

(99) A: Well we simply have got to find out if Serge is a KGB infiltrator.
B: Who if anyone would know?
A: The only person who would know for sure is Alexis; I've talked to him and he isn't aware that Serge is on the KGB payroll. So I think Serge can be trusted.

(100) Serge is on the KGB payroll

The whole point of this exchange is to argue that the presupposition (100) is false; therefore, the discourse in (99) does not carry that presupposition, even though *be aware* is a p-factive predicate.

In short, presuppositions can be cancelled for reasons of context information, if a) what is said taken together with the background assumptions is inconsistent with the presupposition, if b) it is common knowledge that the presupposition is false, or if c) the presupposition is uttered in some kind of *reductio* argument as in (99).

Now consider in more detail what happens in case a presupposition is cancelled. Assume that after looking in the cookie jar and realizing all the cookies are gone, I address my son with the statement (101). The presupposition of (101) is (102).

(101) Admit that you ate all the cookies.

(102) The addressee ate all the cookies

The state of affairs in that situation, i.e. the propositions that make up the discourse background, is such, however, that in fact the son did not eat all the cookies, rather I ate them myself without remembering that I did that. In this case, the presupposition conflicts with the background assumptions established so far in the discourse, because the presupposition is inconsistent with the propositions being part of the discourse background. This is referred to as *presupposition failure* and can broadly be defined as follows (cf. Section 3.4.6 for a refined version).

(103) Presupposition failure
Presupposition failure arises if and only if a presupposition PSP (e.g., the proposition expressed by the complement of a p-factive predicate) conflicts with the assumptions established so far in the discourse, i.e. if PSP is inconsistent with the propositions being part of the discourse background.

Note that after uttering a sentence with an unfulfilled presupposition such as (101), the failed presupposition may then be cancelled via overt denial or via suspension. Overt denial can be used by the speaker or by one of the discourse participants given that they know that the presupposition does not hold. Suspension occurs if speaker or addressee are uncertain about whether a presupposition holds and therefore suspend the commitment to that presupposition.

In summary, the discussion of the projection problem and the defeasibility problem revealed that the question of how presuppositions of sentences in isolation are inherited or

cancelled when combined to more complex sentences cannot be answered conclusively. Table 3.3 below summarizes the main findings regarding constancy and defeasibility of presuppositions.

Table 3.3 Constancy and defeasibility of presuppositions (PSP) under different embeddings

PSP embedded under		Constancy of PSP	Defeasability of PSP
Negation	$\neg S_{PSP}$	yes	in overt denial and suspension
Modality	$\Diamond S_{PSP}$	yes	in overt denial and suspension
Yes/no question	$?S_{PSP}$	yes	in overt denial and suspension
Conditional	$S_{PSP} \rightarrow S'$ $S \rightarrow S'_{PSP}$	yes	if S' presupposes PSP and if S entails PSP
Disjunction	$S'_{PSP} \vee S$ $S \vee S'_{PSP}$	yes	if S' presupposes PSP and if $\neg$ S entails PSP
Conjunction	$PSP \wedge S_{PSP}$	no	—
Verbs of prop. attitude/of rep. speech	$V\ [_{CP}\ PSP]$	yes	if it is clear that PSP is false
Background assumptions	Context + ... PSP ...[a]	yes	in reductio arguments, and if it is clear that PSP is false

[a] ... PSP ... indicates that the presupposition may be embedded or unembedded

On the one hand, certain types of embeddings including negation, modals, yes/no questions, conditionals, and disjunctions are likely to give rise to the preservation of the elementary presuppositions. On the other hand, phenomena such as overt denial, suspension, certain intrasentential contexts, and conflicting background assumptions lead to the cancellation of the elementary presuppositions. As a result, presupposition projection cannot entirely be captured by sentence-internal rules only.

3.3.3 Summary

Section 3.3 focused on the question of how to determine the factive presuppositions of a sentence. This question involves two aspects: identifying the elementary presupposition(s)

of a sentence in isolation and calculating the presuppositions in complex sentences and in specific discourse contexts. Addressing the first aspect, I examined a number of standard presupposition tests: constancy under negation, modality, conditionals, disjunction, yes/no questions, and two text acceptability tests. The analysis of these tests revealed that a single test is often not successful in determining the elementary presupposition of a sentence. The use of a combination of tests, however, was shown to generally suffice to determine elementary presuppositions of sentences in isolation.

The second aspect concerns the projection and the defeasibility problem. It was argued that elementary presuppositions generally survive when embedded under negation, modality, conditionals, disjunction, and yes/no questions. Overt denial, suspension and certain intrasentential constellations were shown to cancel elementary presuppositions. Background assumptions proved to play an important role for the presupposition problem. Depending on the specific discourse context, an elementary presupposition can be both preserved or cancelled. This effect of the context indicates that the defeasibility problem cannot be solved by drawing upon intrasentential mechanisms alone. Cancelling presuppositions leads to presupposition failure, because the elementary presupposition contained in the carrier sentence conflicts with the background assumptions established so far in the discourse.

Now that I have established ways to determine presuppositions in factive complements let me return to the main questions. Is presupposition an inner-grammatical concept? And are p-factive predicates presupposition triggers? These questions will be addressed in Section 3.4.

3.4 A Discourse-Semantic Approach to Presupposition: File Change Semantics

The previous section addressed the questions of how to determine presuppositions and how to predict their inheritance and cancellation patterns. The discussion revealed that elementary presuppositions can be determined in a fairly systematic fashion and are tied to specific linguistic expressions such as p-factive predicates or definite articles. However, presuppositions are not invariant and stable meaning components that behave in a monotonic way. Instead they are defeasible in certain discourse contexts and in specific intra-sentential environments. In order to account for these phenomena, a theory of presuppositions has to allow for both systematic calculation and flexibility. In other words, we need to have a theory that takes into account the context of the sentence uttered and gives up the principled division of a semantic and a pragmatic part of informational content, while still calculating presuppositions in a systematic way.

In what follows, I present one such theory, a slightly modified version of Heim's file change semantics (1982), which incorporates some modifications along the line of van der Sandt (1989, 1992).[9] This approach is based on a discourse-semantic definition of presupposition and therefore avoids most of the problems that purely semantic or pragmatic

[9] Van der Sandt's approach is framed in the discourse representation theory (DRT), developed by Kamp (1981). Nothing hinges on this difference, however, since file change semantics can be rephrased as DRT (cf. Kramer, 1998).

approaches face. I will argue that under this type of hybrid theory, the concept of presupposition is indeed inner-grammatical.

3.4.1 Definite NPs and Factive Complements as Anaphors

How can we adequately analyze indefinite and definite descriptions as they occur in stretches of text? The basic assumption of file change semantics and similar approaches is that, unlike indefinite descriptions, definite descriptions such as *the King of France* can be interpreted as anaphors. In other words, definiteness is regarded as a case of anaphoricity (cf. Lewis, 1979; Heim, 1982; van der Sandt, 1989, 1992; Beaver, 1994, 1997; Krahmer, 1998). Note that definite descriptions have both anaphoric and presuppositional properties. They refer back to something already mentioned in the discourse and, in contrast to anaphors, they have a descriptive content, which is presupposed and thus part of the discourse background.[10]

If presuppositions are likened to anaphors in this general way, this interpretation should also apply to presupposition-carrying elements other than existential presuppositions of definite NPs. In what sense can factive complements be regarded as anaphors? Definite NPs refer back to specific individuals specified in the preceding discourse (104). Intuitively speaking, factive complements refer back to an event (105a) or state (105b) mentioned in the discourse and their descriptive content is presupposed by the complex sentence (cf. also van der Sandt, 1989, 1992).

(104) The dog was barking loudly.

(105) a. Mary regretted that John bought an answering machine.
b. Mary regretted that John was German.

The following examples illustrate how both definite noun phrases and factive complements can be interpreted as definite descriptions.

(106) a. John and Mary saw a big dog.
b. The dog was barking loudly.

(107) a. John bought an answering machine.
b. And then Mary regretted that John bought an answering machine.

The definite NP in (106b) is interpreted as referring back to the indefinite NP *a dog* in (106a), just as the factive complement in (107b) refers back to (107a). The definite NP *the dog* presupposes that there is a dog, i.e. the existence of an individual that is a member of the set of dogs. Similarly, the factive complement presupposes the truth of a proposition, i.e. the existence of an event that fits the description 'John bought an answering machine'. Moreover, note that the use of the indefinite NP in (106a) is similar to the use of the sentence (107a). In both cases, new information is given and entered in the discourse.

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[10] Proposals differ in whether two mechanisms are needed for the interpretation of definite descriptions (e.g., Heim, 1982) or whether the presuppositional expressions can be dealt with by the same mechanism handling the resolution of pronouns (e.g., van der Sandt, 1992).

How are these notions phrased within the theory of file change semantics? The basic idea of file change semantics is that a conversation aims at conveying information from one discourse participant to the other. The addressee keeps track of the information by creating file cards and updating the information. The file cards are part of the file of the discourse, which changes as the conversation proceeds. Consequently, the meaning of an expression is not regarded as a static relation holding between language and truth in the world but as a method of updating the information state of conversation partners. Each individual or event, mentioned for the first time in the conversation, receives a new file card, containing an index number and the description of that individual. Note that Heim restricts herself to the analysis of definite and indefinite NPs. For ease of comparison, I will often use examples with definite NPs, but recall that all arguments are assumed to hold for factive complements as well. Imagine two speakers A and B and assume an empty file F on B's side. Speaker A utters (108).

(108) a. A woman was bitten by a dog.
b. She hit him with a paddle.

After hearing (108a), B inserts two new file cards into his file F and gives each a number (1 and 2):

1
is a woman was bitten by 2

2
is a dog bit 1

Having heard (108b) next, B inserts another file card into F, numbered 3 and updates the old cards 1 and 2. In fact, Heim assumes that each step in a conversation is characterized by a different file; a conversation is then a sequence of files.

1
is a woman was bitten by 2 hit 2 with 3

2
is a dog bit 1 was hit by 1 with 3

3
is a paddle was used by 1 to hit 2

Generally speaking, whenever an indefinite noun phrase is uttered, a new file card is introduced. Definite noun phrases do not introduce new file cards, rather information on an old file card is updated. How are linguistic structures then interpreted in terms of files? I will first sketch the interpretation rules (Section 3.4.2), then illustrate the felicity conditions (Section 3.4.3), and finally outline the accommodation rules (Section 3.4.4).

3.4.2 Interpretation Rules

If we interpret linguistic structures in terms of files we have to look for a sequence of individuals that satisfies a specific file. For illustration, consider the file F that B constructed after hearing statement (108a). Now take a sequence of individuals a_N whose first member

a_1 is a woman, whose second member a_2 is a dog, and a_2 bit a_1. Then a_N satisfies F, no matter what the remaining members of a_N are. If there is (at least) one sequence that satisfies F, F is consistent with the facts, i.e. F is true. Consequently, if F is inconsistent with the facts, F is false. The *satisfaction set* Sat(F) of a file consists of all and only the sequences that satisfy that specific file.

Besides satisfaction sets, the *domain* of a file characterizes files. The domain of F, Dom(F), is the set that contains every number that is a number of some card in F. The domain of our initial file F, for example, contains the numbers 1 and 2, i.e. Dom(F) = {1,2}. The basic idea is to give information about how many and which cards a file contains, since this information cannot be read off the satisfaction sets of a file. Thus, files are characterized in terms of their satisfaction set and their domains. The interpretation rules listed below recursively characterize the satisfaction set Sat(F + ϕ) and the domain Dom(F + ϕ), where <A,ext> refers to a model in extensional semantics (cf. Heim, 1982: 363).

(109) Let a model <A,ext> for English be given.

(I) Let ϕ be an atomic formula, consisting of an n-place predicate ξ and an n-tuple of variables $< \alpha^1, \ldots, \alpha^n >$ whose indices are $i_1, \ldots, i_n$, respectively. Then, for any file F:
Sat(F + ϕ) = {$a_N \varepsilon$ Sat(F): $<a_{i1}, \ldots, a_{in}> \varepsilon$ Ext(ξ)};
Dom(F + ϕ) = Dom(F) $\cup$ {$i_1, \ldots, i_n$}.

(II) Let ϕ be a cumulative molecular formula, with the immediate constituent formulas $\phi^1, \ldots, \phi^n$ (in that order). Then:
Sat(F + ϕ) = Sat((... (F + ϕ^1) + ϕ^2) ... + ϕ^n);
Dom(F + ϕ) = Dom((... (F + ϕ^1) + ϕ^2) ... + ϕ^n).

(III) Let ϕ be a quantified molecular formula consisting of a universal quantifier and the two formulas ϕ^1 and ϕ^2 (in that order). Then:
Sat(F + ϕ) = {$a_N \varepsilon$ Sat(F): for every b_N that agrees with a_N on all i ε Dom(F): if $b_N \varepsilon$ Sat(F + ϕ^1), then there is some c_N that agrees with b_N on all i ε Dom(F + ϕ^1) such that $c_N \varepsilon$ Sat ((F + ϕ^1) + ϕ^2)};
Dom(F + ϕ) = Dom(F).

(IV) Let ϕ be an operator-headed molecular formula, consisting of a negator and the formula ψ. Then:
Sat(F + ϕ) = {$a_N \varepsilon$ Sat(F): there is no b_N that agrees with a_N on all i ε Dom(F) such that $b_N \varepsilon$ Sat(F + ψ)};
Dom(F + ϕ) = Dom(F).

The term Sat(F + ϕ) comprises the notion of file change potential. Recall that the satisfaction set Sat of a file consists of all and only the sequences that satisfy that specific file. Every sentence or, more precisely, every logical form ϕ of a sentence has a file change potential, i.e. uttering the sentence changes the file F into F', with F' = F + ϕ. What do the rules say in detail?

Part I states that after the utterance of an n-place predicate, the updated satisfaction set is a set of sequences of individuals a_N in the previous satisfaction set such that a sequence of these individuals is in the extension of that predicate. At the same time, the domain of F is augmented by the indices related to the n-tuple of variables of that predicate.

Part II of the interpretation rules states that the successive interpretation of satisfaction sets is solely based on conjunction, since the file changes induced by the subformulas are successively executed. For purpose of illustration, assume the following simplified subformulas for (108a): ϕ^1= a woman$_1$, ϕ^2 = a dog$_2$, and ϕ^3 = e$_1$ was bitten by e$_2$. The first immediate constituent formula ϕ^1 is then evaluated with respect to the preceding file F and the resulting satisfaction set (F + ϕ^1) is then evaluated with regard to ϕ^2 and so forth. Likewise, the domain of a cumulative molecular formula is the domain of F plus the indices introduced by ϕ^1, i.e. 1. The resulting domain is united with the indices introduced by ϕ^2, i.e. 2, and so forth.

Part III deals with quantified formulas. To illustrate this interpretation rule, consider the utterance of (110) with its logical formula ϕ.

(110) Everyone who owns a cat has got fleas.

Roughly speaking, *everyone* corresponds to the universal quantifier, *owns a cat* corresponds to ϕ^1 and *has got fleas* corresponds to ϕ^2. In this example, rule (III) states that the satisfaction set of F and the logical formula ϕ are the set of all sequences of individuals in the satisfaction set of F such that for every b_1 and b_2 it holds that if b_1 is a person and b_2 is a cat and b_1 owns b_2 then b_1 is a person and b_2 is a cat and b_1 owns b_2 and b_1 has got fleas. In other words, the underlying formula corresponds to the conditional 'If somebody$_i$ owns a cat, he$_i$ has got fleas'.

Part IV of the interpretation rules is concerned with negated formulas. It states that there be no sequence of individuals that satisfies the initial file F adding the formula ψ. The domain of the old file F plus ϕ remains the domain of F, as no indices are added.

In sum, upon uttering a sentence, the logical form of that sentence is interpreted and the file is updated. The next section illustrates how these two interpretation steps interact.

3.4.3 Felicity Conditions

The felicity conditions determine how the logical form that is to be interpreted and the file that is to be updated constrain each other. Heim's concept of definiteness, expressed in the Novelty-Familiarity-Condition (111) and the Descriptive-Content-Condition (112), is phrased in terms of felicity conditions.

(111) Novelty-Familiarity Condition (Heim, 1982: 312)
Suppose something is uttered under the reading represented by ϕ, and the file prior to the utterance is F. Then for every NP$_i$ in ϕ, it must be the case that:
$i \in$ Dom(F) if NP$_i$ is definite, and
$i \notin$ Dom(F) if NP$_i$ is indefinite.
Otherwise, the utterance is not felicitous under the reading.

(112) Descriptive-Content-Condition (Heim, 1982: 367)
Whenever a [+definite] formula NP$_i$ is to be evaluated w.r.t. a file F, it is required that F entail NP$_i$.

These conditions capture the idea, informally mentioned above, that definite and indefinite NPs differ with regard to the presence of the respective file card. While the use of a definite NP requires that the file card specifying that NP be already present in the file, the use of an

indefinite NP requires that there be no file card specifying that NP as present in the file. This condition puts limitations on which readings an utterance admits with respect to a given file. As such, it does not constrain the well-formedness of logical forms. Neither does that condition imply that novelty and familiarity are pragmatic concepts, in contrast to the purely pragmatic accounts mentioned above.

Now the question arises of how felicity conditions of complex logical forms relate to the felicity conditions of their parts. Note that this problem is analogous to that of the projection problem, since Heim assumes that descriptive definites presuppose their descriptive content. For illustration, let us look at the felicity conditions for (113) and (114), respectively.

(113) She$_1$ hit him$_2$.

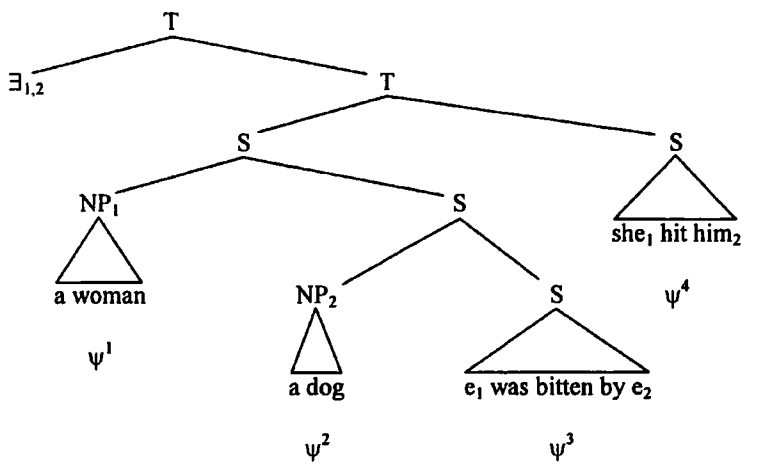
(114) A woman$_1$ was bitten by a dog$_2$. She$_1$ hit him$_2$.

The former statement (113) requires that both indices 1 and 2 be elements of Dom(F), whereas the latter statement requires that neither 1 nor 2 be already in the domain of the initial file. The question of how complex logical forms inherit the felicity conditions that the Novelty-Familiarity-Condition and the Descriptive-Content-Condition assign to their parts, is answered by Heim in the following way:

(115) Felicity of complex logical forms (Heim, 1982: 321)
A complex logical form ϕ is felicitous w.r.t. a given file F just in case every elementary step in the construction of F + ϕ from F can be carried out without violating any felicity conditions.

This felicity condition for complex logical forms spells out the view that meaning is conceived of dynamically, i.e. the felicity of a given sentence is determined not only by previous sentences, but also by the dynamic interpretation of other parts of the same sentence.[11] The evaluation of (114), for example, contains the following four elementary steps ψ^1 to ψ^4, illustrated in (116).

(116)



[11] This intra-sentential dynamism differs from other pragmatic accounts such as Gazdar's (1979) where context effects play a role only in-between clauses (cf. Beaver, 1997).

In order to calculate F (+116), we have to successively calculate $(((F + \psi^1) + \psi^2) + \psi^3) + \psi^4$ (interpretation rule (109. II)). At each of these four calculations, the Novelty-Familiarity-Condition and the Descriptive-Content-Condition have to be met, before the calculation can proceed. To fulfill the Novelty-Familiarity-Condition, it is required that the domain of the initial file F neither entail 1 nor 2. The truth of an utterance, or more precisely of a reading ϕ of an utterance, is then defined in terms of the truth of a file:

(117) Truth of a formula (Heim, 1982: 330)
A formula ϕ is true w.r.t. a file F if $F + \phi$ is true, and false w.r.t F if F is true and $F + \phi$ is false.

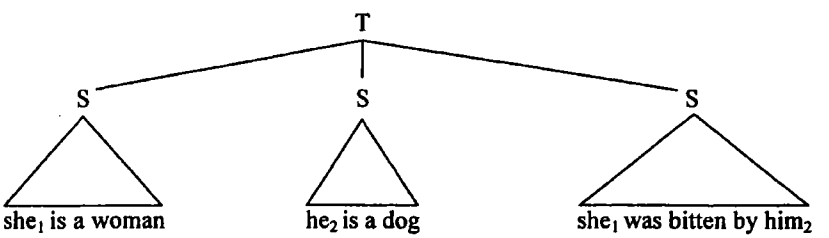
Consequently, an utterance is false (or true) just in case ϕ is false (or true) with respect to F in the sense of (117). If the file F, however, is false, then $F + \phi$ will always be false. If both F and $F + \phi$ are false, (117) assigns neither truth nor falsity to ϕ. Note that for (117) to apply it is assumed that F is true. F is true iff there is at least one sequence a_N such that $a_N \in$ Sat (F).[12] Furthermore, it is assumed that ϕ is felicitous with respect to F. For infelicitous utterances (or readings of utterances), the question of truth does not arise. Regarding the first statement in (114), felicity means that neither 1 nor 2 are members of Dom(F). Then, application of (117) and the interpretation rules yield:

> The first part of the formula (116) is true w.r.t. F if Sat(F') is nonempty, and false w.r.t. F if Sat(F') is empty, where:
> $Sat(F') = \{a_N \varepsilon Sat(F) : a_1$ is a woman and a_2 is a dog and a_2 bit $a_1\}$

To verify an utterance with indefinites, the individuals needed to satisfy the uttered sentence may be found anywhere in the domain of individuals. To verify an utterance with definites, the individuals that are to satisfy the uttered sentence have to be found among the ones which fit certain already established file cards. For illustration, consider the reading of the utterance (118) in (119).

(118) She is a woman. He is a dog. She was bitten by him.

(119)



Both 1 and 2 must be members of Dom(F). Assuming that F is true and that the utterance is felicitous with respect to F, the truth criterion (117) yields the following result:

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[12] As for false files, Heim remarks that, intuitively, not every file that contains a falsehood leads to a false file F'. Suppose a listener's file F entails the information that the kangaroo is native to Swabia. If somebody presents the listener with the utterance *The kangaroo is a mammal that lays eggs* we would judge the utterance simply as false, even though the file F is false since the kangaroo is native to Australia. Therefore, Heim concludes that certain entries on file cards that are irrelevant to the felicity of ϕ may be missing from the corresponding cards of a help file F⁻.

Formula (119) is true w.r.t. F if Sat(F') is non-empty, and false w.r.t. F if Sat(F') is empty, where:
$Sat(F') = \{a_N \varepsilon Sat(F) : a_1$ is a woman, a_2 is a dog, and a_2 bit $a_1\}$

Note that for F' to be true it is not sufficient that some woman was bitten by some dog, but that the members of the pair also fit card numbers 1 and 2 of F. This is the difference to the indefinites. By formulating the changed satisfaction set F' this way, propositional and presuppositional content of an expression are not treated alike, but are not strictly separated either. While the Novelty-Familiarity-Condition requires that indices 1 and 2 are members of Dom(F), in the calculation of the satisfaction set F' these indices are not separated from the assertive part of the utterance. As a result, certain presupposition binding problems are avoided (for details, cf. Beaver, 1997). How the cards 1 and 2 entered the file F is of no importance for the evaluation, i.e. they could be introduced via previously uttered NPs or via contextual salience of the individuals. This means that anaphoric and deictic uses of definites are treated alike.[13]

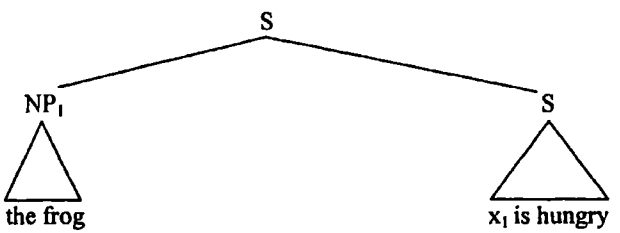
Imagine that the utterance *she$_1$ is a woman* is infelicitous with respect to F, i.e. 1 is not a member of Dom(F), thus violating the Novelty-Familiarity-Condition. This is an instance of presupposition failure. In this case, the utterance does not receive a truth-value. Now, we are in a position to reconsider the notion of presupposition. In light of file change semantics, presuppositions are felicity conditions, as stated in (120).

(120) Presupposition as felicity condition (Heim, 1982: 366)
A sentence under a certain reading can only be uttered felicitously in a context in which the discourse participants already presuppose the presuppositions that the sentence has under that reading. What the discourse participants presuppose in a context is represented by the file which obtains in that context.

The file F that holds for a certain context is required to already entail the information expressed by the presupposition, i.e. that information is not necessarily explicitly written down in F. A file F entails a formula ϕ iff for every world w: $Sat_w(F) \subseteq Sat_w(F + \phi)$. Let me illustrate the handling of presuppositions first with a definite NP. The utterance (121) with the reading under (b) carries the presupposition (c).

(121) a. The frog is hungry.

b.



c. frog(x_1)

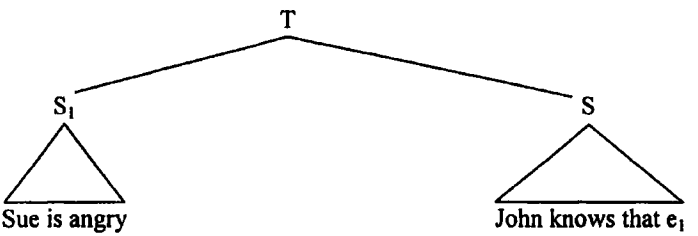
[13] The unification of deictic and anaphoric uses is not uncontroversial. Avrutin (1999: 49) suggests introducing a visual situation card to account for the deictic uses of definites. According to Roeper (p.c.), the different acquisition patterns of deictic and expletive *there* found by Roeper & Shafer (1999) also indicate a different semantic representation of deictic and non-deictic uses.

If (121b) is to be evaluated with respect to a file F then it is required by the Descriptive-Content-Condition that F entail 'frog(x_1)'. Sentence (121a) can be uttered felicitously if F contains a file card with the number 1 and the entry *is a frog* written on it. The file card can exist due to a previously uttered NP or due to contextual or perceptual salience.

Now consider a factive sentence such as (122a) below. Intuitively, we expect that the file F that obtains at the moment at which (122a) is uttered entails a file card specifying an event where Sue is hungry. Following Hegarty (1992) and Avrutin (1999), I assume that the individuals specified on file cards can also be events (cf. Section 4.2 for a detailed account of how to incorporate events). Then, focusing on the event file card, the reading given under (122b) carries the presupposition (122c).

(122) a. John knows that Sue is angry.

b.



c. Sue is angry(e_1)

Modifying the Descriptive-Content-Condition in such a way that not only definite NPs but also factive complement clauses are subject to that condition, we arrive at the desired prediction that F has to entail S_1 in order for the whole utterance to be felicitous. That is, sentence (122a) can be uttered felicitously if F contains an event file card with the number 1 and the entry *Sue is angry* written on it. The file card may be present, because the proposition 'Sue is angry' was asserted in a previous utterance or due to contextual or perceptual salience, for example Sue looked very angry.

In sum, a definite description, i. e. a definite NP or a factive sentence, can only be uttered felicitously if there was a previous mention of this description or if it was perceptually salient. Presuppositions are hence understood as felicity conditions that constrain the range of contexts in which the expression containing that presupposition can be evaluated. The following section shows that in some cases the context can be modified so as to meet this requirement.

3.4.4 Accommodation Rules

Many uses of definite descriptions follow the pattern presented in (123): Definite NPs and factive sentences are used to refer back to a previously established referent.

(123) a. I saw a frog. The frog is hungry.
b. Sue is angry. John knows that Sue is angry.

In many cases, however, speakers use definite descriptions without having mentioned the antecedent before and without the referent being perceptually salient, and still the sentences

are felicitous. I will illustrate two such cases: the immediate situation use and the larger situation use (cf. Hawkins, 1978; Heim, 1982; Avrutin, 1999). Suppose someone addresses me with (124) as I look into the pond. Even though there was no previous mention of a frog and I have not noticed any frog in the vicinity, the utterance is felicitous. This is called immediate situation use.

(124) Watch out, the frog_i will bite you.

Immediate situation use is possible for factives as well. As an answer to the question of why I am late for work I could say:

(125) I have to admit that [my car broke down]$_i$.

This utterance is felicitous even if the addressee neither knows that I have a car nor that it broke down. It is not even required that the listener has noticed the breakdown of my car at all.

Another use of definites – the larger situation use – is exemplified in (126), where the sun was not previously mentioned.

(126) The sun_i is shining.

The first mention of the definite NP *the sun* is perfectly natural. The felicity of (126) depends on some shared knowledge of the discourse participants, i.e. in this case the knowledge that there is only one sun. In a similar way, factive sentences can refer to facts, even if that information were neither part of a recent conversation nor contextually salient, as shown below:

(127) He deeply regrets that Germany is a republic.

Here the shared knowledge concerns information about the political system in Germany. (127) is felicitous if the discourse participants share the information that Germany is a republic.

How are these uses of definite descriptions captured in file change semantics? Heim assumes a mechanism of accommodation (cf. also Lewis, 1979).[14] The basic idea of accommodation is that it is possible under certain circumstances to adjust the file F, with respect to which a formula ϕ is evaluated, by adding to the file enough information to remedy the infelicity that would otherwise lead to presupposition failure. For example, if (124) is uttered, and F does not contain an $i \varepsilon \text{Dom}(F)$, the utterance is infelicitous. When accommodation takes place, F is adjusted to F', which contains an additional card i with an entry *is a frog somewhere close by*; and the utterance is felicitous. While with novel indefinites, we simply add an appropriate new file card to our file, adding a new file card in case of novel definites is more restricted. A new file card that is introduced under accommodation has to be linked to some old file card by cross-references, i.e new and old file card have to be connected via bridging (for bridging, see Clark & Haviland, 1977). If these cross-references are missing, accommodation is not possible. What are the file cards introduced by definites

[14] Note that in written texts accommodation does not seem a very common phenomenon (Kamio & Suzuki, 1996). The authors analyzed uses of factive presuppositions in a contemporary Japanese and a contemporary American novel. They found that very few of the presuppositions are cases of accommodation, i.e. 6.8% in the Japanese, and 14.8% in the American novel. Whether this result also holds for oral communication remains to be investigated.

in (124) and (127) bridged to? The entry *there is a frog somewhere close by* refers to the utterance situation and the entry *Germany is a republic* to some general world knowledge. Both contain information that is available at the beginning of the conversation. Let us therefore assume that every file contains an initial file card with a description of the utterance situation as well as some other facts that hold at the time of the discourse (cf. Heim, 1982; Avrutin, 1999).[15]

In sum, the application of accommodation rules depends on the demands of the felicity conditions. In contrast to interpretation rules that evaluate the pure semantic content, "... accommodation rules deal with a more 'pragmatic' dimension of meaning, (with the information that an expression 'implicates', as some would say)" (Heim, 1982: 400). How does this interaction between rules of interpretation and rules of accommodation bear on the projection problem and the defeasibility problem of presuppositions? This question is addressed in the next section.

3.4.5 Projection and Defeasibility of Presuppositions

Within the model of file change semantics presuppositions are understood as felicity conditions that constrain the range of contexts in which the expression containing that presupposition can be evaluated. If a definite description is used, the file that obtains in the present discourse has to entail its presupposition PSP. Otherwise, the Novelty-Familiarity-Condition and the Descriptive-Content-Condition are not met. If PSP is not entailed by F, the file can be adjusted so as to comprise the necessary file card. Since these felicity conditions have to be fulfilled at every step of the calculation, accommodation can apply at any point in the evaluation and can in turn influence the application of the subsequent interpretation rule. This intrasentential dynamics makes it possible that presuppositions are either projected all the way up to the top level of representation, only locally inherited, or immediately defeated. Let me illustrate this with the example of embedding of a presupposition under negation and conditional.

Presuppositions are generally preserved under negation. Accordingly (128a) may project the presupposition that there is a King of France. The same sentence, however, may lead to cancellation of that presupposition if the presupposition is overtly denied as in (128b).

(128) a. Mary didn't have lunch with [the king of France]$_i$
b. Mary didn't have lunch with [the king of France]$_i$, because France doesn't have a king.

In the case of overt denial the file does not entail the required file card and is not accommodated so as to comprise the required file card either. How are the two readings captured in this model? The overt denial interpretation is achieved as follows. First assume a file F with $i \notin Dom(F)$. In order to calculate the file change that comes about upon uttering (128b), we first have to evaluate the statement without the negation, i.e. F + [Mary had lunch with [the king of France]$_i$]. We add a file card i with the information *king of France* and arrive at:

[15] This file card could be thought of as the background propositions of the discourse, while information stated on previous file cards comprise the foreground propositions of the current discourse.

Sat(F + [Mary had lunch with [the king of France]$_i$]) = {a_N ε Sat(F): a_i is king of France and Mary had lunch with a_i}

Use of the interpretation rule for negation (109. IV) then yields:

Sat(F + [not [Mary had lunch with [the king of France]$_i$]]) = {a_N ε Sat(F): there is no b_i such that b_i is king of France and Mary had lunch with b_i}
Dom(F + [not [Mary had lunch with [the king of France]$_i$]]) = Dom(F)

Thus, this 'narrow-scope' reading denies, as expected, that there is a king of France. The second reading preserves the presupposition and denies that Mary had lunch with him. The basic idea of getting this 'wide-scope' reading is that the evaluation is carried out with an accommodated file F' instead of using the original file F. Imagine as before a file F with $i \notin$ Dom(F). After adding the file card i to F, we arrive at:

F' with Dom(F') = Dom(F) ∪ {i} and
Sat(F') = {a_N ε Sat(F): a_i is king of France}

Evaluating Sat(F + [not ϕ]) now yields:

Sat(F + [not [Mary had lunch with [the king of France]$_i$]]) = {a_N: a_N ε Sat(F), and a_i is king of France and it is not the case that Mary had lunch with a_i} Dom(F + [not [Mary had lunch with [the king of France]$_i$]]) = Dom(F) ∪ {i}

As a consequence, the definite NP *the king of France* is preserved under negation if the file is accommodated and cancelled if the original file is evaluated, which corresponds to cases of overt denial. Factive sentences can be analyzed in parallel fashion (129).

(129) Mary didn't regret that [she had lunch with John]$_i$ (because she didn't have lunch with John at all.)

Under the 'narrow-scope' reading, Dom(F + ϕ) = Dom(F), i.e. Dom(F) is not augmented by {i}, resulting in the denial of an event where Mary had lunch with John, as predicted in cases of overt denial. Under the 'wide-scope' reading on the other hand, Dom(F + ϕ) = Dom(F) ∪ {i}, since the file card i is added to F by way of accommodation. The resulting interpretation is that Mary had lunch with John.

The interpretation of presuppositions embedded under conditionals demonstrates how file change semantics handles cases where a presupposition is locally inherited. Reconsider example (110), repeated below.

(130) Everyone who owns a cat has got fleas.

The underlying formula of (130) is (131).

(131) If somebody$_i$ owns a cat, he$_i$ has got fleas.
ϕ → ψ

Suppose that the file F + ϕ does not entail the presupposition of ψ 'there is a person who owns a cat'. In that case, the interpretation of the definite pronoun is not felicitous as the Novelty-Familiarity-Condition is violated. In order to evaluate ψ accommodation must occur. This accommodation can take place for example in the antecedent ϕ, i.e. locally, yielding an updated file F + ϕ', comprising the appropriate file cards corresponding to 'there

is a person who owns a cat'.[16] As a consequence, ψ can be evaluated, even though the conditional does not presuppose that there is a person who owns a cat, as expected.

In sum, the intrasentential dynamics of the felicity conditions and accommodation rules accounts for the fact that presuppositions may be projected all the way up to the top level of representation, or only locally inherited, or immediately defeated.

3.4.6 Presupposition and Presupposition Failure Again

We have seen how file change semantics interprets definiteness in terms of anaphoricity and how it handles the defeasibility and inheritance of presupposition. Developing the account of presuppositions as anaphors further (cf. also van der Sandt, 1989, 1992), in this section I will suggest discourse-semantic definitions of presupposition, presupposition projection and cancellation, and presupposition failure, which will be adopted in the remainder of this book (except for slight modifications, cf. Section 4.4.2).

Like anaphors, presuppositions are linguistic expressions that are linked to some previously established antecedent. In case the discourse does not provide an antecedent, accommodation can take place to establish an appropriate antecedent. Put differently, presuppositions can accommodate, because – unlike anaphors – they contain enough descriptive content. Presupposition is thus defined as follows:

(132) Presupposition (prefinal version)
Presuppositional expressions are anaphors that have internal structure and semantic content, enabling them to accommodate. Presuppositional expressions require a link to a specific file card, an individual file card in case of a definite NP and an event file card in case of factive complements.

A consequence of (132) is that anaphoric expressions constrain the range of contexts in which an utterance can be evaluated, i. e. presuppositions are regarded as felicity conditions on the current file. These felicity conditions have to be met at each step of the calculation of the updated file, thus considering presuppositional information while building a representation instead of after the semantic content of an expression has been determined. This intrasentential dynamics manifests itself in the conception of presupposition projection. Presuppositions are never cancelled. They are always preserved, but depending on structural or contextual environments may not always reach the top level of representation. Consider the following examples:

(133) If Sue just visited her daughter, Bill regrets that Sue visited her daughter.

(134) If Sue has a son, Bill regrets that Sue visited her daughter.

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[16] Note that this leaves open the question of how the listener can determine what the accommodated context should be. Van der Sandt (1992) suggests the following principles:
(i) Resolution (i. e. binding) is preferred to accommodation.
(ii) One resolution is preferred to another if the first is more local.
(iii) One accommodation is preferred to another if the first is more global.
Principle (i) captures the insight that accommodation is a repair strategy (cf. also Geurts, 2002). See also Beaver (1997) and Kamp (2001) for discussion.

(135) Sue visited her daughter

Unlike (133), (134) presupposes (135). How does the anaphoric linking mechanism capture this difference? In (133), the factive complement is linked to the file card that has been introduced upon uttering the antecedent *Sue visited her daughter*, since no other antecedent is available. Therefore, the presupposition that Sue visited her daughter is not present at the top level of representation. In (134) on the other hand, the factive complement cannot be linked to the file card that has been introduced by the antecedent *Sue has a son*. Hence the factive complement is accommodated at the top level of the representation, yielding the presupposition (135). Consequently, only the latter statement allows anaphoric take-up in subsequent discourse. Compare (136) and (137).

(136) D* If Sue visited her daughter, Bill regrets that Sue visited her daughter. The visit was uneventful.

(137) If Sue has a son, Bill regrets that Sue visited her daughter. The visit was uneventful.

After uttering (134) an event file card stating that Sue has a daughter is added to the current file F. Continuing the discourse as in (137) the addressee then updates this file card with the information that this event was uneventful. (136) does not allow this reading, since the presupposition (135) is only linked at some intermediate level of the representation. Cancellation and projection of presupposition can thus be defined as follows:

(138) Presupposition projection and cancellation (prefinal version)
Presuppositions are linked to a suitable antecedent at some level of representation. Presupposition projection is anaphoric linking at the top level of representation; presupposition cancellation is anaphoric linking at some intermediate level of representation.

How do the above definitions of presupposition and presupposition projection bear on the notion of presupposition failure? The definition in (103) stated that presupposition failure arises if a presupposition is inconsistent with the propositions being part of the discourse background. Now we can articulate more precisely what it means for a presupposition to be inconsistent with the discourse background. Presupposition failure arises if no anaphoric link can be established and if the current file cannot be accommodated by establishing an additional file card at any level of representation. Accommodation is prevented if adding a new file card would lead to a contradiction of some already existing file card. Assume I tell you the following:

(139) You know what. Bill already regrets that Sue moved to New York.

If you know that Sue didn't move to New York, the corresponding file card prevents the addition of a new event file card stating that Sue moved to New York. As with accommodation, the conflicting knowledge can also be part of the initial situation file card. Suppose I ask the following question:

(140) Do you know why Germany is a monarchy?

My question should be rejected because the addressee's situation file card will in most cases entail the information that Germany is a republic. Then the presupposition in (140) fails,

because accommodating the file would lead to an inconsistency. Presupposition failure can then be defined as follows:

(141) Presupposition failure (prefinal version)
Presupposition failure arises if it is impossible to anaphorically link the presupposition to an antecedent at any level of representation, and if – due to conditions of felicity – accommodation cannot take place. In that case, the whole structure is uninterpretable.

In sum, while with presupposition defeasibility a presupposition is locally inherited, presupposition failure occurs if a presupposition cannot even be locally inherited.

3.4.7 Summary

Developing Heim's file change semantics (1982) and van der Sandt's (1989, 1992) presupposition theory further, in this section I presented a discourse-semantic approach to presupposition. In this model, presuppositions are assumed to come out of the lexicon as part of the meaning of the respective linguistic items, and are hence calculated in a systematic fashion. At the same time the principled division of a semantic and a pragmatic part of informational content is suspended, as the context of the sentence uttered plays a crucial role for evaluating sentences. The central idea of file change semantics is that presuppositions are likened to anaphors. As a result, definite descriptions such as definite noun phrases and factive complements are interpreted just like anaphoric expressions, except for the fact that they contain more descriptive content than anaphors.

Presuppositions operate as felicity conditions on the readings of an utterance. They constrain the range of contexts in which the expression containing a presupposition can be evaluated, thus belonging neither to semantics nor to pragmatics proper. Since context change potentials rather than truth-values are assigned to expressions, presuppositions and assertions differ not in terms of truth-conditions but in terms of requirements with respect to the contexts. If a definite description is used, the file that obtains in the present discourse has to entail its presupposition. Otherwise, the Novelty-Familiarity-Condition and the Descriptive-Content-Condition are not met. If the presupposition is not entailed by F, the file can be accommodated so as to comprise the necessary file card. Since these felicity conditions have to be fulfilled at every step of the calculation, accommodation can apply at any point in the evaluation and can in turn influence the application of the subsequent interpretation rule. This intrasentential dynamics makes it possible for presuppositions to be either projected all the way up to the top level of representation or only locally inherited, or immediately defeated. Hence, the phenomena of inheritance and cancellation of presupposition can be interpreted as the linking of an anaphoric expression to an antecedent at some level of representation, resulting in presuppositional or non-presuppositional readings. Presupposition projection is anaphoric linking at the top level of representation; presupposition cancellation is anaphoric linking at some intermediate level of representation. Presupposition failure arises if a definite NP or factive complement does not have an antecedent in the domain of the current file F and if accommodation is not possible. In that case the reading of the utterance is not felicitous, and no truth-value is assigned.

In sum, regarding presuppositions as anaphors allows us to suspend the separation of semantic and pragmatic information. In this regard, discourse-semantic approaches to presupposition are superior to both purely semantic and purely pragmatic theories. Semantic theories cannot account for the context sensibility of presuppositions. Pragmatic models, on the other hand, fail to consider the interdependence between the informational content of an expression and presuppositions because pragmatic information is represented and evaluated separately from semantic content.

3.5 Conclusion

This chapter examined the concept of presuppositions of factive sentences (and definite NPs). Comparing presupposition to entailment, conventional implicature, and generalized conversational implicature, I found that presuppositions in affirmative and negated sentences differ from these semantic and pragmatic inferences with regard to at least one property. Only presuppositions are non-detachable, defeasible in non-affirmative sentences, and preserved under negation. Consequently, it seems unlikely that presupposition could be simply subsumed under some other type of inference.

The preservation and defeasibility patterns of presuppositions raised the general question of how to determine the factive presuppositions of a sentence. My analysis of a number of standard presupposition tests (constancy under negation, modality, conditional, disjunction, yes/no question, and two text acceptability tests) revealed that a single test often does not suffice to identify a presupposition. The use of a combination of tests, however, is generally successful in determining the elementary presupposition(s) of sentences in isolation. The calculation of presuppositions in complex sentences that are part of a discourse is related to the projection and the defeasibility patterns of presuppositions. Elementary presuppositions were shown to generally survive when embedded under negation, modality, conditionals, disjunction, and yes/no questions. Overt denial, suspension and certain intrasentential constellations, on the other hand, cancel elementary presuppositions. Background assumptions play an important role for the presupposition problem, for depending on the specific discourse context, an elementary presupposition may be preserved or cancelled. The discussion of projection and cancellation patterns indicated that elementary presuppositions can be determined in a fairly systematic fashion and are tied to specific linguistic expressions such as p-factive predicates or definite articles. At the same time, presuppositions are defeasible in certain discourse contexts and in specific intra-sentential environments rather than being invariant and stable meaning components.

The discourse-semantic approach of file change semantics allows for both the required systematic calculation and the flexibility necessary when interpreting presuppositions. Its basic assumption is that definite descriptions can be regarded as anaphors. Presuppositions are part of the informational content of a sentence and of the preconditions for the felicity of the interpretation of the presupposing utterance. As felicity conditions, presuppositions constrain the range of contexts in which the expression containing a presupposition can be evaluated. Thus, the interaction of interpretation rules and felicity conditions guides the systematic interpretation of (the logical form of) an utterance.

Likening definite descriptions to anaphors, factive complements can receive an interpretation along the lines of definite NPs. Definite NPs refer back to specific individuals mentioned in the discourse background established so far. Factive complements refer back to a specific event or state mentioned in the previous discourse. The phenomena of presupposition projection and presupposition cancellation are uniformly interpreted as the linking of an anaphoric expression to an antecedent at some level of representation. From this point of view, presuppositions are always preserved. Presupposition projection is anaphoric linking at the top level of representation; presupposition cancellation is anaphoric linking at some intermediate level of representation. And presupposition failure arises if a definite NP or factive complement does not have an antecedent in the domain of the current file F when accommodation is not permitted. In that case the reading of the utterance is not felicitous, and no truth-value is assigned. Note that in this presupposition theory the standard tests for presuppositions correspond to anaphoric linking at the top level of representation. They simply test whether an event or individual variable could in principle, i.e. without conflicting discourse information, be linked to an antecedent at the top level of representation.

Having established a presupposition theory that handles definite NPs as well as factive complements, namely as anaphors, let us return to our main question of whether p-factive predicates are presupposition triggers. Distinguishing pragmatic from semantic-syntactic factivity, in Chapter 2 I defined semantic-syntactic factivity as follows: Only if the complement clause is marked for a certain kind of tense/aspect marking can p-factive predicates induce the presupposition that the complement clause expresses a true proposition. Are we now in a state to say that sentences with a p-factive matrix predicate carry the presupposition PSP in all possible contexts? Only if the answer is positive, can semantic-syntactic factivity be granted an inner-grammatical status. If the answer is negative, semantic-syntactic factivity lies outside the realm of grammar.

I hold that the answer is yes. The argumentation is as follows. Factive complements have been characterized as anaphoric expressions that require a link between the event variable specified in the complement clause and a specific event file card that is already present in the discourse file. If this file card is not present, the file is accommodated so that the respective event file card is added to the discourse file and the anaphoric link can be established. If accommodation cannot take place, no file card can be added and hence presupposition failure arises. In other words, factive complements always have to be bound at some level of representation. Whether the event variable of factive complements is linked to a suitable antecedent at the top level of representation, i.e. whether the presupposition is in fact borne out in the actual sentence, then depends on other intrasentential and context factors. The fact that presuppositions can be cancelled does not necessarily mean that there are no presupposition-inducing elements. Put differently, the property of factive complements to refer back is part of the linguistic expression and not dependent on the context. Since factive complements are complements that are embedded by a p-factive matrix predicate, we can conclude that p-factive matrix predicates are in fact presupposition triggers, thereby supporting the notion of semantic-syntactic factivity proposed in Chapter 2. This understanding of factivity implies that we should expect repercussions of factivity in the syntax. Whether this prediction is borne out will be addressed in the next chapter.

4. The Structure of Factive and Nonfactive Sentences

4.1 Introduction

Making use of the notions of semantic-syntactic factivity and presupposition, developed in Chapter 2 and 3, in this chapter I address the questions of whether we can find syntactic repercussions of factivity and whether and how these syntactic restrictions are structurally represented.

Factive sentences are sentences in which a potentially factive (p-factive) matrix predicate embeds a complement clause with a specific form of tense/aspect marking. P-factive predicates have the lexical-semantic potential to trigger the presupposition that the complement expresses a true proposition. The complex sentence receives an actual factive interpretation if the complement clause is marked with the required tense/aspect feature. I argued that this semantic-syntactic factivity arises as a result of the specific linguistic structure of the sentence rather than as a result of uttering this sentence in certain contexts. Employing the discourse-semantic approach put forth in Chapter 3, I analyzed factive presuppositions as anaphors that always require a link between the event variable specified in the complement clause and a specific event file card that is already present in the discourse file. Consequently, I concluded that factive presuppositions are inner-grammatical. This understanding of factivity predicts repercussions of factivity at the level of syntax. Since Kiparsky & Kiparsky (1971), attempts have been made to systematically account for the differences between p-factive and nonfactive predicates, focusing on the syntactic properties of their complements. Given that we want to maintain the view that factivity is of grammatical relevance, the following questions arise. First, are there syntactic repercussions of factivity that hold for p-factive matrix predicates *in general*? In other words, does factivity denominate a grammatically relevant verb class? And second, are these syntactic restrictions structurally represented and if so how do factive and nonfactive sentences differ? Both questions will be addressed in this chapter. The answer to the first question hinges on a number of implicit assumptions that I will clarify below before turning to the discussion of the syntactic repercussions of factivity.

The first and most central assumption concerns the stipulated relation between semantics and syntax. If I want to show that the property of being p-factive determines a grammatically relevant verb class then I tacitly assume a correspondence of (discourse- and lexical-) semantic and syntactic processes or rules. A correspondence can be present in different forms. Consider a syntactic phenomenon that we find with all p-factive predicates, but also with some nonfactive predicates. In this case we can predict the syntactic phenomenon based on the matrix predicate's being p-factive. Alternatively, consider a syntactic phenomenon that exclusively occurs with p-factive matrix predicates. Only in the latter case can we derive the lexical-semantic property of the matrix predicate from the occurrence of the syntactic phenomenon. If a syntactic property adheres to the former notion of correspondence I will call it a weak property of the class of p-factives. If a syntactic property adheres to the latter notion of correspondence, I will call it a defining property of the class of p-factives. The definition of a weak property is given in (1) and of a defining property in (2) below.

(1) Weak property of the verb class of p-factives
Let v be a variable over verbal and adjectival predicates and A a variable over syntactic phenomena. Then $\forall v$ [p-factive(v) $\rightarrow$ A(v)]. This is false if $\exists v$ [p-factive(v) $\wedge \neg$ A(v)].

(2) Defining property of the verb class of p-factives
Let v be a variable over verbal and adjectival predicates and A a variable over syntactic phenomena. Then $\forall v$ [p-factive(v) $\leftrightarrow$ A(v)]. This is false if $\exists v$ [p-factive(v) $\wedge \neg$ A(v)] or if $\exists v$ [$\neg$p-factive(v) $\wedge$ A(v)].

This notion closely corresponds to Kiparsky & Kiparsky's thesis on the interrelationship of syntax and semantics:

> Our thesis is that the choice of complement type is in large measures predictable from a number of basic semantic factors. Among them we single out for special attention *presupposition* by the speaker that the complement of the sentence expresses a true proposition. It will be shown that whether the speaker presupposes the truth of a complement contributes in several important ways to determining the syntactic form in which the complement can appear in the surface structure. (Kiparsky & Kiparsky, 1971: 345)

From definition (1) it follows that we may find nonfactive predicates that exhibit some phenomenon A and still hold that the feature [±p-factive] is of grammatical relevance. In contrast, if we find a p-factive verb that does not exhibit A, factivity is not a relevant verb class with regard to A. If for each potential phenomenon A we investigate there is a (possibly different) p-factive verb that does not exhibit A, we can deduce that factivity is not a grammatically relevant verb class with respect to Definition (1) (and with regard to the syntactic phenomena under investigation).[1] In that case, factivity is not a relevant verb class in the sense of Definition (2) either, since the requirement of Definition (1) is weaker than that of Definition (2). According to Definition (2), syntactic relevance of the feature [±p-factive] is given only if a bivalent relation between occurrence of a syntactic phenomenon A and the feature [±p-factive] holds. The claim that a syntactic phenomenon A depends on the presence of the feature [±p-factive] can be rejected if it is possible to show either that despite factivity of the predicate A is ungrammatical or that A occurs although the predicate is not factive.

Investigating the range of syntactic phenomena claimed to occur in factive sentences, I will show that only a limited number of these phenomena are indeed weak properties of p-factive matrix predicates, and that none of them is a defining property in the above sense.

A second assumption underlying the issue of syntactic repercussions of factivity is that it is possible to examine these syntactic phenomena without changing the semantic interpretation of the structure at issue and thus failing to make the argument. Syntactic processes such as insertion of lexical items and certain syntactic structures might change the meaning of the sentence in question, for example by turning a factive into a nonfactive sentence or vice versa. Therefore, in the assessment of the syntactic criteria factive and nonfactive readings should be preserved after syntactic modifications.

A final assumption concerns the language-specificity of the findings. If factivity is of grammatical relevance, (possibly different) syntactic relations of factivity should exist in all

[1] That is, leaving open the possibility that there are relevant syntactic phenomena that we have failed to take into account.

languages. In other words, it is assumed that factivity is a universally relevant grammatical notion. I will restrict myself to the investigation of syntactic repercussions of factivity in English, and only in passing point to other languages including French, Spanish, and German. Thus, it remains to be shown whether a parallel argument as the one pursued here can be made for languages besides English.

The chapter is organized as follows. Section 4.2 looks at a variety of syntactic patterns observed in factive sentences. In Section 4.3 the syntactic restrictions that hold for factives in general are accounted for in terms of different event structures for factive and nonfactive complements. Section 4.4 extends this event-structural proposal to the class of response stance predicates, which share crucial features with the class of p-factives matrix predicates, but do not presuppose the truth of their complement clause. Incorporating this verb class into our discourse-semantic model, the definitions of presupposition, presupposition projection, and presupposition failure are modified accordingly. Section 4.5 summarizes the theoretical model of factivity established in the first part of the book.

4.2 Syntactic Restrictions for Factive Sentences

This section examines the hypothesis that p-factive and nonfactive predicates differ with regard to the syntactic properties of their complements. Research on syntactic effects of factivity has resulted in a wide range of syntactic phenomena that have been claimed to result from the factivity of the complement-taking predicates. In Section 4.2.1 to 4.2.13 the following phenomena will be discussed: insertion of *the fact*, gerunds and *-ness* nominalization, subject-to-subject raising, embedding of ECM infinitives, optionality of extraposition, negation-raising, insertion of expletive *it*, sentence pronominalization with *so*, long *wh*-movement, postposing, conjunction with *and/but* or *and so*, insertion of the complementizer *that*, and – as a semantic supplement – inference patterns. The arguments in Section 4.2.1 through Section 4.2.8 were first raised by Kiparsky & Kiparsky (1971); many of the counterexamples are drawn from Reis (1977).

Starting with the weak definition above, the argumentation will be as follows. If factivity has repercussions on syntax, then certain syntactic processes should be prohibited or permitted for *all* p-factive matrix predicates. If we find a p-factive verb that does not exhibit the property in question, factivity is not syntactically reflected with regard to this property. For each of the phenomena existence of a p-factive matrix predicate that does not share this feature will be checked. If a property is found to hold true for all p-factive matrix predicates under investigation, it will be checked whether this property is a defining feature of factives. That is, I will examine whether there is a nonfactive matrix predicate that also exhibits this property. The p-factive as well as the nonfactive (often propositional) predicates are mostly taken from Table 2.3 in Chapter 2. I will show that only five of the syntactic phenomena listed above hold true for all p-factive predicates. Subject-to-subject raising, ECM infinitival complements, negation-raising, long adverbial *wh*-movement, and postposing are generally prohibited in factive sentences. These restrictions are weak rather than defining properties of p-factive matrix predicates, as for each of the syntactic phenomena we can find nonfactive matrix predicates that exhibit the same pattern as well.

4.2.1 Insertion of *the fact*

It has been claimed that only p-factive verbs allow insertion of the noun *the fact* heading a sentential complement consisting of a *that*-clause or a gerund (cf. Wilkinson, 1970; Kiparsky & Kiparsky, 1971; Pusch, 1971; Adams, 1985). This is shown for the subject position with a finite complement in (3), for the subject position with a gerund in (4), and for the object position in (5).[2] The (a) sentences display examples with p-factive verbs, and the (b) sentences examples with nonfactive verbs.

(3) a. The fact that the dog barked during the night is significant.
b. *The fact that the dog barked during the night is likely.

(4) a. The fact of the dog's barking during the night is significant.
b. *The fact of the dog's barking during the night is likely.

(5) a. I want to make clear the fact that I don't intend to participate.
b. *I want to assert the fact that I don't intend to participate.

A closer look, however, reveals that some p-factive verbs do not follow this pattern. *Know* and *realize* seem to prohibit insertion of *the fact* (6). Note, however, that speaker judgment of (6b) may vary.

(6) a. *He knows the fact that Mary bought a mobile phone.
b. ?/*He realizes the fact that Mary bought a mobile phone.

It has been pointed out that evaluative adjectival predicates do not permit addition of *the fact* either, as shown in (7) (Reis, 1977: 178).

(7) *The fact that he bought a mobile phone was stupid/nice of him.

Predicates such as *be stupid* and *be nice* have been classified as if-predicates (cf. Section 2.4.4.2). Thus, they do not constitute counterexamples. Only p-factive *know* and possibly *realize* refute the generalization that p-factives allow insertion of the NP *the fact.* These predicates are semi-factive (cf. Section 2.6) and may therefore be exceptional in certain regards.

Nonetheless I hold that insertion of *the fact* is not a syntactic reflex of p-factive matrix predicates. Rather *the fact* construction itself suggests a presuppositional reading, as pointed out in Section 2.5. This can be most clearly seen with nonfactive predicates (8).

(8) a. Only "The Nation" reported the fact that Clinton was innocent.
b. Only "The Nation" reported that Clinton was innocent.

Report is a nonfactive predicate. Resulting from the insertion of *the fact* in (8a), the listener is likely to infer that Clinton is innocent, while (8b) retains its nonfactive reading. This

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[2] For a related argument regarding Spanish, see Zubizarreta (1982). Only complements of factive, but not of nonfactive predicates, may be preceded by a determiner:

(i) Lamento el que Pedro no haya pasado el exámen.
I-regret DET that Pedro not has passed the exam
(ii) *Creo el que Pedro no haya pasado el exámen.
I-believe DET that Pedro not has passed the exam

difference can be explained in terms of the semantics of the noun *the fact* without reverting to syntactic reflexes of p-factive matrix predicates. Therefore, the syntactic criterion 'insertion of the NP *the fact*' cannot be considered a syntactic repercussion of p-factives.

4.2.2 Gerunds and *-ness* Nominalizations

Only p-factive predicates are said to allow the full range of gerundial constructions[3] and nominalizations in *-ness* (Kiparsky & Kiparsky, 1971; Adams, 1985), as illustrated for object clauses in (9), and for subject clauses in (10) and (11).

(9) a. I regret having agreed to the proposal.
b. *I think having agreed to the proposal.

(10) a. His being found guilty is tragic.
b. *His being found guilty is sure.

(11) a. The redness of his face was tragic.
b. *The redness of his face was likely.

However, the p-factive predicates *know, realize, find out, make clear*, and *be aware* do not freely allow gerunds (12). Note that not all of these predicates are semi-factive.

(12) a. *He knows/realizes/finds out/makes clear having agreed to the proposal.
b. *He is aware having agreed to the proposal.

In the same way as insertion of *the fact*, the gerundial construction itself partially determines a factive reading, independently of the matrix predicate. Due to the gerundial (13a) is interpreted as factive, whereas (13b) with a *that*-clause has a nonfactive interpretation.

(13) a. She wrote me about John's having agreed to the proposal.
b. She wrote me that John agreed to the proposal.

In sum, gerunds and nominalizations are not a reliable reflex of factivity.

4.2.3 Subject-to-Subject Raising

In contrast to nonfactives, factive subject clauses never permit raising the subject of the complement clause into the subject position of the matrix, making this a weak property of factives (Kiparsky & Kiparsky, 1971). This is demonstrated in (14) for p-factives and in (15) for nonfactive predicates. Note that the relevant matrix predicates are all adjectival.

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[3] These gerundial constructions are imperfect nominals in the sense of Vendler (1976). Imperfect nominals are still related to a verb, while perfect nominals lost the verbal character. According to Vendler, imperfect nominals occur together with verbs such as *surprise, mention, deny*, and in connection with nouns like *fact, result*. His notion of *fact* is closely related to the specific property of being factive investigated here.

(14) a. It is tragic/relevant/odd that John is the loser.
b. *John is tragic/relevant/odd/surprising to be the loser.

(15) a. It is likely/seems/turns out/happens that John is the loser.
b. John is likely/seems/turns out/happens to be the loser.

Evaluative predicates allow subject-to-subject raising (Wilkinson, 1970; Reis, 1977), as shown in (16). Since these adjectives can be analyzed as if-predicates (cf. Section 2.4.4.2), they are not a counterexample.

(16) a. It was clever/stupid/wise/nice/foolish (of John) that John was the loser.
b. John was clever/stupid/wise/nice/foolish to be the loser.

However, prohibition of subject-to-subject raising is not a defining property of p-factive matrix predicates, since some nonfactive predicates also block movement of the embedded subject (cf. Kiparsky & Kiparsky, 1971), as shown for the propositional predicate *be possible* in (17).

(17) a. It is possible that Joe loses all the money.
b. *Joe is possible to lose all the money.

Similarly, predicates such as *impossible, true, false, probable, uncertain, (un)necessary, obvious, evident, imperative, urgent, imminent* can be adduced as counterexamples (Reis, 1977). Notwithstanding that speaker judgments vary regarding the grammaticality of subject-to-subject raising for the predicates cited, it is evident that not all nonfactive predicates allow this subject-movement.[4] In sum, prohibition of subject-to-subject raising is a weak but not a defining property of p-factive matrix predicates.

4.2.4 Embedding of ECM Infinitives

P-factive verbs prohibit raising of the embedded subject to the object position of the matrix clause, i.e. ECM infinitives are ungrammatical with factives (cf. Kiparsky & Kiparsky, 1971; Hegarty, 1992). Example (18) demonstrates this claim. *Know, recognize, find,* and *determine*, however, allow ECM infinitives (19).

(18) a. *He resents/regrets/is pleased Mary to be talented.
b. He believes/claims/supposes Mary to be talented.

(19) We know/recognize/find/determine John to be talented.

Whereas Kiparsky & Kiparsky argue that *know* is syntactically nonfactive, Hegarty holds that the sentences in (19) are not straightforwardly factive. "They have the quality of an evaluation, asserting that we have arrived at an evaluation of John as [talented]" (Hegarty, 1992: 32). Using the presupposition tests, discussed in Section 3.3.1, we can show that the

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[4] *False* and *true* for example allow subject-to-subject raising, but the meaning of the unraised and the raised structure differ notably.
(i) It was false/true that Joe declared his love for Mary. ≠
(ii) Joe was false/true to declare his love for Mary.

sentences in (19) are not factive. Recall that the sentences are nonfactive if the implication that John is talented is lost when embedded under negation, modality, yes/no question, antecedent, and disjunction, and moreover if the sentences do not adhere to the presuppositional criteria of text acceptability. The structural tests are given in (20a–e), and the text acceptability tests are shown in (20f) and (20g).

(20) a. We do not know/recognize/find/determine John to be talented.
b. It is possible that we know/recognize/find/determine John to be talented.
c. Do we know/recognize/find/determine John to be talented?
d. If we know/recognize/find/determine John to be talented, then he will get the job/ then he is a phoney.
e. Either we know/recognize/find/determine John to be talented or he will not get the job.
f. D? John is talented. We know/recognize/find/determine John to be talented.
g. D√ We know/recognize/find/determine John to be talented. John is talented.

The sentences in (20a–e) do not carry a presupposition. (20f) is a little odd, and (20g) is perfectly acceptable. This indicates that the predicates *know, recognize, find,* and *determine* lose their factive reading, when embedding an ECM infinitive. Note that the unclear result of the text acceptability test 1 does not matter, since not only presuppositions but also propositions can precede their host sentence. Consequently, the generalization that p-factive verbs do not take ECM complements holds for all p-factive verbs under investigation.

Embedding of ECM complements is also excluded for some nonfactive verbs, including the propositional verbs *allege, assert, contend,* and *insinuate* (cf. also Kiparsky & Kiparsky, 1971; Reis, 1977; Cattell, 1978):

(21) *Mary asserts John to be a loser.

In sum, all p-factive, but also some nonfactive matrix predicates prohibit ECM infinitives, making this restriction a weak property of factives.

4.2.5 Optionality of Extraposition

Extraposition of subject complements of p-factive predicates has been claimed to be optional (22), whereas for complements of nonfactive predicates it is obligatory (23) (cf. Kiparsky & Kiparsky, 1971).

(22) a. It makes sense to me that there are porcupines in our basement.
b. That there are porcupines in our basement makes sense to me.

(23) a. It seems to me that there are porcupines in our basement.
b. *That there are porcupines in our basement seems to me.

Due to the fact that extraposition of complements is optional for p-factive predicates, this rule determines the properties of nonfactive rather than of p-factive predicates. It is the sentence-initial position of the clause itself that with certain matrix predicates suggests the truth of the complement clause triggering what I called pragmatic factivity (cf. Section 2.5, see also Kiparsky & Kiparsky, 1971; Reis, 1977; Hegarty, 1992). Whereas (24a), based on

the ambiguity of *report*, has a factive and a nonfactive reading, from (24b) we most likely infer that the report is true.

(24) a. The UPI reported that Smith had arrived.
b. That Smith had arrived was reported by the UPI.

Note that topicalization is not always associated with a factive reading, as seen with nonfactive predicates such as *be true*, *be possible*, and *be false*.

(25) That Smith had arrived is true/possible/false according to the UPI.

In sum, optionality of a syntactic structure is not a property in the sense of our definition (1). The observation that the topic position of the complement clause interacts with presuppositional properties of the sentence can hence not be attributed to a syntactic reflex of p-factive verbs.

4.2.6 Negation-Raising

Factive verbs never allow negation-raising (e.g., Kiparsky & Kiparsky, 1971; Al-Kasey, 1992). The contrast is demonstrated in (26). (26a) and (26b) display sentences with finite and nonfinite factive complements, (26c) gives an example of a nonfactive sentence.

(26) a. I regret that John cannot win. ≠ I don't regret that John can win.
b. She is surprised not to meet him ≠ She is not surprised to meet him.
c. I believe that John cannot win. = I don't believe that John can win.

In the nonfactive sentence (26c), the unraised and the raised structure have more or less the same meaning, while the raised negation in p-factive *regret* and *be surprised* changes the entire meaning of the sentence. Traditionally it is assumed that in negation-raising, the negation of an embedded clause optionally moves into the matrix clause, while retaining the meaning of the original sentence (cf. Klima, 1964; Horn, 1978; for a different view see R. Bartsch, 1973). In more recent terminology, the negation of the matrix clause is said to have scope over the embedded clause (e.g., Rooryck, 1992).

As a consequence of this difference regarding negation-raising, the occurrence of negative-polarity items differs as well. Negative-polarity items have to occur in the scope of a negation. Since negation-raising is impossible for p-factive matrix predicates, negative polarity items in factive complement clauses are ungrammatical if the matrix predicate is negated, while with nonfactives they are possible (see Wilkinson, 1970; Kiparsky & Kiparsky, 1971; Rivero, 1971; Reis, 1977; Al-Kasey, 1992). The negative-polarity item *anybody*, for example, can only appear in the nonfactive complement (27a), but not in the factive complement (27b).[5]

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[5] Regarding the licensing of negative polarity items, Spanish and German behave similarly, as illustrated in (i) and (ii). The (a) sentences are nonfactive, and the (b) sentences are factive.

(i) a. No quiere que hable en absoluto.
not she-want that she-speak.SUBJ at all
b. *No siente que haya hablado en absoluto.
not she-regret that she-has spoken.SUBJ at all

(27) a. John didn't think that he had invited anybody.
b. *John didn't regret that he had invited anybody.

According to some native-speakers, *realize* and *know* allow negative-polarity items, as shown in (28), but lose their factive property in that case.

(28) ??John didn't realize/know that Mary had invited anybody.

Thus, besides prohibition of subject-to-subject raising and ECM infinitives, prohibition of negation-raising is a weak syntactic property of p-factive predicates. Note that permission of negation-raising in general is limited to the class of propositional attitude verbs (see e.g., Reis, 1977). Most nonfactive verbs do not allow negation-raising either, as exemplified for object-complements in (29) and for subject complements in (30).

(29) Mary said that he was not here. ≠ Mary didn't say that he was here.

(30) It is necessary that John doesn't win. ≠ It is not necessary that John wins.

In short, prohibition of negation-raising proves to be a weak indicator of the factive status of a predicate.

4.2.7 Insertion of Expletive *it*

Unlike nonfactive predicates, p-factive predicates are claimed to permit insertion of *it*. This contrast is illustrated in (31).

(31) a. *Bill thinks/claims/supposes it that Mary married John.
b. Bill resents/regrets/admits it that Mary married John.

This observation has been argued to result from the assumption that *it* is the reduced form of *the fact*. In that case it would follow automatically that only p-factive predicates allow the object pronoun *it* (see Kiparsky & Kiparsky, 1971; Pusch, 1971; Hegarty, 1992). As argued by Reis (1977) and Ullmer-Ehrich (1977), however, the claim that *it* is the pronominalized form of *the fact* is questionable. Even if we propose an expletive *it* in the context of extraposition, there are p-factives that do not unanimously allow the expletive, as demonstrated in (32) for English, and in (33) for the German equivalent (Reis, p.c.).

(32) Mary knew/realized/grasped/understood (*it) that the mobile phone was gone.

(33) Maria wusste/bemerkte/entdeckte (*es), dass das Handy verschwunden war.

Given that the above structures are factive without *it*, we can conclude that insertion of expletive *it* is not a syntactic reflex of the semantic feature [+p-factive].

(ii) a. Sie dachte nicht, dass er einen Finger rühren würde.
she thought not that he a finger lift would
b. *Sie bedauerte nicht, dass er einen Finger rühren würde.
she regretted not that he a finger lift would
Note that in German and in Spanish, mood selection also plays a role in determining grammaticality (for a discussion of the Spanish examples, see Al-Kasey, 1992).

4.2.8 Sentence-Pronominalization with *so*

Whereas nonfactive verbs permit pronominalization with *it* and *so*, it appears that p-factive verbs do not allow *so*-pronominalization (Kiparsky & Kiparsky, 1971; Adams, 1985), as illustrated in (34).

(34) a. John thought that Bill had done it, and Mary thought it/so, too.
b. John regretted that Bill had done it, and Mary regretted it/*so, too.

Know and *confess*, however, seem to allow pronominalization with *so*, even though they are p-factive matrix predicates.

(35) John confessed that he had bought a phone, and Bill confessed so, too.

(36) Mary knew that she loved Bill, and Sue knew so, too.

In order to see whether these sentences contradict the generalization, we first have to test whether (35) and (36) are indeed factive. Using the standard presupposition tests proves difficult, because negation, yes/no question, etc. cannot be applied straightforwardly to complex sentences. The outcomes of the text acceptability are given in (37) for *confess* and in (38) for *know*.

(37) a. D√ John had bought a phone and Bill had bought a phone.[6] John confessed that he had bought a phone, and Bill confessed so, too.
b. D* John confessed that he had bought a phone, and Bill confessed so, too. John had bought a phone and Bill had bought a phone.

(38) a. D√ Mary loved Bill. Mary knew that she loved Bill, and Sue knew so, too.
b. D* Mary knew that she loved Bill, and Sue knew so, too. Mary loved Bill.

The contrasts in (37) and (38) confirm the factivity of the predicates. As a result, possibility of sentence-pronominalization with *so* is not predicted by the semantic property of being factive.

4.2.9 Long *wh*-Movement

It has long been noted that p-factive predicates do not allow long movement of *wh*-phrases as freely as nonfactive predicates. The focus of this subsection will be on adverbial *wh*-phrases; extraction of *wh*-subjects and *wh*-measure phrases will be touched upon briefly.

Unlike nonfactive predicates, p-factive predicates do not allow long movement of adverbial *wh*-phrases such as *why, when, where,* and *how* out of the embedded clause (Cattell, 1978; Torrego & Uriagereka, 1990; Rizzi, 1990; Hegarty, 1992; Rooryck, 1992, Al-Kasey, 1992).[7] Examples (39) and (40) illustrate the contrast.

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[6] This sentence represents only one possible reading of the VP ellipsis in *Bill confessed so, too* in (35), the so-called 'sloppy identity reading' (Ross, 1967). The 'strict identity' reading is that only John had bought a mobile phone (for a semantic analysis of these readings, see Heim & Kratzer, 1998). My argument does not hinge on this difference.

[7] Note that this is not to say that these adverbials form a homogeneous class. With respect to extraction, for example, locative and temporal adverbials do not diverge as radically from arguments as for example causal adverbials such as *why*.

(39) a. Why did John believe (that) Sue killed Harry?
b. Because John heard Sue talk about it.
c. Because Harry had cheated on Sue.

(40) a. Why did John regret that Sue killed Harry?
b. Because John liked Harry.
c. *Because Harry had cheated on Sue.

While *why* in (39) is ambiguous and can refer either to the main or to the subordinate clause, in (40) *why* can only refer to the matrix clause. In case both readings are grammatical, it depends on the specific matrix verb and the context which of the two readings is preferred. In a comprehension experiment, adults preferred a downstairs reading for sentences such as (39) in between 24 % and 53 % of the cases, while a downstairs reading of sentences such as (40) was almost always rejected (Philip & de Villiers, 1992). Factive sentences with non-finite complements as in (41) block long adverbial *wh*-movement as well.

(41) a. Why$_{i/j}$ did he forget t_i having bought roses before *t_j?
b. Why$_{i/j}$ was she surprised t_i to get roses *t_j?
c. Why$_{i/j}$ did she regret t_i getting roses *t_j?

The prohibition of long adverbial *wh*-movement by p-factive but not by nonfactive predicates has also been noted for Spanish and German. (42) illustrates the case of nonfactives, and (43) of p-factives.

(42) a. Cuándo$_{i/j}$ dijiste/pensaste/creías t_i que vendieron el coche t_j?
'When did you say they sold the car?'
b. Wann$_{i/j}$ hast du gesagt/gedacht/geglaubt t_i dass sie das Auto
when have.2SG you said/thought/believed.PART t_i that they the car
verkauft haben t_j?
sold.PART have t_j
'When did you say they sold the car?'

(43) a. Como$_{i/j}$ supiste t_i que vendieron el coche *t_j?
'How did you find out that they sold the car?'
b. Wie$_{i/j}$ fandest du heraus t_i dass sie das Auto verkauft haben *t_j?
how found.2SG you out that they the car sold.PART have
'How did you find out that they sold the car?'

(44) and (45) show that a downstairs reading is not possible with the p-factive predicates *know, realize, recognize, and be aware.*

(44) a. Why did John know/realize/recognize that Sue killed Harry?
b. Because John liked Harry.
c. *Because Harry had cheated on Sue.

(45) a. Why was John aware that Sue killed Harry?
b. Because John liked Harry.
c. *Because Harry had cheated on Sue

Thus, all factives prohibit long adverbial *wh*-movement. Barrierhood to long *wh*-extraction is not a defining property of factives, however, because some nonfactive matrix predicates

block this movement, as well. This is illustrated for negative-implicative verbs in (46), and for propositional adjectival predicates in (47) and (48).

(46) $Why_{i/j}$ did Sue forget t_i PRO to buy champagne $*t_j$?

(47) $Why_{i/j}$ was it likely/possible t_i that John loves only his mother $*t_j$?

(48) $Why_{i/j}$ was John likely t_i to love only his mother $*t_j$?

In sum, prohibition of long *wh*-movement is a weak syntactic reflex of factivity.

Next let us briefly look at *wh*-subjects. While long extraction of a *wh*-subject is grammatical with nonfactives (49), it seems much worse with factives (50) (cf. Adams, 1985; Rooryck, 1992; Hegarty, 1992).[8] The (a) sentences demonstrate the pattern in English, and (b) sentences illustrate the French counterparts.

(49) a. Who_i do you believe t_i likes this book?
b. Qui crois-tu qui aime ce livre?

(50) a. ?/$*Who_i$ do you regret/understand t_i likes this book?
b. *Qui regrettes/comprends-tu qui aime ce livre?

(50) is problematic for two reasons. First, some speakers actually find subject-extraction out of factive complements acceptable (e.g., Hegarty, 1992). More importantly, the assertive counterpart of (50) is ungrammatical without the complementizer *that*, as shown in (51).

(51) *You regret/understand John likes the book.

The ungrammaticality of (50) results from the *that*-trace filter (cf. Chomsky & Lasnik, 1977) stating that the sequence of an overt complementizer followed by a trace is ungrammatical. Long w*h*-movement of the subject is prohibited if the complementizer *that* is present whether the matrix predicate is p-factive as in (52a) or nonfactive as in (52b).

(52) a. $*Who_i$ do you regret/understand/forget that t_i likes this book?
b. $*Who_i$ do you believe/think/suppose that t_i likes this book?

Consequently, subject *wh*-extraction is not predicted by the factivity of the predicate.

Besides *wh*-adverbials and *wh*-subjects, extraction patterns of *wh*-measure phrases have been attributed to the factivity of the predicate (Cinque, 1990; Al-Kasey, 1992). As exemplified in (53), the data are inconclusive. Whereas in Spanish and to some extent in German fronted measure phrases seem unacceptable in factive sentences, the equivalent English structures sound perfectly natural.

---

[8] Similarly, the patterns for French stylistic inversion can be attributed to the type of the matrix verb as well (Adams, 1985). Inversion is possible with nonfactives (i) and not possible with factives (ii).
(i) a. le livre que Jean croit que Marie aime
b. le livre que Jean croit qu'aime Marie
the book that Jean believes that likes Mary
(ii) a. le livre que Jean regrette que Marie aime
b. *le livre que Jean regrette qu'aime Marie
the book that Jean regrets that likes Mary

(53) a. *Cuántos kilos sabías/recordabas/sentías mucho que pesabas t?
How many kilos did you know/remember/regret that you weighed?
?Wieviel Kilo hast du gewusst/dich erinnert/bedauert, dass du wiegst?
b. Cuántos kilos creías/decías que pesabas t?
How many kilos did you believe/say that you weighed?
Wieviel Kilo hast du geglaubt/gesagt, dass du wiegst?

Thus, prohibition of fronted *wh*-measure phrases is not a syntactic reflex of factivity, at least with regard to English.

Summarizing the patterns of long *wh*-movement, the extraction patterns of adjunct *wh*-phrases, but not of subject and measure phrases are predicted by the semantic property of being factive.

4.2.10 Postposing

Factive sentences with a fronted *wh*-phrase do not allow postposing of the matrix clause (cf. Cattell, 1978; also Al-Kasey, 1992), while in nonfactive sentences this syntactic structure is permitted. The contrast is illustrated in (54) below.

(54) a. *Why did Sue kill Harry, do you forget/regret/admit?
b. Why did Sue kill Harry, do you believe/think/suppose/say?

While the term postposing is intuitively clear, the underlying structure is subject to debate. Sentences such as (54) were originally analyzed as instances of extraction. In more recent literature an account in terms of parenthesis is suggested, as restrictions that typically hold for extractions do not apply to postposing. More specifically, structures such as (54b) are argued to be an instance of integrated parenthesis (for German, cf. Reis, 1995, 1997). In integrated parentheses, the host clause satisfies the propositional argument of the parenthetical verb, for example of *believe* in (54b). Besides this interpretational dependence, the parenthesis is also prosodically integrated into the host clause. Integrated parentheses carry no focus or stress and no focus-background of their own, and are not separated from the host clause via intonational breaks. The special function of the parenthesis is hence to place the host clause in the perspective of the subject of the parenthetical verb (cf. Reis, 1995). I will follow Reis (1995, 1997, 2000) in analyzing postposing as an instance of parenthesis; the term postposing will be used to simply refer to the surface structure.

P-factive verbs such as *remember, recall*, and *know* seem to permit postposing, as exemplified in (55).

(55) Why did Sue kill Harry, do you remember/recall/know?

The intonation pattern, however, reveals that the sentences in (55) are grammatical only if the *wh*-clause is read as an independent clause, followed by a question like *Do you remember.* Thus, unlike integrated parentheses, these sentences have intonational breaks.

Therefore, prohibition of postposing operations is a further syntactic reflex of factivity. Some nonfactive matrix predicates block postposing as well, as shown in (56) for propositional adjectival predicates.

(56) *Why did Sue love Harry, is it likely/possible/false/true?

For this reason, postposing operations are not a defining property of p-factive matrix predicates.

4.2.11 Conjunction with *and, but* or *and so*

P-factive and nonfactive sentences are claimed to differ with regard to their restriction on certain conjunction patterns (Wilson, 1972). If a p-factive matrix predicate is asserted, conjunction with *but* and *and* supposedly results in an unacceptable stretch of text (57a), whereas conjunction with *and so* yields an unacceptable stretch of text if a p-factive matrix predicate is negated (58a).

(57) a. John knows that Nixon is bold, *but/*and Nixon is bold.
b. John thinks that Nixon is bold, *but/and Nixon is bold.

(58) a. John doesn't know that Nixon is bold, *and so Nixon is bold.
b. John doesn't think that Nixon is bold, *and so Nixon is bold.

However, this pattern only applies to a specific group of p-factive verbs, namely lexically positive verbs (cf. Reis, 1973). Lexically negative predicates such as *forget, regret, ignore, be sorry* as well as verbs that are noncommittal as to the desirability of the truth of the complement such as *be surprise* behave differently. This is demonstrated in (59) and (60), respectively.

(59) a. John forgets that Nixon is bold, but/?and Nixon is bold.
b. John doesn't forget that Nixon is bold, *and so Nixon is bold.

(60) a. John is surprised that Nixon is bold, but/?and Nixon is bold.
b. John isn't surprised that Nixon is bold, *and so Nixon is bold.

Generally speaking, conjunction with *and so* is ungrammatical for all p-factive predicates, since the complement clause is taken to be true and must not be introduced after uttering the presupposition-containing sentence. Note that this is just what the text acceptability test 2 comes down to (cf. Section 3.2.1.7). Since the restriction of conjunction with *but* does not hold for lexically negative p-factive predicates, the conjunction patterns are not a syntactic repercussion of factivity.

4.2.12 Insertion of Complementizer *that*

P-factive predicates have been claimed to require the presence of the complementizer *that* (61a), while for nonfactive verbs the complementizer is optional (61b) (cf. Hegarty, 1992). However, as I showed in Section 2.3 many p-factive verbs such as *admit, forget, notice,* and *know* do not need the *that* complementizer (62).

(61) a. Sue mentioned/recalled *(that) Bill left.
b. Sue thinks (that) Bill left.

(62) John admits/forgot/noticed/knows (that) Mary left.

Presence of the complementizer *that*, while being required for many p-factive predicates, is not a syntactic reflex of factivity.[9]

4.2.13 Semantic Addendum: Inference from a Subset to a Larger Set

Let me finally add a note on inference patterns of factive sentences. They are discussed here, even though they are truly semantic, because they have been argued to hold for p-factives only, in a fashion very similar to the syntactic phenomena discussed so far. It has been proposed that p-factive verbs prohibit upward entailment, i.e. they do not allow an inference from a subset to a larger set, as demonstrated in (63) (Philip & de Villiers, 1992).

(63) a. Sue forgot that her aunt was coming to town by train.
*→ Sue forgot that her aunt was coming to town.[10]
b. Sue thought that her aunt was coming to town by train.
→ Sue thought that her aunt was coming to town.

However, upward entailment is not blocked for lexically positive p-factive matrix predicates such as *remember* and *be aware*, allowing an inference from a subset to a larger set, as shown in (64).

(64) Sue remembered/was aware that her aunt was coming to town by train.
→ Sue remembered/was aware that her aunt was coming to town.

de Villiers, Curran, DeMunn & Philip (1997) suggest that blocking upward entailment results from the presence of a negative as implicit in *forget* (63a). As predicted, explicit negative elements in nonfactive sentences also prohibit upward entailment (65), but contrary to their prediction, upward entailment is also blocked for non-negative predicates such as *be pleased* or *be surprised* (66).

(65) Sue didn't think that her aunt was coming to town by train.
*→ Sue didn't think that her aunt was coming to town.

(66) Sue was pleased/surprised that her aunt was coming to town by train.
*→ Sue was pleased/surprised that her aunt was coming to town.

Notwithstanding the question of how to account for these inference patterns, inference is not a property that is triggered by the factivity of the matrix verb.

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[9] Note the similarity of this pattern to the complementizer pattern of languages with two finite complementizers that exhibit meaning differences that can be related to but not equated with factivity. Mayan Jakaltek, for example, has two different complementizers in finite clauses. One is similar to factive *that* (*chubil*), expressing a high degree of credibility or certainty. The other one encodes *that* or *if* (*tato*), expressing a notion of disbelief or reservation about a hearsay as well as an expected, supposed or believed fact. These complementizers can be chained, in which case the factive *that* has to come first (cf. Craig, 1977).

[10] Note that for the inference pattern in (63a) to hold, maximal focus has to be excluded (Reis, p.c.).

4.2.14 Summary

In this section I assessed a wide range of syntactic phenomena that have been proposed to result from the complement-taking predicate being p-factive. Of the 13 properties under investigation, five stood up to this claim. Unlike nonfactive predicates, p-factive predicates always prohibit subject-to-subject raising, ECM infinitival complements, negation-raising, long adverbial *wh*-movement, and postposing. Note that all these properties are in fact restrictions on p-factives. They are weak rather than defining properties of p-factives, since the same restrictions are also found in various types of nonfactives. How can we account for these syntactic restrictions of p-factive predicates? In the next section I will suggest a structural distinction between the complements of p-factive and nonfactive matrix predicates from which the different syntactic patterns of p-factives and nonfactives follow automatically. Furthermore, as shown in Section 4.4, the structural characteristics of p-factives can be extended to another class of verbs that pattern in an interesting way on factives, even though they are nonfactive.

4.3 Reflection of Factivity in the Complements' Event Structure

Developing a proposal by Hegarty (1992), I propose that p-factive and nonfactive sentences differ in terms of their event-structural interpretation. The main idea is the following. The lexical-semantic property [±p-factive] of the matrix predicate determines the (event-) structural representation and interpretation of its complement clause.[11] The different syntactic patterns found for p-factive and nonfactive sentences can then be attributed to the different structures of their complements at the level of Logical Form (LF) and thus at the level of (discourse-)semantic interpretation. In order to formulate interpretation rules for sentential complements, we have to enrich the model of file change semantics by the addition of event variables. Section 4.3.1 sketches the enriched discourse-semantic model. Section 4.3.2 describes the event-structure of finite complements and Section 4.3.3 of nonfinite complement clauses. In Section 4.3.4 the syntactic restrictions of p-factive and nonfactive predicates are accounted for in terms of the selectional properties of the matrix predicates at issue. Section 4.3.5 summarizes how factivity can be accounted for in terms of its complements' event-structure.

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[11] Alternatively, a number of researchers has assumed that factive and nonfactive sentences differ in their *syntactic* complement types, with factives selecting a complement clause marked as nominal. Kiparsky & Kiparsky (1971) propose that factive matrix predicates select a nominal node *fact*, while nonfactive verbs directly select the complement clause S (cf. also Wilkinson, 1970; Pusch, 1971). Restating this proposal in more recent syntactic terminology, factive verbs are claimed to select a CP headed by Comp[+N] (cf. Rouveret, 1980; Zubizaretta, 1982; Adams, 1985; Rizzi, 1990) or a complement clause marked as DP (cf. Torrego & Uriagereka, 1990). It remains an open question whether the stipulation of additional nodes or of [±N] features in Comp can be motivated by independent principles.

4.3.1 Event Semantics and Discourse-Binding

As mentioned in Section 3.4, in order to interpret and evaluate factive presuppositions Heim's original model of file change semantics has to be enriched so that individuals specified on file cards can also be events. The basic assumption is that verbs carry an event argument (Davidson, 1976). This is motivated by examples like the following:

(67) A: John buttered the toast in the bathroom with a knife at midnight.
B: Really? Tell me more about it.

The pronoun *it* in B's response clearly does not refer to any object such as John, the toast, or the bathroom but to the entire action of buttering a toast under specific circumstances. Following Parsons (1985), Higginbotham (1985, 1989), Hegarty (1992), and Avrutin (1999), I assume that every verb, whether it describes a state, a process, or a transition, has an event argument.[12] A verb has an array of semantic arguments, filling various θ-roles including an event argument. This information is stored in the lexical entry of the verb in form of a thematic grid (cf. Stowell, 1981), as exemplified in (68).

(68) Thematic grid of *see*
see +V -N, <1,2,E> where 1 is the actor, 2 is the object, E is the event argument

(69) Thematic grid of *dog*
dog -V +N, <1>

In general, predicates assign thematic roles, which are projected into syntax as argument positions that have to be filled. The correlation between predicates and arguments is determined by the requirements of the modified θ-Criterion, given in (70), which applies both at LF and SS (Higginbotham, 1985).

(70) θ-Criterion
a. If X discharges a thematic role in Y, then it discharges only one.
b. Every thematic position is discharged.

The different modes of discharging a θ-role are not understood as referring to things and events in a model. Instead, they are relativized to a discourse context that is not fixed throughout a conversation. Recall that the discourse background is modeled as a file of file cards for each discourse participant; the file cards are updated or new file cards are introduced as the conversation proceeds. Following Higginbotham (1985, 1989), discharging a θ-role can happen via θ-marking, θ-binding, and θ-identification, with θ-binding and θ-identification being restricted to strict sisterhood.

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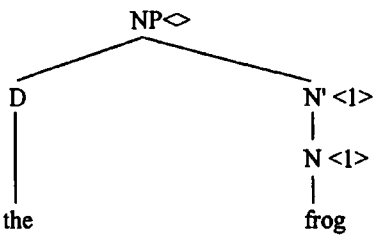
[12] This assumption is controversial. Even if we can classify states, processes and events all as eventualities (Bach, 1983), it does not necessarily follow that verbs referring to states contain an event variable as well. Davidson (1976) assumes that only action predicates and predicates talking about events, causes, and effects have an event argument. Similarly, Kratzer (1989, 1993) distinguishes between individual-level and stage-level predicates, only the latter of which she claims have an event argument. In contrast, Pustejovsky (1995) argues that the difference between these two types of predicates is manifested not by the presence or absence of an event argument but rather by differences in the so-called *qualia structure*, more specifically in the *agentive quale*. For arguments similar to Pustejovsky, see Zucchi (1989) and Portner (1992).

First, θ-marking describes the assignment of a θ-role to an argument, for example *walk* assigns *inter alia* the θ-role <1> where 1 is the actor. This θ-role is projected into syntax as an argument position that has to be filled. Filling it by 'John' yields the expression *walk(John)*. The corresponding entry in the θ-grid is then discharged.

Second, θ-binding pertains to the discharge of an open θ-role by a binder, for example by a definite determiner or by tensed Infl in root clauses. The underlying assumption is that lexical heads such as N or V introduce variables, whereas the corresponding functional heads are responsible for the binding of those variables (cf. Kamp, 2001). (71) illustrates how the definite determiner binds the open θ-role in the noun *frog*:

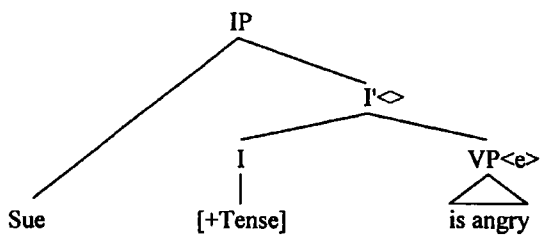
(71) a.



b. δx [dog(x)]

The empty angle brackets in (71a) indicate a θ-grid whose θ-roles have all been discharged; NP<> is a closed expression. The determiner discharges the open position, i.e. maps the set of all dogs to a dog that is unique with regard to the current discourse. In semantic terms, we arrive at a definite description of an individual. The discourse-semantic effect of θ-binding by *the* is to introduce the δ-operator, illustrated in (71b). Note that the δ-operator stands for the ι-operator if applied to files within a discourse frame (Hegarty, 1992). Hence, θ-binding by a definite determiner is δ-binding. The definite determiner discharges an open θ-role by selecting a file card for individuals within the discourse frame. Tensed Infl binds the event variable in root clauses but over file cards for events. The discourse-semantic interpretation is existential generalization over the event-position, as assumed in Davidson (1976). (72a) illustrates the binding of the event variable, (72b) gives the discourse-semantic interpretation. Note that D_E stands for the set of file cards referring to events in a given discourse D.

(72) a.

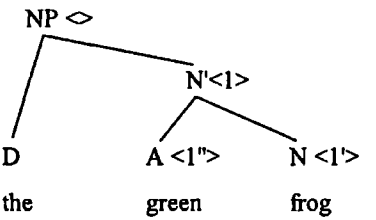


b. $\exists e \varepsilon D_E$ [is_angry(Sue, e)]

Thus, θ-binding by tensed Infl in root clauses is existential binding within the discourse frame D. Tensed Infl discharges an open θ-role by selecting a file card for events within the discourse frame. The event variable is existentially bound within the domain D_E.

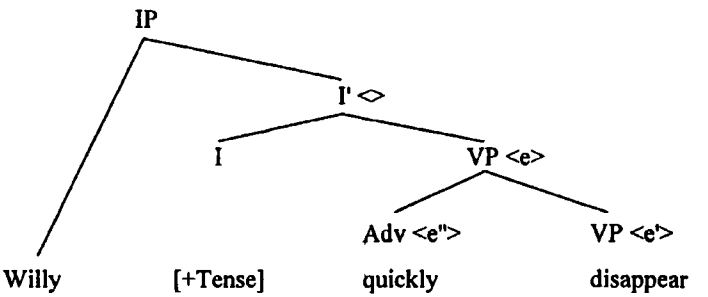
Third, the mechanism of θ-identification identifies two open θ-positions. This is for example the case in adjectival or adverbial modification, assuming that certain adverbials are predicated over events (cf. Davidson, 1976), or in traces of wh-adverbials (cf. Section 4.3.4). (73) illustrates the identification of two individual arguments, (74) exemplifies the identification of two event arguments.

(73) a.



b. δx [frog(x) & green(x)]

(74) a.



b. $\exists e \varepsilon D_E$ [disappear(Willy, e) & quick(e)]

The annotations of the arguments <e> and <1> illustrate the process of identification: <1''> and <1'> are θ-identified as <1>, and <e''> and <e'> are θ-identified as <e>.

Summarizing, given that all verbs carry an event argument, the model of file change semantics can be enriched by simply allowing variables to refer to events as well. The event argument can be discharged via θ-marking, θ-binding, or θ-identification, relative to a specific file that obtains in a given discourse situation. Having sketched how the formalism works in main clauses, I now turn to the question of how the event variables are bound in complement clauses. Section 4.3.2 describes in detail the event structure of factive and nonfactive finite complement clauses, and Section 4.3.3 extends this analysis to nonfinite complement clauses.

4.3.2 The Event Structure of Factive and Nonfactive Finite Complements

Following Hegarty (1992), I assume that the lexical-semantic property [±p-factive] of the matrix predicate determines the event-structural representation and interpretation of its complement clause. More specifically, I suggest that the event variable in a factive complement is bound differently than the event variable in a nonfactive complement. My proposal diverts from Hegarty's regarding the question of which element binds the event variable in

factive complements. While Hegarty argues that the complementizer *that* discharges the event argument of a factive complement clause, I hold that the event variable in factive complements is bound via non-overt features of factive Comp that are present at LF. The argumentation rests on the principle of deletion at the level of LF, as stated in (75) below.

(75) Deletion at LF (Lasnik & Saito, 1984)
An element that does not contribute to the semantic interpretation can be deleted at LF.

Given that LF is the level of representation that encodes properties relevant for the (discourse-) semantic interpretation of an expression, the complementizer *that* should be present at LF. Presence of *that* is not obligatory, however, in all factive complements (cf. Section 4.2.12). As a result, Hegarty's proposal predicts that the complementizer is only present at LF if the complementizer *that* is spelled out overtly and thus can δ-bind the embedded event variable in only a subset of factive sentences.

Taking the principle in (75) as to also apply to non-lexicalized elements, I propose that a non-overt feature in Comp rather than the overt complementizer triggers the δ-binding of the embedded event variable.[13] The feature of Comp pertinent to δ-binding follows directly from the semantic-syntactic account of factivity proposed in Chapter 2. There I argued that all factive complement clauses contain a topic time that precedes or overlaps with the topic time of the matrix clause. This precede/overlap condition was formulated as $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$. For sake of illustration, let us then assume that p-factive matrix predicates carry the feature [+p-factive] as part of their lexical-semantic entry. Let us further assume that Comp carries the information that the complement clause meets the precede/overlap condition, and this is captured as a feature hosted by Comp. For the sake of simplicity I will dub the feature $[t_{CC} \leq]$.[14] From the assumption that the feature $[t_{CC} \leq]$ is present in all factive complement clauses and hence not deleted at the level of LF, it follows that Comp$[t_{CC} \leq]$ δ-binds the embedded variable.

How does the discourse binding mechanism then proceed in detail? Given that tensed Infl discharges the event position in clauses with an interrogative, assertoric, or relative marker or feature, Infl fails to discharge the event position in finite and non-finite complement clauses. The event argument of a factive complement is δ-bound by Comp$[t_{CC} \leq]$, as illustrated in (76). In the LF (76a), Comp$[t_{CC} \leq]$ δ-binds the event variable in the complement clause embedded by a p-factive verb, yielding the discourse-semantic interpretation in (76b).

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[13] See Rooryck (1992) for another account of factives in terms of specific Comp features. He contends that the head of the CP selected by factive verbs has a feature that blocks certain movements. He claims that the head of a factive complement carries the feature [+wh], which at the same time accounts for the restriction on extraction of *wh*-adverbials out of sentential complements of factive verbs. Thus, factive islands are reduced to *wh*-islands. This hypothesis is not pursued here, since the [+wh] feature proposed for factive complements seems empirically unwarranted.

[14] I do not have much to say about how exactly this marking comes about. Intuitively, at least the following steps are involved. The topic time marking of the embedded verb is linked to Comp via Infl and V. This tense chain is independently necessary in order for the sentence to receive a temporal interpretation at all (cf. Hoekstra & Hyams, 1996; Hyams, 1996). In Comp the topic time relations between embedded clause and matrix clause are compared and – in case the precede/overlap condition is fulfilled – Comp is marked as $[t_{CC} \leq]$.

(76) a. John mentioned $[_{CP<>}$ Comp$[t_{CC\leq}]$ $[_{IP<e>}$ Willy $[_{I'<e>}$ I $[_{VP<e>}$ visit Berlin]]]]

selects δ-binds

b. regarding δe [visit(Willy, Berlin, e)], John mentioned that it holds[15]

Since the event argument is δ-bound at IP, it is no longer open at CP. Thus, p-factive matrix predicates that select a closed complement CP<> trigger a factive interpretation of the entire sentence. Adopting the discourse-semantic framework presented in Chapter 3, we can now state more precisely what makes a complement a definite description of an event corresponding to a unique file card within the discourse frame satisfying that description. It is a complement clause the event variable of which is δ-bound by Comp$[t_{CC\leq}]$. Only in that case is the event stated in the complement clause presupposed as a fact.[16]

In nonfactive – more specifically propositional – complements the event argument is not δ-bound by Comp but rather propagates up to CP. At CP it is existentially bound by the nonfactive matrix predicate, as illustrated in (77a), yielding the interpretation in (77b):

(77) a. John believed $[_{CP<e>}$ Comp$[_{IP<e>}$ Willy$[_{I'<e>}$ I $[_{VP<e>}$ visit Berlin]]]]

selects
∃-binds

b. [∃eεM_E: visit(Willy, Berlin, e)] believe(John, e)[17]
M = John's mental model, M_E = set of events in John's mental model

The embedded event variable is not bound by Comp and hence still open at CP. The nonfactive matrix predicates thus select a complement with an open event position, i.e. IP<e> or CP<e>. Propositional complements do not refer to some established event in the discourse frame, but to some mental model M of the speaker and the set of events in that mental model M_E. The content of the attitude ascription can be treated as an indefinite description of an event within the context of *believe*. Embedding under *believe* relativizes the quantification to John's mental model, establishing existential quantification over M_E (Hegarty, 1992). Put differently, the event position of the complement clause refers to some part of the speaker's mental model and thus allows identification of the event variable as for example in (77) as the object of John's belief. Note that speech report verbs such as *claim, say, tell* are subject to the same mechanism as propositional verbs, as exemplified below.

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[15] Here and in the following, the discourse-semantic representation is limited to the representation of the embedded event argument. For reasons of clearness, the event argument of the main clause, e.g., the event that John mentioned p, is left out.

[16] Note that the complement of a factive verb does not denote an event, but the fact that a particular event occurred. This contrast is exemplified in the following pair (cf. Peterson, 1979):
(i) Mary's refusal of the offer was followed by silence.
(ii) *That Mary refused the offer was followed by silence.
The complement in (ii) does not denote an event but a fact. Since a fact cannot be followed by anything, (ii) is ungrammatical.

[17] This analysis is parallel to the one given by Higginbotham (1989) for perception sentences like *John saw Mary leave the barn*:
[∃e: leave(Mary, the barn, e)] see(John, e)

(78) a. John claimed that Willy visited Berlin.
b. [$\exists e \in M_E$: visit(Willy, Berlin, e)] claim(John, e)

Summarizing the binding mechanism of embedded event variables, presented here, δ-binding can be defined as follows:

(79) δ-binding
δ-binding is θ-binding within a discourse frame. Definite determiners and Comp[$t_{CC} \leq$] in factive complements are δ-binders. A δ-binder discharges an open θ-role by selecting a file card within the discourse frame. Definite determiners select file cards for individuals; Comp[$t_{CC} \leq$] selects file cards for events. δ-binding by a definite determiner yields a definite description of an individual, δ-binding by Comp[$t_{CC} \leq$] yields a definite description of an event.

The definition above allows us to restate the definition of semantic-syntactic factivity developed in Chapter 2 (cf. (47)) in terms of δ-binding, as given in (80) below.

(80) Semantic-syntactic factivity (III)
A sentence is factive if a p-factive matrix predicate selects a complement clause with the embedded event variable already bound. The embedded event variable can only be δ-bound by Comp[$t_{CC} \leq$], yielding a definite description of an event.

Importantly, factivity is not exclusive to finite complements of p-factive matrix predicates but can be triggered by a limited range of non-finite complements as well. The next section addresses the question how the event structures of the relevant p-factive complement types can be characterized and how they differ from the event-structure of nonfactive nonfinite complement clauses.

4.3.3 The Event Structure of Factive and Nonfactive Nonfinite Complements

My proposal of the event-structures of factive and nonfactive nonfinite complement clauses closely parallels the account of finite complement clauses. This is motivated by the fact that factivity of sentences with finite and nonfinite complements can be attributed to the very same property: The topic time of the embedded clause precedes or overlaps with the topic time of the matrix clause (cf. Chapter 2). More specifically, I make the following assumptions. Factive nonfinite complements contain a complementizer position marked as [$t_{CC} \leq$]. Comp[$t_{CC} \leq$] is present at LF and δ-binds the embedded variable at IP.[18] Nonfactive nonfinite complements, in contrast, are not marked as Comp[$t_{CC} \leq$]. Their event variable propagates up to a higher node (IP or CP) and is discharged there, depending on the type of matrix predicate. I will start by reviewing the event structure of the nonfinite complement types that in concert with certain p-factive matrix predicates trigger factivity: perfectives, control infinitives, and PRO-ing gerunds. Then I will give an overview of the event structure of the main types of nonfactive nonfinite complements: propositional infinitives, volitive

[18] I am not concerned with the actual structure of the infinitival clauses here. For sake of exposition I assume that all factive infinitival complements are CPs. Hence, Comp occupies the same structural position in finite and nonfinite complement clauses.

infinitives, positive-implicative and negative-implicative infinitives, and complements of if-predicates. It should be noted that the parallel between finite and non-finite structures suggested here aims at providing a unified account of the event-structural properties of factive sentences and their syntactic repercussions. This is not to say that finite and non-finite complement clauses may not differ at all in their interpretation.

First, reconsider perfective complements such as (81).

(81) John forgot having bought roses before.

The embedded event-argument is δ-bound by Comp[$t_{CC}\leq$], as illustrated in (82a). The discourse-semantic interpretation is given in (82b).

(82) a. John forgot [$_{CP<>}$ Comp[$t_{CC}\leq$] [$_{IP<e>}$ PRO[$_{I'<e>}$ I [$_{VP<e>}$ having bought roses]]]]

selects δ-binds

b. regarding δe [buy(John, roses, e)], John forgot that it holds

The event argument is δ-bound at IP and the p-factive matrix predicate selects a closed complement CP<>, thus triggering a factive interpretation of the entire sentence just like the finite structures discussed in Section 4.3.2.

Second, control infinitives induce a factive interpretation of the complex sentence if embedded by emotive adjectival predicates such as *be pleased* or *be surprised* (83).

(83) Mary was surprised to meet John.

Comp[$t_{CC}\leq$] δ-binds the event variable of the infinitival complement (84a), resulting in a definite description of the embedded event, as shown in (84b). Assuming that control infinitivals are CP (cf. Chomsky & Lasnik, 1991; Hegarty, 1992), PRO is ungoverned as required.

(84) a. John was surprised [$_{CP<>}$ Comp[$t_{CC}\leq$] [$_{IP<e>}$ PRO [$_{I'<e>}$ to [$_{VP<e>}$ meet Sue]]]]

selects δ-binds

b. regarding δe [meet(John, Sue, e)], John is surprised that it holds

The event-structure of the embedded clause and the δ-binding mechanism are hence identical to that of factive finite complements as in *John was surprised that he met Sue.*[19]

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[19] Note that under this assumption the difference between nonfinite (i) and finite (ii) remains unexplained.

(i) John was surprised to meet Sue.

(ii) John was surprised that he met Sue.

The meanings of (i) and (ii) differ in that the finite complement clause refers to a particular occasion on which John met Sue, whereas the nonfinite complement clause is ambiguous as to whether it refers to a particular meeting or any meeting (cf. Rudanko, 1989). This contrast depends on the type of embedded verb, however. While eventive predicates like *be surprised* bring about a meaning difference, stative predicates such as *resemble* do not. Compare (iii) and (iv).

(iii) John was pleased to resemble his mother.

(iv) John was pleased that he resembled his mother.

Both complements denote a particular situation that covers an indefinite time span.

Third, some p-factive verbs such as *regret* and *recall* trigger a factive interpretation of the complex sentence if embedding gerundial complements (85).

(85) John regretted meeting Sue.

According to the account defended here, the event variable of the gerundial complement has to be δ-bound within the complement clause, since p-factive *regret* selects a complement clause with the event variable already bound. The question of which element can δ-bind the embedded event argument, is difficult to answer, as the syntactic analysis of gerundial complements is still under debate (see e.g., Chierchia, 1984; Abney, 1987). Since structural assumptions are not crucial to my argumentation, I will neglect issues of syntactic structure and assume that either Comp or Infl can host the relevant features. For the sake of concreteness, in the following example (86) a CP analysis is given.

(86) a. John regretted $[_{CP<>}$ Comp$[t_{CC\leq}]$ $[_{IP<e>}$ PRO $[_{I'<e>}$ $[_{VP<e>}$ meeting Sue]]]]

selects δ-binds

b. regarding δe [meet(John, Sue, e)], John regretted that it holds

Comp$[t_{CC\leq}]$ δ-binds the complement in (86a), resulting in a definite description of the embedded event (86b). In sum, all three types of factive nonfinite complements receive a uniform analysis in which Comp hosts the feature $[t_{CC\leq}]$ that remains present at LF and thus can δ-bind the embedded event argument yielding a definite description of an event.

Let us now contrast the event structure of factive nonfinite complement clauses with the event structure of nonfactive nonfinite complements. My analysis of propositional, volitive, positive-implicative and negative-implicative infinitives, and complements of if-predicates will focus on the mechanism of discharging the embedded event position (for an overview of the verb types, cf. Table 2.3). Analogous to the analysis for finite complements, all nonfactive nonfinite complement types have in common that their event position propagates up to IP or CP and is discharged via existential binding in semantic composition with the verb that selects this complement.[20]

First, propositional infinitives are embedded by propositional verbs such as *believe, consider, expect, figure, imagine, presume, suppose, suspect.* As depicted in (87), the event structure is supposed to be the same as for the finite complements of those verbs.

(87) a. John believes Max_i $[_{IP<e>}$ t_i to have visited London]
b. $[\exists e \varepsilon M_E$: visit(Max, London, e)] believe (John, e)

Unlike the finite complements selected by propositional verbs, propositional infinitival complements are analyzed as IP (cf. also Hegarty, 1992), but receive the same discourse-semantic interpretation as their finite counterparts in (77).[21]

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[20] In principle, we could also argue that all nonfinite complements have a Comp position, only differing in the value of the tense feature (but see Boskovich, 1997, for a discussion of the relation between tense marking and presence of Comp).

[21] Not that if the event structure for finite and nonfinite propositional complements is identical, it would be difficult to account for the fact that verbs like *think* do not take ECM complements. On the other hand, it is questionable whether the discourse-semantic interpretation of the nonfinite structure is really parallel to the finite one.

Second, volitive infinitives are complements that are selected by a variety of verbs with different selectional properties. Verbs such as *want, desire, wish* optionally realize the subject of the complement; verbs such as *try, hope, promise* never realize the subject of the complement, and verbs like *tell X to, ask X to* always realize the subject of the complement. Examples of each type are given in (88), (89), and (90) below. I assume that the event argument is existentially bound by the optional complementizer *for*, since the event in the complement clause does not refer back to some event already present in the discourse.

(88) a. Mary wants $[_{CP<>}$ for $[_{IP<e>}$ Bill to visit London]
b. Mary wants $[_{CP<>}$ (for) $[_{IP<e>}$ PRO to visit London]

(89) Mary tries $[_{CP<>}$ (*for) $[_{IP<e>}$ PRO to go to London]

(90) Mary asks $[_{CP<>}$ (*for) $[_{IP<e>}$ Bill to go to London with her]

The first two types of verbs have been argued to express an attitude towards an irrealis event (Pesetsky, 1988). In (88) Mary wants some currently irrealis event to be realized; in (89) Mary tries to realize some irrealis event. The null prepositional complementizer *for*, which is an optional governor, assigns case to an overt subject and shields a PRO subject from government by the higher verb. That the IP<e> complement of *for* will not be interpreted as propositional, but as denoting an irrealis event is due to the lexical property of *for*. Verbs like *ask X to* form a special subgroup. The object NP is obligatory, and the complementizer *for* is never present. For sake of simplicity, I assume that these speech verbs form a further subgroup of irrealis infinitivals, never realizing *for*, and never omitting the object NP.

Third, infinitival complements can be embedded by if-predicates such as *see, hear, make, cause,* and possibly adjectival predicates such as *be wise, be stupid.* These infinitival structures imply that the event in the complement clause is true if the matrix clause is asserted, but they do not presuppose it. Thus, they are not analyzed as definite descriptions. Infinitival complements of perception verbs and of causatives are analyzed as being indefinites. In contrast to propositional complements, the matrix verb does not discharge the event position of its complement clause in relation to a mental model. Example (91) below illustrates the semantic interpretation of complements embedded by *make.*

(91) a. John made [Bill leave]
b. $\exists e \varepsilon D_E$ [leave(Bill, e)] make(John, e)

Fourth, reconsider complements of positive-implicative verbs such as *happen, manage,* and *remember.* An asserted matrix clause entails that the complement clause is true and a negated matrix clause that the complement clause is false. Therefore, the event of the matrix clause and the embedded clause can be collapsed with regard to its truth-conditions (cf. Hegarty,1992, for a similar suggestion). This is exemplified in (92).

(92) a. John managed $[_{CP<e>}$ PRO to meet Bill]
b. $\exists e \varepsilon D_E$ [meet(John, Bill, e)]

The complement is assumed to raise at LF and to adjoin to the matrix VP where its event position is θ-identified with the matrix event position.

Finally, negative-implicative infinitives are embedded by verbs such as *forget, avoid, fail, neglect, decline,* and *refrain.* An asserted matrix clause entails that the complement clause is false and a negated matrix clause that the complement clause is true. Focusing on

the event binding mechanism, I suggest an analysis parallel to the one proposed for positive-implicative infinitival complements, as illustrated in (93).

(93) a. John forgot [$_{CP<e>}$ PRO to meet Bill]
b. $\exists e \varepsilon D_E \neg$[meet(John, Bill, e)]

(93b) means that on an occasion of a given sort such as John coming to town, John did not meet Bill.

In sum, the nonfactive infinitival complements all have in common that the event variable in the complement clause is not δ-bound, and thus the infinitival complement cannot be interpreted as a definite description. In other words, the event variable does not refer back to an event already present on a file card within a given discourse frame. On the other hand, in the factive infinitival complements described before the embedded event argument is δ-bound by Comp, triggering an interpretation as a definite description. This event-structural distinction is equivalent to the event-structural mechanisms proposed for finite factive and nonfactive complements. How does the structural distinction between the complements of p-factive and nonfactive matrix predicates bear on syntactic restrictions of p-factives, discussed in Section 4.2, such as blocking long adverbial *wh*-movement?

4.3.4 Syntactic Restrictions Again

Unlike nonfactives, p-factive predicates always prohibit long adverbial *wh*-movement, negation-raising, ECM infinitival complements, subject-to-subject raising, and postposing. In this section I will demonstrate how these syntactic restrictions of p-factive predicates can be accounted for by making use of the event-structural binding mechanism proposed above. My analysis of prohibition of long adverbial *wh*-movement and ECM infinitives draws on Hegarty (1992).

First consider the extraction patterns of adverbial *wh*-phrases from factive and nonfactive complements. Following Hegarty (1992), I assume that adverbial *wh*-phrases have an event θ-position that is identified under sisterhood with the event variable of the modified clause, and that the event position of an adverbial can be θ-identified with an event-position accessible in the position of its trace. I divert from Hegarty's proposal in that I assume that there is no antecedent government across Comp[$t_{CC}\leq$]. The latter requirement rests on the notions of the Empty Category Principle (94) and antecedent government (95).

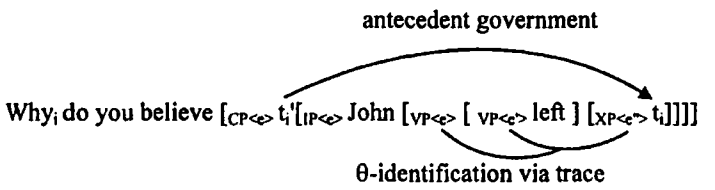
(94) Empty Category Principle (ECP, Chomsky, 1986)
Traces must be properly governed. A properly governs B if and only if A θ-governs B or A antecedent governs B.

(95) Antecedent government (cf. Lasnik & Saito, 1984)
α antecedent governs β iff
a. α binds β (α c-commands β, and α and β are coindexed) and
b. There is no γ (γ = XP or X^0) such that α c-commands γ and γ dominates β, unless β is in the spec of γ.

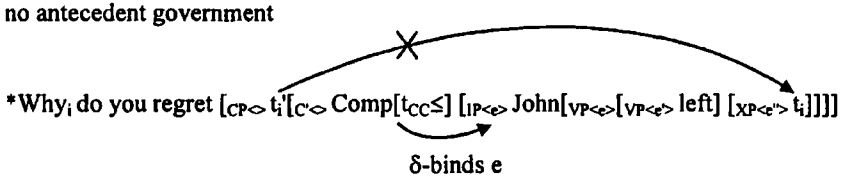
Stated informally, the line of reasoning is the following: Holding at SS and LF, the ECP requires that traces are properly governed. Adjunct traces are not θ-governed for they are

not θ-marked, thus they have to be antecedent governed. Focusing on the government relation between the original trace in the complement clause and the intermediate trace located in SpecC, the intermediate trace is present at LF and binds the original trace. However, it cannot antecedent govern the original trace because Comp[t_{CC}≤] is a potential governor according to definition (95b). Since Comp[t_{CC}≤] is not coindexed with the original trace, antecedent government by Comp[t_{CC}≤] is excluded. Note that blocking of antecedent government in factive complements does not hinge on the presence of the complementizer.[22] The LF structures of a nonfactive and a factive sentence with a fronted *wh*-adverbial are given in (96) and (97), respectively. t_i and t'_i indicate the traces of the adverbial *wh*-element; e' and e" indicate the event variables of VP and adverbial *why*.

(96)



(97) no antecedent government



For p-factive matrix predicates, long extraction of *wh*-adverbials is impossible, because due to Comp[t_{CC}≤] the trace t_i' cannot antecedent govern t_i. Thus, in this representation the ECP is violated. The event argument of the wh-adverbial <e"> has to be θ-identified with the event argument <e'> of the modified clause under strict sisterhood. Since t_i is not a legitimate trace, consider the potential of the intermediate trace in SpecC for θ-identification. At t_i' the event argument of the embedded clause is already δ-bound, thus rendering θ-identification impossible. In consequence, the downstairs reading of *why* is not available in (97). In other words, IP functions as a barrier for long *wh*-extraction out of factive complements. Note that the proposed structure also accounts for the fact that emotive adjectival predicates with an infinitival complement do not permit long *wh*-extraction, since the movement traces originating in the VP would not be antecedent governed owing to the IP barrier, just as in the parallel example (97). In the propositional sentence (96), the complementizer position does not block government. Therefore, t_i' antecedent governs t_i. Consequently, the event argument of *why* can be θ-identified with the event argument of the lower

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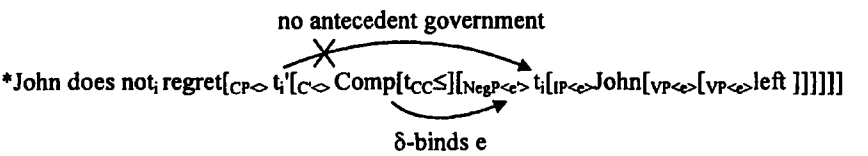
[22] This is the main difference to Hegarty's assumption that there is no government across an overt complementizer. Note that my account, but not Hegarty's, predicts that extraction of *wh*-subjects out of factive complement clauses is impossible even if the complementizer is not overtly realized, i. e. if the *that*-trace effect does not arise. (i) and (ii) should hence be ungrammatical:
(i) *Who$_i$ did you forget [$_{CP}$ t'_i that [$_{IP}$ t_i came?]]
(ii) ?/*Who$_i$ did you forget [$_{CP}$ t'_i [$_{IP}$ t_i came?]]
Since speaker judgment seems to vary with regard to (ii), it remains an open question whether this prediction is actually borne out.

verb. The resulting event position propagates up to the CP node where it is discharged in semantic composition with the nonfactive verb *believe* and existentially bound. In sum, the difference in the admissibility of long adverbial *wh*-extraction can be accounted for by assuming that p-factive and nonfactive matrix predicates bind the event variable of the lower clause differently, granted that only Comp[$t_{CC}\leq$] is present at LF.

Second, let us look at the factive barrier to negation-raising. Negation-raising can be explained in analogy to the barrier to long *wh*-movement, as illustrated below.

(98)



Given that Neg is an operator-phrase that has to move through SpecCP, Comp[$t_{CC}\leq$] prevents antecedent government of the trace t_i. If we furthermore assume that sentential *not* contains an event argument, the event argument of the negation has to be θ-identified with the event argument of the embedded clause under strict sisterhood. Since antecedent government of the original trace is blocked by the presence of Comp[$t_{CC}\leq$] and the embedded event argument is already bound at C', θ-identification is not possible. In consequence, the downstairs reading of the negation is not available.

Third, consider the restriction on ECM infinitives, repeated in (99) below.

(99) a. *John regrets Mary$_i$ [$_{IP<e>}$ t_i to be talented].
b. John believes Mary$_i$ [$_{IP<e>}$ t_i to be talented].

In (99a) the embedded event variable cannot be δ-bound for there is no δ-binder present within IP. Infl can only bind the event argument in main clauses. The matrix verb therefore fails to select a complement clause where the event variable is already bound. Since *believe* selects a complement clause with the event variable still open, (99b) is grammatical.

Fourth, let us look at the patterns of subject-to-subject raising, repeated in (100).

(100) a. *John$_i$ is tragic [$_{IP<e>}$ t_i to be the loser].
b. John$_i$ is likely [$_{IP<e>}$ t_i to be the loser].

The argumentation is parallel to that of ECM infinitivals. In (100a) the embedded event variable cannot be δ-bound for there is no δ-binder present within IP. Hence, the matrix predicate cannot select a complement clause with the event variable already bound as required by its selectional properties. Adjectival predicates like *be likely*, on the other hand, are propositional and thus select a complement clause with the event variable still open, making the structure in (100b) grammatical.

Finally, consider the postposing operation, which is permitted if the matrix predicate is nonfactive, but is ungrammatical if the matrix predicate is p-factive. The relevant contrast is repeated in (101).

(101) a. *Why did Sue kill Harry, do you forget/regret?
b. Why did Sue kill Harry, do you believe/think/suppose/say?

Following Reis (1995, 1997, 2000) in the assumption that the structures in (101) are integrated parenthetical *wh*-constructions rather than cases of extraction, it ensues that the verb

in the second clause does not subcategorize the first clause. Consequently, there is no Comp[$t_{CC}\leq$] that could fulfill the function of blocking antecedent government thereby falsely ruling out (101b). Without committing myself to any particular representation, let us assume the structure of integrated parentheses to be something like in (102).

(102) a. *Why$_i$ did Sue kill Harry t_i [do you forget]
b. Why$_i$ did Sue kill Harry t_i [do you think]

The restrictions ruling out (102a) seem to be based on non-syntactic principles. It may be due to the correspondence between the event structure of nonfactive complements and the semantics of integrated parentheses. "Integrated parentheticals identify the individual x and his/her relation to R of believing, saying, etc. to the respective proposition p, such that according to x's beliefs or sayings etc. p is an assertable proposition" (Reis, 1995: 70). In factive sentences, the proposition is presupposed or referred back to rather than merely expressed, and thus cannot be part of an integrated parenthetical construction.

Summarizing, the syntactic restrictions of p-factive predicates regarding long adverbial *wh*-movement, negation-raising, ECM infinitival complements, subject-to-subject raising, and postposing all follow directly from the event-structural binding mechanism proposed for factive sentences.

4.3.5 Summary

In this section I argued that the different syntactic restrictions found for factive and nonfactive sentences can be derived from the different event structures and binding mechanisms of their complements. The lexical-semantic property [±p-factive] of the matrix predicate determines the event-structural representation and interpretation of its complement clause. Enriching the discourse-semantic model of file change semantics by variables for events, we arrive at a model in which variables referring to individuals or to events can be bound. Binding these θ-roles within a discourse frame, i.e. relative to a file that obtains in a discourse, is called δ-binding. Tensed Infl binds the event variable in root clauses over file cards for events. In complement clauses, the event variable cannot be bound by tensed Infl and has to be bound otherwise. In nonfactive complements, the event variable propagates up to the IP or CP node where it is existentially bound by the matrix verb. Accordingly, nonfactive matrix predicates such as propositional verbs select a complement with an open event position. In comparison, p-factive matrix predicates select a complement with the event variable already bound. The embedded event variable is δ-bound by Comp[$t_{CC}\leq$]. The feature [$t_{CC}\leq$] articulates that the complement clause fulfills the precede/overlap condition regarding the topic time relation between matrix clause and complement clause. While definite determiners select file cards for individuals, factive Comp[$t_{CC}\leq$] selects file cards for events. δ-binding by a definite determiner yields a definite description of an individual, and δ-binding by Comp[$t_{CC}\leq$] yields a definite description of an event. The notion of semantic-syntactic factivity was accordingly reformulated as follows. A sentence is factive if a p-factive matrix predicate selects a complement clause with the embedded event variable already bound. The embedded event variable can only be δ-bound by Comp[$t_{CC}\leq$], yielding a definite description of an event. Importantly, the event-structure of finite and nonfinite complement clauses is assumed to be identical with regard to the event structures

and binding mechanisms. Consequently, Comp[$t_{CC\leq}$] δ-binds the embedded event variable in factive finite as well as nonfinite complements. This unified approach correctly predicts the syntactic restrictions found to hold for all p-factive predicates. Prohibition of long adverbial *wh*-movement, negation-raising, ECM infinitival complements, subject-to-subject raising, and postposing directly follow from the event-structure of factive complements. Interestingly, there are some verbs that exhibit the same syntactic restrictions as p-factive matrix predicates, while clearly being nonfactive. In the next section I will argue that the properties of this group of verbs can be captured in the framework of δ-binding event variables as well.

4.4 Widening the Perspective: Response Stance Complements

Some nonfactive verbs pattern on p-factive verbs in their prohibition of the syntactic operations considered here. I demonstrated that the proposal of δ-binding can explain the syntactic restrictions of the complements of p-factive verbs. In Section 4.4.1 I will provide evidence for the claim that the complements of this group of nonfactive verbs have the same event structure as factive complements, even though they are not factive. Assuming that δ-binding the embedded event variable is available to this type of complement as well the syntactic properties in question follow automatically. The characteristics of response stance complements then is that they are δ-bound by Comp without being factive. In Section 4.4.2 I will modify the notion of presupposition, presupposition projection and presupposition failures to account for the similarities and differences between factive and response stance sentences.

4.4.1 The Event Structure of Response Stance Predicates

Cattell (1978) noted that complements of verbs such as *accept, agree, confirm, deny, verify,* and *doubt*, which he called *response stance verbs*, do not allow long adverbial *wh*-movement (103a) and postposing (103b). Moreover, negation-raising (104a), ECM infinitival complements (104b) (cf. also Hegarty, 1992), and subject-to-subject raising (104c) are blocked in complements of response stance matrix predicates.

(103) a. *Why$_i$ does Mary accept that John loves Harry t_i?
b. *Why does John love Harry, do you accept?

(104) a. Mary does not accept that John loves Harry.
≠ Mary accepts that John doesn't love Harry.
b. *Mary accepts John to love Harry.
c. *Mary$_i$ accepts t_i to love Harry.

However, response stance verbs are not factive, as can be seen when embedding response stance sentences such as (105a) under negation. (105b) does not presuppose that John loves Harry.

(105) a. Mary accepts/confirms/doubts/denies that John loves Harry.
b. Mary does not accept/confirm/doubt/deny that John loves Harry.

According to Cattell, response stance verbs express a response to an opinion that someone else has put to the speaker. In other words, the stance has a source outside the speaker. Consider the following example, in which B responds to A's opinion. Note that B does not commit himself to the belief that John loves Harry.

(106) A: I think that John actually loves Harry. But what about you?
B: I accept that John loves Harry.

In (106) B expresses a response to an opinion explicitly stated by A. Response stance verbs can also be used to comment on a proposition that nobody actually formulated.

> I can say *I admit that democracy is difficult,* even if no one has actually suggested that it is. What I am doing, of course, is meeting a possible proposition, which I can imagine someone putting forth; and in this sense I am still making a response, but making it to an imagined, rather than an actual, stance. (Cattell, 1978: 68)

Given that p-factive predicates are admissible if the proposition expressed in the complement is already part of the discourse frame of the participants, we can now liken factive and response stance complements in the following way. P-factive matrix predicates and response stance matrix predicates are related in so far as they both induce a reference to something previously heard or read. In other words, within a given discourse the complements of both types of matrix predicates refer back to some previously mentioned event that is bound at some level of representation. The event variable of factive and equally of response stance complements is incorporated into an event file card already established in the discourse frame. In case no appropriate event file card is present, the file is accommodated. Thus, the response to a 'possible proposition' noted by Cattell is equivalent to the immediate and larger situation use of presuppositional expressions (cf. Section 3.4.4) because both require accommodation. P-factive and response stance verbs differ in that the latter do not embed a complement that is presupposed to be true. As a result of this characteristic of response stance verbs, the standard intrasentential presupposition tests are predicted to fail. The text acceptability tests, however, which make use of the observation that the complement clause refers back to some previous event, should produce the same results as in the case of factives. Both predictions are borne out. The outcome of the five sentence internal presupposition tests is demonstrated in (107), using *accept* for a response stance verb.

(107) a. Susan does not accept that John loves Harry.
b. It is possible that Susan accepts that John loves Harry.
c. If Susan accepts that John loves Harry, then she will get a divorce.
d. Either Susan accepts that John loves Harry or she will get a divorce.
e. Does Susan accept that John loves Harry?

(108) John loves Harry.

As predicted, none of the sentences above presuppose(108). The two text acceptability tests are illustrated in (109a) and (109b) below. The tests may be modified by adding to the proposition something like *I heard that* to make clear that it is not a fact but an opinion that is at issue in the discourse.

(109) a. D√ (I heard that) John loves Harry. I accept that John loves Harry.
b. D*? I accept that John loves Harry. (I heard that) John loves Harry.

As for factives, the conjunction of the proposition of the complement clause and the sentence containing that proposition in (109a) yields an acceptable stretch of text. (109b) on the other hand is rather odd, as predicted.[23] These findings enable us to describe p-factive and response stance matrix predicates in a unified fashion, using the feature [±rf]:

(110) [±rf]

A matrix predicate is marked as [+rf] iff within a given discourse its complement refers back to some previously mentioned event. An rf-predicate is factive iff it retains the presupposition that the proposition expressed in the complement clause is true under the standard presupposition tests. An rf-predicate is response stance iff the first, but not the second text acceptability test is successful, and the intrasentential presupposition tests fail. A verb is marked as [-rf] iff it is neither p-factive nor response stance. It is called non-rf.

Response stance predicates are also referred to as r-predicates, and r-complements are complements of response stance predicates. Likewise, the terms f-predicates and f-complements are used as shorthand for p-factive predicates and complements of p-factive matrix predicates, respectively. The notion of referring back to some previously mentioned event underlying the text acceptability test is captured in the δ-binding mechanism. From this we can conclude that r-predicates have the same event structure as f-predicates (cf. also Hegarty, 1992). As illustrated in (111), they select a complement clause with the event variable already bound.

(111) a. They agree that Willy visited Berlin.
b. Regarding δe [visit(Willy, Berlin, e)] they agree that it holds

Note that as a further consequence, δ-binding within the discourse frame does not require that the event in question actually hold, it only requires the event to be at issue in the discourse. Consequently, an event is present in a file card if it is presupposed that the event holds or if the event is at issue in the discourse. The definition of δ-binding from (79) can now be extended to also comprise the complements of r-predicates. The new definition is given in (112) below.

(112) δ-binding (extended)

δ-binding is θ-binding within a discourse frame. Definite determiners and Comp[$t_{CC}\leq$] in rf-complements are δ-binders. A δ-binder discharges an open θ-role by selecting a file card within the discourse frame. Definite determiners select file cards for individuals; Comp[$t_{CC}\leq$] select file cards for events. δ-binding by a definite determiner yields a definite description of an individual, δ-binding by Comp[$t_{CC}\leq$] yields a definite description of an event.

In complements of r-predicates the embedded event variable is δ-bound by Comp. Thus, the syntactic restrictions observed for response stance sentences can be derived from this event-structural binding mechanism in the same way as for the factive sentences. Note that this account of r-predicates moreover gives an explanation for why expressions such as *believe*

[23] That (109b) is not as unacceptable as the factive counterpart might be ascribed to the possibility to interpret the second sentence as referring to a new event file card rather than being linked to the event established in the preceding complement clause.

the claim do not permit a downstairs reading of *wh*-adverbials. These complex predicates imply that the subject has already heard or read about the notion being cited. Hence they express a response stance, as illustrated in (113a), contrasted with a propositional in (113b).

(113) a. $Why_{i/j}$ does Mary believe the claim t_i that John loves Harry $*t_j$?
b. $Why_{i/j}$ does Mary believe t_i that John loves Harry t_j?

Likewise, verbs of manner of speaking like *scream* and *whisper*, which allow neither long adverbial *wh*-movement nor postposing (114), may – at least under one reading – be classified as r-predicates as well.

(114) $Why_{i/j}$ does Mary whisper/scream t_i that John loves Harry $*t_j$?

The outcome of the two text acceptability tests, illustrated below, is not very clear.

(115) a. D√ (It is said that) John loves Harry. Susan whispered John loves Harry.
b. D√/?? Susan whispered that John loves Harry. (It is said that) John loves Harry.

Acceptability of (115b) seems to vary with the reading of the matrix verb: If *whisper* is interpreted as relating the subject's point of view (in the sense of *say*), then the text becomes acceptable. However, if *whisper* is interpreted as expressing primarily how that communication came about, i.e. by means of speaking in a low voice, (115b) is less acceptable. As it is beyond the scope of the present work to examine this phenomenon in more detail, I will simply assume that the reading that blocks long *wh*-movement and postposing is the response stance reading, possibly realized as containing an inherent adverb (e.g., *say loudly/quietly*).[24]

Table 4.1 below summarizes the main characteristics of rf- and non-rf predicates. The behavior of non-rf-predicates is exemplified by the class of propositional predicates. For each verb class, the following information is supplied: the mode of discharging the embedded event variable, the weak restrictional syntactic properties, and examples of the members of the verb class.

As can be seen from Table 4.1, the classes of rf- and non-rf- predicates differ in the event structure of their complements as well as in their syntactic restrictions. Note that long adverbial *wh*-movement is allowed for propositional predicates, but prohibited for some non-rf-predicates such as negative-implicatives. Therefore, all five syntactic properties listed above are weak, but not defining features of r- and f-complements. Put differently, from the factivity of the matrix predicate we can infer the syntactic restrictions holding for their complements, but from the occurrence of a certain syntactic restriction we cannot infer that the matrix predicate is p-factive, or response stance for that matter.

P-factive and response stance verbs are similar in that δ-binding is available for the event variable in complements of both f- and r-predicates, resulting in the same syntactic restrictions. According to our structural assumptions so far, r- and f-predicates do not differ at all then, because they both embed a definite description of an event. Only factive sentences however, presuppose the truth of their complement clause, reflected in passing not only the

[24] It is self-evident that the notion of response stance verbs needs to be refined in order to capture the aspects of verbs as diverse as *accept* and *scream*. Nevertheless, I hold that the underlying intuition is on the right track. In a similar spirit, Cinque (1990) attributes the weak islandhood of factive and manner-of-speaking verbs to a common characteristic, i.e. being dominated by VP instead of V'.

Table 4.1 Rf- and non-rf-predicates

[±rf]	Verb class	Event structure	Syntactic restrictions	Verbs
[+rf]	factive	δ-binding of embedded e by Comp[t_{CC}≤]	*long *wh*-movement *postposing *ECM-infinitives *negation-raising *subject-to-subject raising	*comment, emphasize, find out#, forget, inform, know#, mention, notice, point out, realize#, recall, recognize#, remember, be significant, be aware#, be odd, be tragic*
[+rf]	response stance	δ-binding of embedded e by Comp[t_{CC}≤]	*long *wh*-movement *postposing *ECM-infinitives *negation-raising *subject-to-subject raising	*accept, agree, confirm, doubt, deny, verify* Manner of speaking: *scream*, whisper**
[-rf]	propositional	∃-binding of embedded e by matrix predicate	√long *wh*-movement */√postposing */√ECM-infinitives */√negation-raising */√subject-to-subject raising	Report of speech: *tell, claim, say* Report of states of mind: *think, believe, imagine* Others: *allege, assert, assume, conclude, consider, declare, estimate, feel, judge, maintain, propose, state, suggest, suppose, suspect, be likely, be possible*

semi-factive; * preliminary classification

text acceptability tests but also the intrasentential presupposition tests. How can we capture this crucial difference between p-factive and response stance verbs while maintaining the parallel event structure? This question is addressed in the next section.

4.4.2 Presupposition Revisited

The proposal advanced in the previous sections rests on two assumptions. First, factive and nonfactive sentences differ with regard to the place and to the type of binding of the embedded event variable. Second, the mode of discharging the event argument via δ-binding

by Comp[$t_{CC}\leq$] is assumed to be available not only for factive complements but also for response stance complements. Put differently, δ-binding is not exclusive to expressing a presupposition. Response stance and p-factive matrix predicates both embed a definite description of an event. Whether the event has been mentioned previously in the discourse or whether it is presupposed does not matter. This proposal successfully accounts for the syntactic restrictions observed in factive and response stance, but not generally in nonfactive complements.

The question then arises of how we can capture the difference between response stance and factive complements within the discourse-semantic proposal suggested here. In this section I provide an answer to that question by using the notion of binding at different levels of representation, introduced in Chapter 3. As a result, the notions of presupposition, presupposition projection, and presupposition failure will be modified as to account for the interpretation of the class of response stance predicates as well.

Intuitively speaking, the class of response stance predicates is expected to diverge in some aspects from the discourse-semantic analysis of factive presuppositions. In the definition of [+rf] in (110) I stated that response stance and factive sentences pattern on the text acceptability tests, while only the factive sentences pass the intrasentential presupposition tests. How do those facts bear upon the discourse-semantic representation? Recall the notion of presupposition projection as anaphora resolution (cf. Chapter 3). Each individual or event mentioned for the first time in the conversation receives a new file card in the file of the speaker. Any subsequent mention of that individual or event by way of a definite NP or a factive complement updates the old file card. This update may take place at the topmost level of representation or at some intermediate level. As long as the definite NP or the factive complement is anaphorically linked at some level of representation, the representation is felicitous. Only anaphoric linking at the top level of representation, however, results in a presuppositional reading of the factive sentence (cf. definition (138) in Chapter 3).

With regard to the difference between factive and response stance complements, two conclusions can be drawn. First, updating an already established file card, i.e. δ-binding an event or individual variable, is a mechanism available to response stance verbs. And this is exactly the reason why the two text acceptability tests can be applied to both f- and r-predicates. Anaphoric linking at the top level of representation, resulting in a presuppositional reading of the sentence is only available to the event argument in factive complements. Thus, p-factive but not response stance verbs are presupposition triggers. This distinction is mirrored by the different outcomes of the intrasentential presupposition tests. In other words, I claim that f- and r-predicates simply differ as to at which level of representation the embedded event variable can be δ-bound. Factive sentences carry the elementary presupposition that the proposition expressed in the complement clause is true, as can be shown by using the various presupposition tests presented in Section 3.3.1. What these tests come down to is nothing but anaphoric linking at the top level of representation, i.e. as if there were no projection or defeasibility problem. Hence, without any additional information, we can safely infer from (116) that John has a cat, linking the respective event variable at the top level of the representation.

(116) John_i forgets that [he_i has a cat]$_e$.

(117) Max agrees that [John has a cat]$_e$.

Even leaving aside questions of defeasibility and projection, (117) does not presuppose that John has a cat. Upon uttering (117) the event variable is anaphorically linked at some level of representation, but never at the top level.

Summarizing, the event variable of factive complements can be δ-bound at the top level of representation – save for defeasibility that is –, whereas the event variable of response stance complements must be δ-bound at some intermediate level of representation. Consequently, we can now modify the definitions of presupposition, presupposition projection, and presupposition failure put forth in Chapter 3 as to also account for the interpretation of the class of response stance verbs. The basic assumption underlying this modification is that definite descriptions have, in addition to their anaphoric property, a presuppositional property (cf. Section 3.4), which distinguishes p-factive verbs from response stance verbs. The definition of presupposition (cf. (132) in Section 3.4.6) is modified as follows.

(118) Anaphor and presupposition (final version)
Definite NPs and f- and r-complements are anaphors that have internal structure and semantic content, enabling them to accommodate. Anaphors require a link to a specific file card: Definite NPs require a link to an individual file card, f- and r-complements require a link to an event file card. This link is established via δ-binding the variable. In addition, definite determiners and f-predicates induce a presupposition, i.e. the individual or event variable can be linked at the top level of representation.

The properties of projection and defeasibility (cf. Definition (138) in Section 3.4.6) are then characterized as follows:

(119) Projection and cancellation (final version)
Anaphors are linked to a suitable antecedent at some level of representation. Presupposition projection, i.e. δ-binding at the top level of representation, is only available to presupposition triggers. δ-binding at some intermediate level of representation is always possible. In case of f-complements and definite NPs this is equivalent to presupposition cancellation. In case of r-complements only intermediate δ-binding is allowed.

From the two definitions above it follows that the notion of presupposition failure has to be refined as well. Recall that a presupposition fails if it is at no level of representation possible to anaphorically link the presupposition to an antecedent or to accommodate the context accordingly. Linking of the event argument of an r-complement fails under more or less the same circumstances, save that linking at the top level of representation is not available to response stance complements. The following definition captures the refinement of the original definition in (141) (Section 3.4.6).

(120) Anaphoric and presupposition failure (final version)
Anaphoric failure arises if it is impossible to link the individual or event argument to an antecedent at any available level of representation, and if – due to conditions of felicity – accommodation cannot take place. Anaphoric failure w.r.t. presuppositions is called presupposition failure.

Extending the account in Section 3.4.6, let us now look at the different levels of binding the event variable in r- and f-complements in more detail. I assume that δ-binding at an inter-

mediate level of representation for r-complements is parallel to the δ-binding for definite noun phrases in hypothetical contexts such as conditionals. Consider the following two stretches of discourse (121) and (122) and compare them to the related f-complement (123) and r-complement (124), respectively. The individual and the event argument are underlined.

(121) John has a cat. His cat is happy.

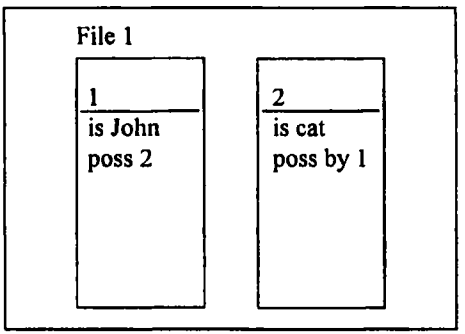
(122) If John has a cat, his cat is happy.

(123) John has a cat. $John_i$ forgets that he_i has a cat.

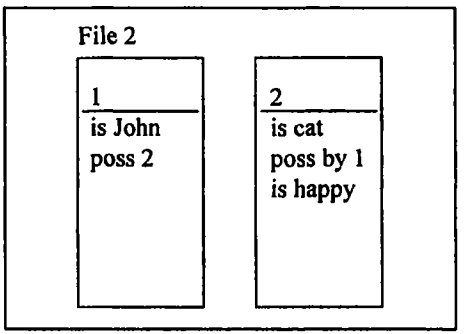
(124) It is said that John has a cat. Max agrees that John has a cat.

In (121) and (123), both arguments are bound at the top level of representation, because they refer back to an individual or an event, respectively, that is already present within the discourse. In (122) and (124), on the other hand, both arguments are linked at an intermediate level of representation: The individual variable in the former sentence can be linked to the indefinite NP *a cat* in the antecedent of the conditional, and the event variable in the latter sentence can be linked to the event in the preceding sentence that is not established as a fact within the current discourse. For the sake of simplicity, let us assume a reduced number of file cards where an event variable is only represented for the complement clause. Then we can illustrate the binding relations for the examples above as follows:

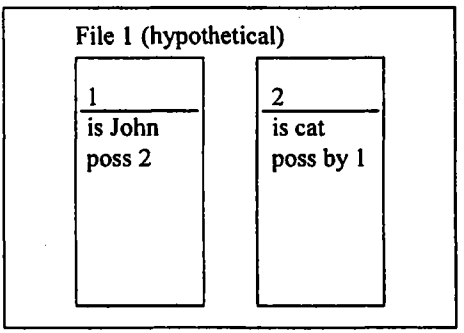
(125) John has a cat.



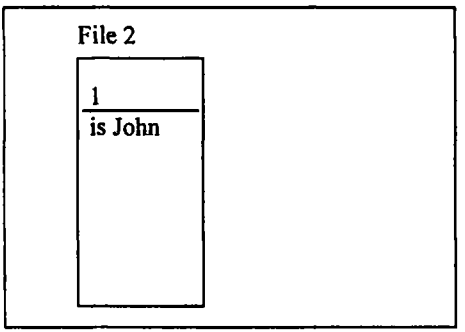
His cat is happy.



(126) If John has a cat,

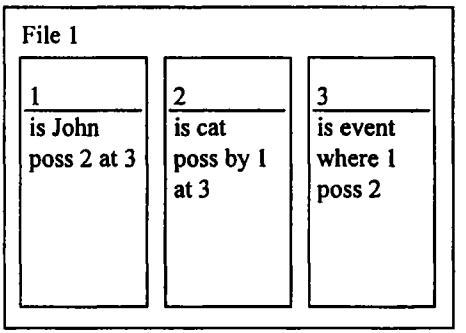


his cat is happy.

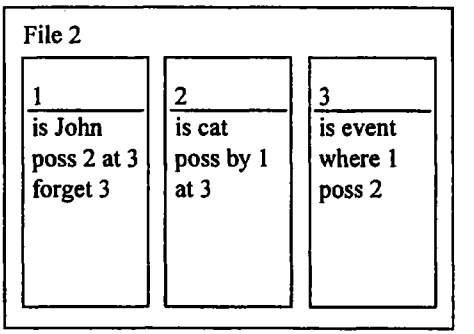


While in the representations above Files 1 are identical, Files 2 differ. In (126) the definite NP *his cat* is evaluated in the local context, created by the conditional. In other words, it is anaphorically linked at an intermediate level. Thus, the underlying presupposition that there is a cat that John owns is no longer present in the second file that contains the updated file cards after the consequence has been uttered. In (125) on the other hand, the definite NP *his cat* is linked at the top level and hence the presupposition is projected. The file card 2 for the cat is therefore present in the second file. Compare these structures to the parallel structures of f- and r-complements, employing event-arguments.

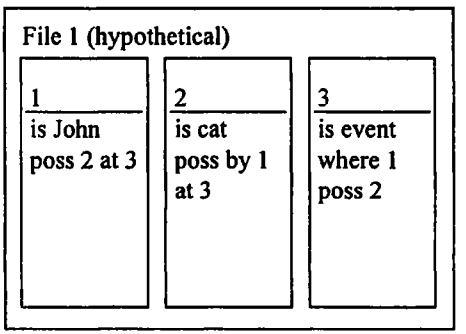
(127) John has a cat.



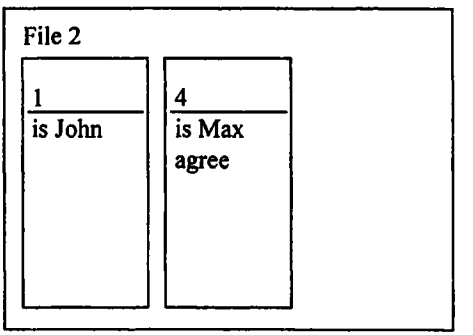
$John_i$ forgets that he_i has a cat



(128) Maybe John has a cat.



Max agrees that John has a cat.



The second files in (127) and (128) differ in that only the former has a file card 3 for an event where John owns a cat. The event variable is linked at the top level in the factive sentence (127) and linked at some intermediate level in the response stance sentence (128). Note that due to the definition of projection and cancellation in (119) the files in (128) also represent factives in case of presupposition cancellation as in *If John has a cat, then Max forgets that John has a cat.* This difference corresponds to the difference of linking the individual-variable in (125) and (126).

In conclusion, while p-factive and response stance verbs behave similarly with regard to δ-binding of the embedded event variable, they differ just as the matrix clause and the conditional do with regard to the level at which the variable can be bound. Recall that syntactic consequences could be verified for the class of f-predicates and r-predicates, i.e. verbs that

refer back to an event that is presupposed as a fact or is at issue in the discourse. As a result, the finding that factivity has repercussions on syntax can now be phrased more specifically. It is the property of δ-binding the event variable of sentential complements that results in syntactic restrictions for complements of p-factive and response stance matrix predicates.

4.5 Conclusion

Making use of the notions of semantic-syntactic factivity and presupposition, developed in Chapter 2 and 3, this chapter provided the core of the syntactic perspective underlying the present study. I addressed the questions of whether we can find syntactic repercussions of factivity and whether and how these syntactic restrictions are structurally represented.

Among the wide range of syntactic phenomena that have been proposed to result from the complement-taking predicate being p-factive, only five stand up to this claim. Unlike nonfactive predicates, p-factive predicates always prohibit subject-to-subject raising, ECM infinitival complements, negation-raising, long adverbial *wh*-movement, and postposing. These restrictions are weak rather than defining properties of p-factives, since the same restrictions are also found in various types of nonfactives. I argued that the different syntactic restrictions found for factive and nonfactive sentences can be accounted for by differences in the event structures and binding mechanisms of factive and nonfactive complements.

Adding variables for events to our discourse-semantic model, we arrived at a model in which we can formulate how the event variable in sentential complements can be bound. In nonfactive complements, the event variable propagates up to the IP or CP node where it is existentially bound by the matrix verb. Accordingly, nonfactive matrix predicates such as propositional verbs select a complement with an open event position. In comparison, p-factive matrix predicates select a complement with the event variable already bound. The embedded event variable is δ-bound by Comp[$t_{CC}\leq$], the feature of which articulates that the complement clause fulfills the precede/overlap condition regarding the topic time relation between matrix clause and complement clause. δ-binding by Comp[$t_{CC}\leq$] yields a definite description of an event. Semantic-syntactic factivity is accordingly reformulated as the interaction of a p-factive matrix predicate and a complement clause with the embedded event variable already δ-bound by Comp[$t_{CC}\leq$]. I demonstrated that factive nonfinite complement clauses can be analyzed as having the same event-structure and employing the same binding mechanism as finite factive complements, thus accounting for the fact that certain perfective, infinitival, and gerundial complements receive a factive reading as well when embedded by a p-factive matrix predicate and show the same syntactic restrictions.

A restricted class of verbs – response stance predicates – syntactically patterns on the class of p-factives, while clearly being nonfactive. I argued that the properties of this group of verbs could be captured in the framework of δ-binding event variables as well. R-predicates and f-predicates are related in that they both δ-bind the embedded event variable. They differ in that the event variable is bound at different levels of the representation. Definite descriptions induced by r-predicates and f-predicates are regarded as anaphors of which only the latter can be bound at the top level of representation, resulting in a presupposi-

tional interpretation. Consequently, the syntactic restrictions found to hold for f- and r-complements can be derived from the property of δ-binding the event variable of sentential complements rather than from the property of presupposing the truth of the complement clause.

Before turning to the acquisition of factivity, let me summarize the different facets of factivity proposed in Chapter 2 to 4. Factivity is multidimensional in nature. The interaction of a potentially factive matrix predicate and a tense/aspect marked complement clause triggers a factive reading of the complex sentence. From a discourse-semantic perspective, a factive interpretation is achieved if the event argument of the complement clause is δ-bound by Comp[$t_{CC}\leq$]. Binding at the top level of representation results in an actual presuppositional interpretation. The syntactic restrictions observed in factive sentences (prohibition of long adverbial *wh*-movement, negation-raising, ECM infinitival complements, subject-to-subject raising, and postposing) directly follow from the event-structure of factive complements. The similarity between response stance and p-factive predicates is captured by assuming the same event structure but a different level of binding the embedded event argument, thus blocking an actual presuppositional reading of the sentence.

5. Factivity in Language Acquisition

5.1 Introduction

> The [...] undeniably fascinating data from child language [...] are, in a sense, ahead of the theory. A good deal of intriguing acquisition data lack an explanatory theoretical apparatus. (Roeper, 1988: 35)

What does a compositional model of factivity, which encompasses lexical-semantic, syntactic, and discourse-semantic dimensions, imply for the acquisition of factivity? On the one hand, the language learner faces a challenging task. In order to acquire an adult-like understanding of factivity, she has to discover the relevant features of factivity at multiple levels of representation. On the other hand, the compositionality of the concept allows the language learner to acquire factivity in a stepwise fashion. Some of the central learning tasks the child has to cope with are listed below.

1. The language learner has to discover which predicates are p-factive and which are non-factive.
2. She must learn that only tensed/aspect marked complement clauses, i. e. for the most part finite complements, in concert with a p-factive matrix predicate trigger a factive interpretation.
3. She has to realize that certain matrix predicates trigger a factive reading also when embedding nonfinite complements.
4. The language learner must learn that p-factive predicates induce the presupposition that the proposition of the complement clause is true and that this presupposition refers to an already established event in the discourse, by way of linking it to an old file card or by accommodating the present file.
5. The complex patterns of presupposition projection and presupposition defeasibility have to be mastered.
6. She has to realize that – rather than the complementizer *that* – factive Comp δ-binds the event variable.
7. The child has to find out that p-factive predicates do not allow long movement of *wh*-adverbials, postposing, ECM infinitives, negation-raising, and subject-to-subject raising, but that all these restrictions are not an exclusive property of the class of p-factives.
8. Upon encountering response stance predicates, the child must realize that these predicates for the most part pattern on p-factive predicates in that they also δ-bind the embedded event variable and exhibit the same syntactic restrictions, while carrying no presupposition.

Note that most of the tasks above refer to the instantiation of features of Universal Grammar, with perhaps language-particular lexical items (Roeper, p.c.). The property of p-factive predicates to induce a presupposition, for example, is independent of the target language. In contrast, the tasks 3 and 7 represent language-specific choices. Consider the case of German, Spanish, and English. As mentioned in Chapter 2, German and Spanish

allow perfective complements with matrix predicates such as *forget* in a factive interpretation, while this complement type is altogether excluded for English. Similarly, factive gerundial complements do not exist in German, but in English. Syntactic restrictions such as subject-to-subject raising or ECM infinitives are likely to be subject to parametric choice as well, as the range of possible syntactic structures considerably differs from language to language. In what follows, I will focus on the acquisition of factivity in English. However, given that the majority of the acquisition tasks is a matter of instantiating universals the claims and arguments made here should apply to languages other than English as well.

In view of the numerous tasks on the way to mastering factivity, three questions arise (cf. also Schulz, 2000). At what age does the child master which aspects of factivity? How is factivity acquired? And how and why do children advance in their understanding of the concept of factivity? The general questions behind these factivity-specific questions, stated below, constitute the focus of language acquisition research (e.g., Roeper, 1988; Tracy, 1991b, 1995; Pérez-Leroux, 1993; Schaeffer, 1997).

(A) What do children know?

(B) How do they acquire that knowledge?

(C) How and why do they modify their language systems?

While the first question is descriptive, the others are mainly explanatory in nature. In answering these questions we have to take into consideration that language acquisition presents a logical as well as a developmental problem. On the one hand, children acquire their mother language in a relatively short time and in a fairly uniform fashion despite the fact that the child's linguistic environment is impoverished. This is called the *learnability or logical problem of language acquisition.* The data the language learner is exposed to is deficient in that utterances often contain false starts, repetitions, and slips of the tongue. Furthermore, utterances are not labeled with grammatical categories, nor does the child ever hear the set of all grammatical sentences in her mother tongue. This is referred to as the *poverty of the stimulus* (cf. Hornstein & Lightfoot, 1981). On the other hand, language acquisition is not instantaneous but gradual, taking place over the course of a couple of years. "For a period of varying length, children do not talk like adults. Whatever our theoretical bias, this discrepancy needs to be accounted for" (Tracy, 1995: 144). This is called the *developmental problem of language acquisition.* Besides the question of how to explain the differences between child and adult language it also comprises the question of how to characterize the sequence of the intermediate stages[1] of language development towards the adult state. In sum, the task of any language acquisition research is to address the three questions above, while accounting for both the logical and the developmental problem of language development.

In this chapter the development of the concept of factivity is discussed from a syntactic, lexical-semantic and cognitive perspective. The chapter is organized as follows. Section 5.2 states a set of acquisition hypotheses than can be derived from the compositional model of factivity. In Section 5.3 two caveats for language acquisition research are recapitulated, the

[1] Note that the notion of *stages*, and similarly of *steps*, *phases*, and *sequences*, attempts to grasp developmental progress; it is not implied that language acquisition actually proceeds in discrete and overt steps (cf. also Roeper, 1992; Tracy, 1991a, 1995).

general indeterminacy of language data and the effect of the research method on the kind of data available. Section 5.4 discusses the acquisition of complex clauses. Results from previous research are compared with my own findings from the analysis of two longitudinal case studies. In Section 5.5 I look at the relation between cognitive development and language development and argue that a theory of mind is a prerequisite for acquiring factivity. Focusing on the question of what the child's representation of factive and nonfactive sentences looks like at various ages, Section 5.6 contains an overview of previous studies on the comprehension of p-factive and nonfactive predicates. In Section 5.7 I discuss experimental results on the acquisition of two syntactic restrictions shown to hold true for factive sentences: prohibition of long adverbial *wh*-movement and negation-raising. Section 5.8 summarizes the findings.

5.2 Hypotheses for Language Acquisition

In view of continuity assumptions for language acquisition (e.g., Pinker 1984; Roeper, 1992), a series of hypotheses for acquisition can be derived from the multidimensional approach to factivity outlined in Chapter 2 to 4. Rendering the model of factivity into terms of language acquisition, the following general hypothesis emerges (cf. also Schulz, 2002).

(H0) Children are expected to acquire the concept of factivity stepwise and not in an all-or-nothing fashion.

Moreover, the following set of more specific hypotheses H1 to H4 can be derived from the semantic-syntactic model of factivity. H1 concerns the interaction of lexical-semantic and syntactic aspects in achieving a factive reading of a complex sentence. The relationship between p-factive and nonfactive matrix predicates is captured by H2. H3 expresses the discourse-semantic dimension of factivity, and H4 adresses the syntactic restrictions of factive sentences.

(H1) A target-like understanding of factivity requires recognition of the compositional character of factivity, i.e. the interrelation of a potentially factive matrix predicate with a tensed/aspect marked complement clause.

- H1.1 Since the complementizer *that* is not obligatory in factive complements, *that* does not play a leading role in acquiring the target-like interpretation of factive and nonfactive sentences.
- H1.2 Production of finite complement clauses does not coincide with mastery of factive structures.
- H1.3 Acquisition of factive nonfinite complements is delayed, as it is more difficult to infer their non-overt tense/aspect marking from the surface structure than for factive finite complement clauses.
- H1.4 Response stance complements occur rather late in children's speech, resulting from the specific property of r-predicates to δ-bind the embedded event variable without inducing a presupposition.

H1.5 Children are sensitive to the contributing factors 'type of matrix predicate' and 'type of complement clause' from early on.

(H2) Since p-factive and nonfactive matrix predicates differ in the possible truth-values that their complement clauses can receive, the language learner masters (some of) these nonfactive predicates at the same time at which she correctly interprets complement clauses of p-factive matrix predicates as presupposed to be true.

(H3) Given that within a discourse-semantic framework p-factive predicates are linguistic presupposition triggers, children assign truth-values to complement clauses based on this linguistic property rather than according to pragmatic measures such as probability. In calculating a sentence's interpretation, language learners take into account the previously established discourse background.

(H4) Children recognize the syntactic restrictions of factive complements (prohibition of long adverbial *wh*-movement, negation-raising, ECM structures, subject-to-subject raising, and of postposing) only after they have established rf Comp as a δ-binder of the embedded event variable at the level of LF.

These hypotheses will be compared with results from studies on the emergence of complex sentences in children's speech and from experimental studies on the comprehension of p-factive and nonfactive predicates. Besides reviewing previous studies, I will present three new studies: an analysis of two longitudinal CHILDES corpora (cf. Section 5.4.2) and two comprehension experiments, which will be discussed in detail in Chapter 6. Section 5.4 puts H1.1 to H1.4 to test. H1.5 will be examined in Chapter 7. H2 will be investigated in Section 5.6 and Chapter 7. H3 will be tested in Chapter 7, and Section 5.7 focuses on H4. Before I turn to the acquisition data, in the next section I will call attention to two general caveats when assessing language acquisition data.

5.3 Language Acquisition Data: Two Caveats

Whether we use data from observational or experimental studies, in language acquisition research primary language data are used to draw conclusions about the language knowledge of the learner. In order to arrive at a meaningful assessment and interpretation of the findings two caveats have to be borne in mind. First, the data are is general underdetermined by the theory. Second, the type of method used crucially determines the type of data available (cf. also Tracy, 1995; McDaniel, McKee & Cairns, 1996). In this section I will briefly summarize the argument of the indeterminacy of the data and review the main characteristics of the two methods pertinent to studies on the acquisition of factivity: longitudinal case studies and comprehension experiments.

The first caveat concerns the indeterminacy of the data. Generally speaking, every utterance – apart from memorized utterances and imitations – is governed by the present language competence of the speaker of that utterance (cf. Chomsky, 1965). However, it is less transparent precisely how competence and performance are related. Lust, Chien & Flynn (1987) state the general problem of psycholinguistic research as follows:

> Psycholinguistic research is specifically empirical in the sense that it pursues the assessment of language knowledge through the measurement and analyses of various modes of language behavior, principally speaking and understanding. [...] Evidence of language competence which is evaluated through psycholinguistic study is thus always mediated by the processing factors involved in each behavioral instance of each language function [i. e. language production and comprehension, P.S.], as well as by the basic variance assumed in any sampling of performance data. (Lust et al., 1987: 273)

Despite the fact that processing factors may intervene in more or less substantial ways, any psycholinguistic study aims at gaining insight into a specific area of language knowledge by studying language behavior.[2] An important feature of the resulting data is that they are in principle underdetermined by the theory, i.e. they can be explained by more than one theoretical assumption (cf. Fritzenschaft, Gawlitzek-Maiwald, Tracy & Winkler, 1990; Gawlitzek-Maiwald, Tracy & Fritzenschaft, 1992; Tracy, 1995). Nonetheless, the decision for a specific theoretical model is a prerequisite for assessing grammatical knowledge since only a theoretical metalanguage allows framing and classifying the language data. Note that the indeterminacy of the data is increased by the fact that young children cannot provide secondary linguistic data such as metalinguistic judgments.

The second caveat concerns the role of the method for the type of data available for assessment. Longitudinal case studies and comprehension experiments exhibit divergent characteristics that lend themselves to use for very different aspects of the acquisition of factivity and give rise to very different data. Consider first longitudinal studies of spontaneous speech.[3] They are fairly unconstrained regarding the design of the discourse situation. The child produces and hears a variety of utterances, without the adult conversation partner(s) systematically intervening or guiding the conversation.[4] Recordings take place in regular intervals and generally for an extended period of time. Ideally, in this way large corpora can be collected comprising a wide range of linguistic structures, uttered in various discourse situations. Especially for the onset of language acquisition, observational studies are very valuable, as only a limited range of experimental tasks is available for very young children.[5] Furthermore, case studies provide information about individual variation in the course of language development that is left aside in experimental group studies (cf. also Tracy, 1995). Another advantage of longitudinal case studies is that they continue to provide important information about a variety of linguistic aspects as new theoretical hypotheses arise. In addition, unclear data (e. g., ambiguous references, pronouns, or deictic expressions) can often be disambiguated by examining the reactions of the discourse partners, and

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2 See Crain & Thornton (1998) and Crain (1999) for a different view: Instead of assuming that processing factors compete with grammatical knowledge, Crain advances the Modularity Matching Model according to which competence grammar preempts performance factors, which impede performance only in well-defined circumstances.

3 For the first longitudinal studies in German, see Stern & Stern (1907). For early studies in English, see Brown (1973), Kuczaj (1976), and Bloom and collaborators (1980, 1984, 1989).

4 Note that the situation is not truly natural, as the mere presence of an observer already influences the situation. It is impossible to know what the subject's behavior would have been like otherwise; this is referred to as the observer paradoxon (Labov, 1972).

5 See for example Hirsh-Pasek & Golinkoff (1996) for an overview of studies with very young children starting at the age of four months, employing the technique of the intermodal preferential looking paradigm.

by considering para- and extralinguistic aspects such as intonation, stress, gestures, and context. Finally and most important, longitudinal case studies are able to capture the overall course of language development, in contrast to experiments, which only illuminate the current state of the learner's language competence.

At the same time, longitudinal studies exhibit several limitations. First, even in frequent recordings lasting one or two hours, only a small percentage of the child's utterances can be collected. Therefore, if a particular structure occurs in the sessions sampled, it is difficult to decide when this occurrence qualifies as productive grammatical competence of the respective form. In addition, frequent use of certain structures does not necessarily point to a current developmental pattern, but is often due to the specific discourse structure.[6] The absence of a certain structure, on the other hand, does not necessarily indicate that the child has not yet acquired that structural pattern. This absence could be due to both lack of a certain linguistic ability and simply lack of appropriate discourse contexts in the sample. This issue is related to a second general problem of longitudinal studies: Not every predicted step in language acquisition has to be observable in all children and independent of the kind of discourse. This is what Roeper (1992) calls *silent stages* in language acquisition. Third, when using corpora that are only accessible in their written form we are confronted with the problem that transcription is already a considerable first step towards interpreting the data that might distort our understanding of how language acquisition proceeds.[7] Fourth, longitudinal case studies naturally focus on describing individual developmental sequences and are thus not representative. Many of the aspects that have been claimed to contribute to language development, *inter alia*, social status, language behavior of adults and peers, recording situation, and overall cognitive development, could only be controlled for with a wealth of case studies. Fifth, observational studies might lead to underestimating the children's actual grammatical competence, as comprehension of a certain grammatical structure may precede its production. Thus, spontaneous production data prove unsuited for investigating structures that are unlikely to be spontaneously produced by the child, as they will not occur in sufficient numbers in the sampling sessions. Finally, studies of spontaneous speech cannot shed light on the question of how the child actually interprets specific language structures, given that her reaction to them seems adult-like. Likewise, even if a child utters a target-like structure, we cannot safely exclude the possibility that she assigns in fact a non-target-interpretation to that structure.

Comprehension experiments, in contrast, belong to the high-constrained side of psycholinguistic research methods and are thus suited for the investigation of very fine-grained aspects of language acquisition. All techniques used in comprehension experiments such as act-out, forced picture selection, comprehension question, grammaticality judgment, and truth-value judgment aim at gaining insight into the grammatical competence of the child. They involve a number of interpretation steps not all of which are linguistic in nature (e.g., Lust et al., 1978; de Villiers & Roeper, 1996). The child is required to perceive the linguistic stimulus, i.e. a sentence or a story, to represent it in memory, and to interpret its meaning. In act-out and forced picture selection tasks, she then has to access the given props or

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[6] For example, the increasing number of *because*-clauses, noted in a recording by Tracy (p.c.), which resulted from the large number of *why*-questions asked by the adult conversation partner.

[7] But see Tracy (1991b) on strategies for a careful interpretation of language data that helps avoid these problems.

pictures in the given context and to reencode the interpretation of the linguistic stimulus in terms of the present material. Last, the language learner is required to physically represent this meaning by sequential activities with the dolls and props in space and time (act-out) or convert this analysis to a decision for a picture (forced picture selection). In comprehension question, grammaticality judgment, and truth-value judgment tasks, the child has to construct an interpretation of the test sentence, i.e. a yes/no question, a *wh*-question, or an assertion, and to judge the assertion or respond to the question. Common to all techniques is that the non-linguistic response reflects the child's grammatical knowledge only indirectly. Abstracting away from the differences between the specific comprehension techniques, the basic structure of a comprehension experiment is as follows (cf. also Crain, 1980). We start with the presentation of an utterance (U), which is assigned a certain meaning (M) by the child. The child's interpretation results in a specific reaction (R) that according to the type of experiment receives a certain code (C). Out of the entire reaction chain U → M → R → C, only the elements U → C are visible.

Comprehension experiments differ from observational studies in that specific independent variables such as linguistic and visual stimuli are varied in a systematic way to test the reaction of the subject in relation to those variables. Disruptive factors such as location of the experiment, sex of the subjects, or order of test items are controlled for by either keeping them constant or by systematically varying them across the test trials. Experiments are generally administered to a group of subjects and thus can result in statistically reliable statements. In addition, experimental studies can test the interpretation and production of structures that the child would otherwise hear only rarely or most likely would not produce spontaneously. What is more, even minimal differences in the child's interpretation can be discovered by controlling both the discourse situation and the variation of independent variables.

The method of comprehension experiments is restricted in at least three ways. First, it cannot be excluded that the knowledge tested in an experiment is only specific to that very study and the task employed therein and thus cannot easily be applied to the behavior in natural language situations (cf. also Maratsos, 1983). Second, an experiment is able to capture only a discrete moment in the language development of the learner. Though repetition of an experimental study is possible in principle, it still cannot record actual language development. Repeated implementation of an experiment may bias the outcome and, moreover, many of the factors triggering developmental progress would still remain unnoticed. Finally, comprehension experiments face the problem that a certain construction presented in the experiment might not be understood correctly, without this being reflected in the subject's response. The subject might show a certain response (e.g., choose a picture or puppet or give an affirmative answer) that is target-like, but is in fact not the result of an adult-like representation of the structure.

Concluding, longitudinal observations and experimental studies lend themselves to investigating different aspects of the child's language system. When assessing longitudinal studies on the emergence of complex clauses or experimental studies on the understanding of factive predicates the overall strengths and weaknesses of the method should be borne in mind.

5.4 Acquisition of Complex Clauses

Around their third birthday children learning English begin to produce complex sentences such as *I hope they have peanut butter for me* or *I wish that you stop talking.* As the language learner discovers the relation between complement-taking predicates and sentential complements, the concept of embedding becomes part of the child's grammar (cf. Hyams, 1986). And once the concept of embedding is available, sentences can in principle be embedded *ad infinitum.* That a three-year-old is capable of producing a sentence like *When Mommy gets home I'm gonna tell her I brushed my teeth* shows that multiple embedding is not beyond the capacity of young children. The discovery of embedding paves the way to recursion, one of the main features of natural languages (cf. Feldman, 1988). How does the acquisition of complex sentences proceed? That is, what are the first complement types to appear in children's spontaneous speech? When do children first produce factive sentences? Which p-factive matrix predicates do children use with which complement types? Hypotheses H1.1 to H1.4 imply the following developmental path. Children produce finite complement clauses before producing factive sentences. The complementizer *that* is often absent in children's speech. Factive sentences with finite complements occur before factive structures with nonfinite complement clauses. Response stance predicates occur rather late in acquisition. In this section I will contrast these hypotheses with findings from longitudinal case studies. Section 5.4.1 contains a review of previous research on the emergence of complex sentences. In Section 5.4.2 I discuss the results from my analysis of two corpora from the CHILDES database (MacWhinney & Snow, 1990). I will show that hypotheses H.1.1 to H.1.4 are borne out: Children produce finite complement clauses before producing factive sentences and that factive sentences with finite complements occur before factive structures with nonfinite complement clauses.

5.4.1 From Simple to Complex Sentences: An Overview

I will start with an overview of the acquisition of complex sentences and then review the complement-taking verbs and the types of complement clauses occurring early in children's speech. The acquisitional path from simple to complex sentences looks roughly as follows (cf. Brown, 1973; Limber, 1973; Bloom, Tackeff & Lahey, 1984; Radford, 1990; Tracy, 1995; Gawlitzek-Maiwald, 1997). After the phase of one-word utterances that starts sometime around their first birthday, between 18 and 24 months children begin producing their first multi-word utterances such as *read Mommy Daddy book* from which functional categories are absent. Shortly after, the first modal verbs such as *may, can, could,* auxiliary *be* and *do* occur. Moreover, the children start using contracted forms of *want, go, have to* (*wanna, gonna, hafta*) embedding a complement. Around their third birthday children produce the first 'real' complex sentences, appearing in object position.

How can this developmental sequence be characterized? Following Tracy (1995), we can distinguish three major milestones – framed in terms of conceptually distinguishable and successively constructed layers of phrase structure – that children pass on their way to language mastery. At milestone 1, reached between the ages of 1;6 and 2;0, children's utterances are restricted to the level of VP. They typically lack overt functional categories such

as tense and agreement features, determiners and the like. Milestone 2, characterized by the initial use of modal verbs, auxiliaries, and tense marking, is reached when the children are about two years old. At this milestone, the layer of IP is added to the children's phrase structure. Then, around age 3 children approach milestone 3, extending the levels of phrase structure to the layer of CP. As a diagnostics for the existence of a level of phrase structure above IP, Tracy (1995: 180) suggests the presence of lexical complementizers, contexts that allow an interpretation of the sentence as semantically subordinate, and occurrence of well-formed interrogatives with inversion and *do*-insertion.

Note that acquisitional models like the one sketched here claim that the structural layers VP, IP and CP emerge successively in the course of development. In other words, approaches in this spirit assume an initially reduced competence of the child or state the child's need for structure building (cf. also Radford, 1990; regarding event structure, see Schulz, Wymann & Penner, 2001). The so-called *full competence models*, on the other hand, claim that the child is endowed with all functional projections and the relevant properties of the language from the onset (e.g., Poeppel & Wexler, 1993; Wexler, 1994; Hyams, 1996). Only the particular sets of forms that are used to spell out certain properties are missing from the child grammar.[8] To date the question of whether the child has indeed access to all structural layers from the onset still awaits a satisfactory answer. For reasons of concreteness, in the remainder of the book the *structure building approach* will be assumed. Thus, the complementizer system essential for complex sentences is supposed to be acquired around age 3. I will not be concerned, however, with the question of how to precisely characterize children's syntactic representations of various finite and nonfinite complements at different ages.[9]

Let us now take a closer look at the complement-taking verbs and the types of complement clauses used by young children. Based on the longitudinal analysis of the spontaneous speech of three two-year-old children, Limber (1973) found that of the over 200 complement-taking verbs in English, only a subset of 27 appears in the spontaneous speech of these children. Note that auxiliaries including *going to* and *have to* were excluded from analysis as were some modal verbs. Table 5.1 below lists the complement-taking verbs used by the three children ordered by occurrence in the first or second half of the third year of life.

In the first half of the third year of life, volitive verbs such as *want, need, like* and probably *ask/tell* are most frequent, followed by perception verbs (*watch, see,* maybe *lookit*). After the age of 2;5 more diverse verb types occur. Besides volitive *hope, wish*, and perhaps *told*, propositional verbs such as *think, guess,* and *said* enter the children's vocabulary. Moreover, *remember* and *forget* occur in the children's speech. These can be analyzed as either implicative (positive-implicative in case of *remember*, and negative-implicative in case of *forget*) or factive.

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[8] A much discussed example is the optional infinitive hypothesis referring to a stage in which inflected and non-inflected matrix verbs co-occur in children's speech (Wexler, 1994). It is assumed that the child knows the grammar of inflection as well as the inflectional and complementizer system but not the adult forms of inflections.

[9] For an analysis of complex sentences in general, see Fritzenschaft et al. (1990), Gawlitzek et al. (1992), Penner & Müller (1992), Gretsch (1993), Tracy (1995), and Penner (1996). For an analysis of nonfinite structures, see Gawlitzek-Maiwald (1997).

Table 5.1 Complement-taking verbs used by two-year-olds

Age 1;11 – 2;5	Age 2;5 – 3;0
want	*think*
need	*told*
like	*guess*
watch	*know*
see	*hope*
lookit	*show*
let	*remember*
ask (tell)	*finish*
*say**	*wonder*
*go**	*wish*
make	*help*
	said
	pretend
	decided
	forgot

* used to express direct speech as in *Cows say "moo"*.

Limber's findings have been confirmed in a number of other studies, most notably by Bloom and colleagues (cf. Bloom, Lahey, Hood, Lifter & Fiess, 1980; Bloom, Tackeff & Lahey, 1984; Bloom, Rispoli, Gartner & Hafitz, 1989), who evaluated spontaneous production data from children aged 2;0 to 3;2. Other studies report that, in addition to the verbs cited above, the matrix verbs *love, mean, miss, try*, and *understand* are produced during the third year as well (Brown, 1973; Bretherton & Beeghly, 1982). In all studies, *want* appears as the first complement-taking verb (cf. also Olson & Astington, 1986; Gawlitzek-Maiwald, 1997; Naigles & Hoff-Ginsburg, 1998). Taken together, these studies indicate that p-factive matrix predicates occur later than nonfactive matrix predicates. This finding is also supported by frequency analyses of children's spontaneous speech (cf. Hart, Walker & Gray, 1977). The most commonly used complement-taking verbs belong to the class of nonfactives (*want, see, say, think, tell, watch, help, try, ask*). Among the p-factive verbs, only semi-factive *know* occurred frequently.

Which types of complement clauses occur with which complement-taking verbs and in which order? Limber (1973) and Bloom et al. (1980, 1984, 1989) report the production of *wh-*, *to-* and *that*-complements, but neither of *ing-* nor of *for to*-complements. That gerundial complements appear rather late in children's speech has also been found by de Villiers & de Villiers (1985). Likewise, Gawlitzek-Maiwald (1997) reports absence of *for to-* and gerundial complements in three bilingual children between the ages of 2;0 and 5;5.[10] Is there a fixed order of acquisition for *wh-*, *to*, and *that*-complements? According to Limber and Bloom at al. (1984, 1989), infinitives – embedded by verbs such as *want* and *watch* – are the first type of complement clause, followed by *wh*-complements as in *I show you how*

[10] Save for rare exceptions such as *This bear likes - eating chokey yogurts* (H: 2;8).

to do it. Think is reported to be the first matrix predicate taking finite complement clauses. In the second half of the third year *think* is followed by a variety of verbs also taking propositional objects, with the complementizer *that* generally being omitted until close to age 3.

In her study of the acquisition of infinitival complements, Gawlitzek-Maiwald (1997) reconsiders the order of nonfinite before finite complements. The first *to*-infinitives typically embedded by *want, have,* and *going* are argued to function as precursors rather than real infinitival complements, paving the way to mastering the IP layer in English main clauses. Thus, infinitival complements are in fact acquired later than finite complements and take quite some time to emerge in children's speech.[11] One of the children studied, Hannah, used first precursor infinitives embedded by *want* (2;3), *have* (2;9) and *going* (2;9), before at 3;0 producing *want* with a lexical subject (*I want you coming with me*). A month later *think* occurred with a finite complement clause (*I think it - is a figure*). Between the ages of 2 and 5, only control infinitives were used productively by the three children studied, while raising structures were produced only rarely.

This analysis is also appealing from the perspective of Universal Grammar, since it disposes of the difference found between the acquisition of complex sentences in English and German (cf. Schulz, 1995). In German, it has generally been assumed that acquisition of finite complements takes place before acquisition of nonfinite complements. *Sagen* (say) and *wissen* (know) are among the first matrix verbs to occur with finite complement clauses. These are followed by *lassen*, (let) *probieren* (try, test), and *versuchen* (try), which are the first matrix verbs to occur with infinitival complements (cf. Fritzenschaft et al., 1990).

Does the acquisition of the syntax of complementation proceed on a verb-by-verb basis? Or does the child learn the general rules for a certain type of complement clause? In the latter case we would expect that once the language learner produces a certain complement type, it will appear with a range of different matrix predicates. From an analysis of the spontaneous speech of four children between the ages of 1;7 to 3;0 Bloom et al. (1989) conclude that acquisition of the syntax of complementation is lexically specific:

> Rather than learning a general rule for complementation *per se*, or even separate rules for *wh*-complements, *S*-complements, *to*-complements, *if*-complements and so forth, the children's grammatical knowledge was specific to the matrix verbs. The matrix verbs determined whether a complementizer occurred, and if a complementizer occurred, which one. (Bloom et al., 1989: 119)

Note that this assumption implies a close connection between matrix predicate and complement clause. This is in agreement with the view underlying the definition of semantic-syntactic factivity that both a specific matrix predicate and a specific type of complement clause contribute to the factivity of the entire sentence.

Let us now consider the hypotheses H1.1 to H1.4. All longitudinal studies reviewed above focused on the acquisition of syntactic structures rather than on the acquisition of the semantics or the semantics-syntax interface of complex sentences. As a result, these studies do not speak to the question of at what age the child acquires factivity (cf. H1.2 and H1.3. Limber (1973) finds that children usually omit the complementizer *that*, thus confirming

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[11] Note that under both accounts, the acquisition of a certain type of complement clause is conflated with the acquisition of the requisite morphology. Alternatively, one could argue that a certain morphology rather than the complement type itself is acquired later or earlier than another (Reis, p.c.).

H1.1.[12] This assumption also agrees with the hypothesis that the complementizer *that* is not acquired until the subordination position is fixed (cf. Roeper, 1991). H1.4 is confirmed only indirectly, as no response stance predicates are reported to occur in children's speech up to age 5.

Summarizing, children begin to produce complex sentences in their third year of life. *Want, watch, show, see, think,* and *know* are among the first matrix predicates. The range of complement types produced by children at this age comprises *wh-* and *to*-complements as well as *that*-complements (without the overt complementizer), but neither gerundial nor overt *for to*-complements. Based on these findings, the investigation into the acquisition of factive sentences will focus on the following complement types: *that*-complements with and without the overt complementizer and *to*-complements. A careful analysis of the various types of *wh*-complements is beyond the scope of this book. However, finite *why*-complements are taken into account, since they trigger a factive reading when embedded by p-factive matrix predicates (cf. Section 2.3). In the next section, I will present my analysis of two corpora from the CHILDES database, focusing on the production of factive and nonfactive sentences.

5.4.2 The Emergence of Factive Sentences: Two Case Studies

Analyzing data from two longitudinal corpora, in this section I will test the hypotheses H1.1 to H1.4 and show that they are confirmed. As predicted, children produce finite complement clauses before producing factive sentences and factive sentences with finite complements before factive structures with nonfinite complement clauses. Response stance verbs are not found before age 5, as expected. In addition, my analysis corroborates the finding from previous studies that the complementizer *that* is often absent from children's speech, more specifically from factive finite complement clauses.

My analysis is based on natural data from two longitudinal corpora from the CHILDES database (cf. MacWhinney & Snow, 1990). I selected the corpora from Adam and Abe as these corpora are the most comprehensive. The Adam-corpus (cf. Kuczaj, 1976) comprises Adam's spontaneous language production between the ages of 2;3 and 4;10 and consists of 55 recordings with each session lasting about 60 minutes. The Abe-corpus (Brown, 1973) encompasses Abe's spontaneous language production between the ages of 2;5 and 5;00 and consists of 210 recordings, with each session lasting between 30 and 60 minutes.

In a first step, I examined the occurrence of the response stance predicates *accept, deny, confirm, agree,* and *doubt.* As predicted, response stance verbs do not occur at all in Adam's

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[12] Omission of the complementizer has also been reported in sentence repetition tasks (cf. Phinney, 1981a). Additional evidence for children's initial insensitivity to the complementizer comes from tasks in which children do not take into account the position of *that* when interpreting a sentence. Roeper & de Villiers (1994) found that four- and five-year-olds regarded sentences such as (i) and (ii) below as equivalent:

(i) Sally said that in the spring they would plant pumpkins.

(ii) Sally said in the spring that they would plant pumpkins.

However, note that the same interpretation pattern arises if children violated the barrier to movement of the prepositional phrase *in the spring* while being sensitive to the presence of the complementizer.

and Abe's speech and are thus neglected in the discussion. Then I analyzed all utterances containing the matrix predicates *try, want, think, tell, forget, recall, regret, confess, resent, say, remember, hope, wish, be surprised,* and *be pleased.* The selection of predicates was based on three criteria. First, predicates differed as to whether they only subcategorize nonfinite (*try, want*) or finite complements (*think*) or whether they select finite and nonfinite complement clauses (*tell, forget, recall, regret, confess, resent, say, remember, hope, wish, be surprised, be pleased*). Furthermore, the predicate-complement structures were chosen so as to clearly represent the semantic verb classes p-factive (*forget that, remember that, recall, regret, confess, resent, be surprised, be pleased*), negative-implicative (*forget to*), positive-implicative (*remember to*), and indeterminate, i.e. propositional (*think, tell that, say that*) and volitive (*tell to, say to, hope, wish*), respectively. Finally, all the predicates were selected either because they have been reported in previous studies to be acquired in the third and fourth year of life or because they are pertinent to the acquisition hypotheses. None of the predicates listed above occurred with gerundial complements; therefore the analysis of nonfinite complements is confined to *to*-complements. Furthermore, the analysis of finite complements is restricted to *that*-complements with and without the overt complementizer; finite *why*-complements are attested neither in Adam's nor Abe's speech. Finally, some of the matrix predicates do not occur at all in the recordings and are thus neglected in the further analysis. The p-factive matrix predicates *resent, recall, confess*, and *resent,* and the adjectival matrix predicate *be pleased* are not produced by Adam and Abe until the end of the recordings.

Tabelle 5.2 illustrates the occurrence of the different matrix predicates with the various complement types at the time at which they first appear in Adam's speech. For the purposes of the current work, I focus on first occurrences while disregarding the intricate question of how to define mastery, i.e. productivity of a certain form (for a discussion, cf. Naigles & Hoff-Ginsburg, 1998). Owing to missing information on intonation contour, I used the following diagnostics for coding a complement clause as being embedded: a) the clause is transcribed as being part of a complex sentence, b) the context allows an interpretation of the sentence as semantically subordinate, and optionally c) a lexical complementizer is present (cf. Tracy, 1995). Note that the complementizer *that* is not required in most cases. Therefore the decision whether a second clause following the main clause is indeed a complement clause is generally difficult.[13]

In what follows I will sketch the acquisitional sequence that can be derived from the data in Table 5.2. Note that in the examples adult utterances are supplied only where necessary for the interpretation of the child's utterance. Adam's first sentential complements are precursors of *to*-infinitives, followed by the first finite complements embedded by *think*, thus confirming the findings from previous studies (Limber, 1973; Gawlitzek-Maiwald, 1997). The first precursors of sentential complements produced by Adam are embedded by *want.*

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[13] For an alternative analysis, cf. Diessel & Tomasello (2001). Based on a study of seven children from the CHILDES database, among them Adam and Abe, it is claimed that in most of the children's complex sentences the main clause does not express a full proposition but functions merely as an epistemic marker, attention getter, or marker of illocutionary force. Consequently, the complement clause is not regarded as truly embedded. Note, however, that form and function of a complement clause may differ depending on the definition of what constitutes embedding.

Table 5.2 Matrix predicates and their complement types with time of first occurrence in the Adam corpus

Matrix predicates	***try***	***want***	***think***	***tell***	***forget***	***say***	***remember***	***hope***	***wish***	***be surprised***
V	n.a.	*	*	*	n.a.	*	3;7	n.a.	*	n.a.
Nominal complements:										
V [YP]	2;8	2;3	2;9	2;4	3;3	2;5	3;7	3;6	n.a.	n.a.
To-complements:										
V [NF]	*2;9	*2;6	*	*	*	*	*	*	*	*
V [*to* NF]	3;3	2;6	*4;9	*	3;6	n.a.	n.a.	n.a.	n.a.	4;10
V NP [NF]	*	*2;9	*	*	*	*	*	*	*	*
V NP [*to* NF]	*	3;3	*	3;4	*		*	*	*	*
That-complements:										
V [CP]	*	*	2;11	*	4;1	3;4	4;1	3;7	3;6	n.a.
V NP [CP]	*	*	*	3;8	*	n.a.	*	*	*	*
V [*that* C']	*	*	4;3	*	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
V NP [*that* C']	*	*	*	4;2	*	n.a.	*	*	*	*

* = ungrammatical structure; n.a. = not attested; V = verb; YP = nominal or prepositional phrase; NF = nonfinite IP or CP; NP = nominal phrase; CP = finite sentential complement; C' = finite complement clause without complementizer

(1) A: want to.[14] (2;5)

(2) A: want to ride that. (2;6)

Due to possible contraction effects these utterances cannot be taken as evidence of having acquired the structure of *to*-infinitives. At the age of 3;3 Adam produces the first *want+NP+to* structures (3), which jointly with the first occurrence of *try* embedding an infinitival clause (4) indicate that Adam has acquired part of the nonfinite sentential complementation.

(3) A: you want Mommy to have one. (3;3)

(4) A: I trying to get out a pencil. (3;3)

The first finite complement occurs with *think* at 2;11 (6), 6 weeks after its first use with an NP complement (5), and 4 months before the first analyzed nonfinite complements appear. Note, however, that the first occurrences of *think* with a sentential complement have to be treated with caution as they may be instances of parenthesis rather than of subordination.

(5) A: what me think? (2;9)

(6) M: oh, think a minute. (2;11)
A: I don't think [/] think.
A: I think [#] dat go on. (attaches train to tractor)[15]

The p-factive matrix verbs *forget* and *remember* appear with an NP complement first at age 3;3, as illustrated in (7) for *forget*.

(7) A: yeah [#] a school. Mommy tried to cut out the teacher (cut out) [#] Mommy forgot de t(eacher). (3;3)
U: Mommy forgot what?
M: Mommy forgot to cut out who?

Adam's use of *forget* is compatible with a negative-implicative interpretation of the verb, expressing a failed intention on the mother's part (*Mommy forgot to cut out the teacher*).

During the third year of life finite and nonfinite complements embedded by a variety of matrix verbs appear. *Say* (8), *wish* (11), and *hope* (12) are used with finite complements; *tell* with nonfinite (9) and finite (13) complements, and *forget* with nonfinite complements (10).

(8) U: have you been to the doctor? (3;4)
A: yeah.
U: what did he say?
A: say [#] he examine me.

(9) A: Don't tell him to walk on step. (3;4)

(10) A: I forgot to make a sailboat. (3;6)

(11) A: I wish I could play with this. (3;6)

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[14] A stands for Adam, M for mother, and U for Ursula, another adult interlocutor. Due to the Standard English notation of the examples, contracted and uncontracted forms are not distinguished.

[15] [#] indicates incomprehensible elements in the recording.

(12) A: You hope he [#] hit. (3;7)

(13) A: I told you it's will sail all by itself. (3;8)

Note that at the time at which Adam exclusively produces *tell* and *forget* with nonfinite complements, he uses other matrix verbs exclusively with finite complements (*say*: 3;4, *wish*: 3;6, *hope*: 3;7). Furthermore, *remember, say, wish,* and *hope* do not appear at all with nonfinite complements until the end of the recordings at the age of 4;10. The first finite factive complements are produced at age 4, exemplified in (14) and (15).

(14) A wants to get some of his money back that he gave M as a grocer.
A: I forgot I gave you some dollars. (4;0)
A: gi(ve) my dose dollars. [...]
M: it's alright.

(15) A: You remember I broke my window. (4;1)
M: how did you break your window?
M: what window?
A: my window to my fire [//] [#] to my big fire truck.

Both the context for *forget* and for *remember* are compatible with a factive interpretation. In (14), Adam and his mother play a grocer game, and he wants his mother to give him some of the money he had given her before, claiming that he forgot that he had given her money already. Adam's command *Give my dose dollars* makes clear that the preceding utterance cannot have a negative-implicative reading like *I forgot to give you some dollars.* In (15), the mother's question *how did you break your window* indicates that she interprets Adam's statement as factive. The first and only factive *to*-complement occurs at the age of 4;10, embedded by the adjectival predicate *be surprised* (16). Adam plays with a pistol and comments on the surprised look of his brother Paul.

(16) M: what're you doing that for? (4;10)
M: are you his admirer? (talking to Paul)
A: he's surprised to see his brother shooting.
A: I knocked it down.
A: I almost got it.

Summarizing the acquisitional sequence of factive sentences, we find a stepwise acquisition of factivity, as predicted by the semantic-syntactic definition of factivity. Adam produces p-factive matrix predicates with nominal complements at age 3;3 and p-factive matrix predicates embedding nonfinite complements at age 3;6. Nonfactive finite complement clauses occur first around age 3;4, whereas factive finite complement clauses only appear at age 4, thus confirming H1.2. Furthermore, the factive complements analyzed here lack an overt complementizer *that*, corroborating hypothesis H1.1. The only factive nonfinite complement attested is a *to*-infinitive embedded by the emotive adjectival predicate *be surprised.* The adjectival matrix predicate *be pleased* and p-factive matrix predicates embedding gerundial complements (*resent, recall, confess,* and *regret*) are not produced by Adam until the end of the recordings. The factive *to*-complement does not occur before 4;10, thus pointing to a delayed acquisition of this factive structure, in concordance with H1.3. As the matrix predicate *be surprised* is not used with any other complement, it remains unclear

whether this delay is due to the type of complement clause or to the matrix predicate itself. With respect to response stance complements, it was found that response stance verbs do not occur at all in Adam's speech, as implied by H1.4.

Let us now turn to the data from Abe, whose acquisition patterns look very similar to Adam's. Table 5.3 below illustrates the occurrence of the different matrix predicates with the various complement types at the time at which they first appear in Abe's speech.

As can be inferred from Table 5.3, Abe uses the p-factive verbs *forget* and *remember* with an NP complement rather early. (17) shows the first occurrence of *forget*+NP.

(17) Ab: Don't forget mine home.[16] (2;4)

In (17) Abe wants the father to bring his toy home. *Forget* refers to a failure of performance rather than to an intention that is being forgotten. Abe's first complement clauses are precursors of *to*-infinitives, embedded by *want* ((18) and (19)), followed shortly after by the first finite complement clauses embedded by *say* ((20) and (21)), *hope* (22), and *think* (23).

(18) Ab: uhuhuh alligator wan(t) (t)a ride in boat. (2;5)

(19) Ab: I want my Dad come with me. (2;5)

(20) M: yeah, we'll make popcorn. (2;7)
Ab: My mommy said that we make popcorn at the [#] we go at the movies.

(21) Ab: because I'm gon (t)a said I don't want him. (2;7)

(22) Ab: I hope they have peanut butter for me. (2;7)

(23) Ab: I think everything gots@ some present for you.[17] (2;8)

Similarly to the acquisition pattern found for Adam, Abe produces the first ECM-infinitives later than the first finite complements. At age 2;8 *try* is used with an infinitive without overt *to* (24); *remember* and *try* are produced two months later embedding a *to*-infinitive with overt *to*, indicating the first real *to*-infinitival complements, illustrated in (25) and (26).

(24) Ab: why the truck driver try kill that man? (2;8)

(25) Ab: we have ta remember something to do I know what I remember something to do. (2;10)

(26) Ab: I'm trying to cover this up what you doing [#] Mommy? (2;10)

Starting at 2;10, Adam uses a variety of matrix verbs with finite and nonfinite complements. *Wish* is used with finite complements ((27) and (28)), and *tell* with finite (29) and nonfinite (30) complements, just as *say* (cf. (21) and (32)). Adam produces *forget* embedding a nonfinite complement first at age 3;2 (31).

(27) Ab: I wish that you stop talking. (2;11)

(28) Ab: I wish I do that. (2;11)

(29) Ab: when Mommy gets home [#] I'm gon (t)a tell her I brushed my teeth. (3;2)

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[16] Ab stands for Abe, M for his mother, and F for his father.

[17] @ marks clearly ungrammatical forms.

Table 5.3 Matrix predicates and their complement types with time of first occurrence in the Abe corpus

Matrix predicates	***try***	***want***	***think***	***tell***	***forget***	***say***	***remember***	***hope***	***wish***	***be surprised***
V	n.a.	*	*	*	n.a.	*	n.a.	2;10	*	4;1
Nominal complements:										
V [YP]	2;6	2;5	2;8	2;6	2;4	2;5	2;11	n.a.	n.a.	n.a.
to-complements:										
V [NF]	*2;8	*	*	*	*	*	*	*	*	*
V [*to* NF]	2;10	2;5	*	*	3;2	3;3	n.a.	n.a.	n.a.	n.a.
V NP [NF]	*	*2;5	*	*	*	*	*	*	*	*
V NP [*to* NF]	*	2;8	*	3;2	*	n.a.	* 2;10	*	*	*
that-complements:										
V [CP]	*	*	2;8	*	3;9	2;7	4;4	2;7	2;11	n.a.
V NP [CP]	*	*	*	3;2	*	3;8	*	*	*	*
V [*that* C']	*	*	4;1	*	3;9	2;7	n.a.	4;5	2;11	n.a.
V NP [*that* C']	*	*	*	n.a.	*	4;6	*	*	*	*

* = ungrammatical structure; n.a. = not attested; V = verb; YP = nominal or prepositional phrase; NF = nonfinite IP or CP; NP = nominal phrase; CP = finite sentential complement; C' = finite complement clause without complementizer

(30) Ab: when you tell me to knock it down [#] I could knock it down? (3;2)

(31) Ab: hey you forgot to put your name. (3;2)

(32) Ab: see he bites heads he's a mean alligator I'm gon (t)a get him with this hook fishersay@ says to get mean alligators with this hook. (3;3)

Note that at the same time at which Abe produces *forget* exclusively with *to*-complements, he uses certain matrix verbs including *wish* and *hope* only with finite complements, and other matrix verbs such as *tell* and *say* with both finite and nonfinite complements. The first finite factive complements embedded by *forget* are produced at age 3;9 (cf. (33) and (34)). These are followed by factive complements embedded by *remember* (35).

(33) Ab: I ate all my cereal. (3;9)
F: Did you drink your orange juice?
Ab: I forgot that [#] I didn't.

(34) Ab: uhhuh let em see if this is good too bad it's glass I forgot it's glass. (3;9)

(35) Ab: no I remember he never hurts himself except if he falls really hard Chop-wood is a good motorcycle driver. (4;4)

Due to the context, all examples above can be judged factive. In (33), Abe states that he didn't drink his orange juice. Note that *I forgot to* would have been a possible response as well. In (34) Abe first states *it's glass* before continuing with the sentence presupposing that it's glass. (35) comments on the fact that Chop-wood is a good driver who never hurts himself.

The examples in (36) and (37) show that finite complements with overt *that* continue to occur with nonfactive matrix predicates such as *think* (36) and *hope* (37).

(36) Ab: Do you think that they would know that it says their name. (4;1)

(37) Ab: yeah I sure hope that it's not a storm [#] Daddy [#] these kind of guns and my other guns used to be real guns. (4;5)

In sum, we find the same stepwise acquisition of factivity as seen in Adam. Abe starts producing p-factive matrix verbs with nominal complements at 2;4 and p-factive verbs embedding nonfinite complements at age 2;10. Nonfactive finite complement clauses occur first around age 2;7. Factive finite complement clauses, however, only appear at age 4, thus providing further evidence for H1.2. Abe produces factive complement clauses embedded by *forget* with and without overt *that* at age 3;9. This confirms that the complementizer *that* does not play a leading role in acquiring factivity (cf. H1.1). The adjectival matrix predicate *be pleased* and p-factive matrix predicates embedding gerundial complements (*resent, recall, confess*, and *regret*) are not produced by Abe until the end of the recordings. *Be surprised* occurs only in a main clause. These findings suggest a delayed acquisition of nonfinite factive complements, as predicted by H1.3. With respect to response stance complements, it was found that response stance verbs do not occur at all in Abe's speech as predicted (cf. H1.4).

Comparing the data from Adam and Abe it becomes even more evident that the acquisition of factive structures proceeds in a stepwise fashion. Table 5.4 below gives an overview of the ages at which Adam and Abe first produce the relevant types of matrix predicates and sentential complements.

Table 5.4 Acquisition of factive sentences by Adam and Abe

	Adam (Brown, 1973)	**Abe** (Kuczaj, 1976)
Age range	2;03 – 4;10	2;05 – 5;00
P-factive verb	3;03 *forget*+NP 3;07 *remember*+NP	2;04 *forget*+NP 2;11 *remember*+NP
Nonfactive verb with *that*-complement	2;11 *I think that go on* 3;04 *Say he examine me*	2;07 *My mommy said that we make pop corn*
P-factive Verb with *to*-infinitive	3;6 *I forgot to make a sailboat*	2;10 *We have to remember something to do* 3;2 *you forgot to put your name*
Factive complement	4;01 *I forgot I gave you some dollars* 4;01 *You remember I broke my window*	3;09 *I forgot that [#] I didn't* 4;04 *I remember he never hurts himself*

Table 5.4 shows that both Adam and Abe start producing factive complements around age 4. Judging from the occurrence of the first p-factive matrix predicates and the first finite complement clauses embedded by nonfactives, the occurrence of the first factive structures is delayed. Adam starts using factive complements between 6 months (for *remember*) and 10 months later (for *forget*) than finite nonfactive complements. The delay is even more visible in Abe. Abe's first factive complements appear between 14 months (for *forget*) and 21 months later (for *remember*) than the first finite complements. Put differently, the acquisition of factivity comprises more than just combining p-factive matrix predicates and – in the default case – finite complement clauses. In order to master factivity, the child has to discover the special relationship holding between p-factive matrix predicates and finite complement clauses. Based on the two case studies we can conclude that at age 4 this becomes possible.

In conclusion, I analyzed the first occurrences of a range of factive and nonfactive matrix predicates taking finite, nonfinite, and nominal complements in the spontaneous speech of two children from the CHLDES database. My case studies of Adam and Abe revealed that production of finite nonfactive complements precedes the production of finite factive complements, as implied by H1.2. The complementizer *that* was found to be often absent, thus confirming H1.1. Factive infinitival complements occur not all before 5 (Abe) or only

late in the fifth year of life in an isolated instance (Adam), lending support to H1.3. As predicted by H1.4, response stance verbs are not attested before age 5. It has to be left for further research to determine at what age factive infinitives become productive in children's speech and when children start producing response stance matrix verbs and complements. With regard to production, the stepwise acquisition pattern predicted by H0 and H1.2 can now be formulated more precisely as follows:

(38) Factivity Acquisition Hypothesis$_{Prod}$ (FAH$_{Prod}$)
Complement clauses that are subcategorized by a p-factive matrix predicate are produced later than complement clauses (nonfinite or finite) subcategorized by nonfactive matrix predicates.

From the two case studies we inferred that Adam and Abe produce their first factive sentences at age 4. Results from a cloze task experiment (de Villiers & Pérez-Leroux, 1992) suggest that factive complement clauses occur in children's production at about age 5.[18] Two questions arise from this finding. First, is the age at which the first factive complements occur subject to large inter-individual variation, or are the first factives in the children's speech brought about by other developmental achievements and therefore expected to occur at about the same age? Second, what is the child's internal representation of factive – and nonfactive – sentences? Note that (38) is a statement about production. No claim is being made regarding the child's representation and interpretation of these structures. While the analysis of the context of the sentences analyzed above is compatible with a factive reading, due to the limitations inherent to observational data we cannot infer the child's actual internal representation of these sentences. Addressing question one, in Section 5.5 I will discuss the theory of mind development and argue that emergence of a theory of mind is a prerequisite for acquiring factivity. Section 5.6 summarizes previous research into the comprehension of factive and nonfactive verbs.

5.5 Cognitive Aspects of Mastering Factivity: Theory of Mind

The notion *theory of mind* refers to one's knowledge that while there is a single reality different people may have different representations of that reality (cf. Johnson, 1982; Olson & Astington, 1986; Moore & Frye, 1991).[19] Theory of mind allows us to attribute mental states including thoughts, beliefs, opinions, and desires, which do not have to agree with

[18] de Villiers & Pérez-Leroux (1992) report that three- and four-year-olds, when prompted with matrix verbs that subcategorize both finite and nonfinite complements, produced significantly more *to*- than *that*-complements, even if – due to the context – only use of the finite complement was acceptable. For example, following a story in which Big Bird forgets that he made a cake, the children were prompted with the beginning *Big Bird forgot ...* that could be continued by *that he made a cake*, but not by *to make a cake*. However, the five-year-old children still responded only in 50 % of the cases with the obligatory *that*-complement, suggesting that the experimental set up may have added to the complexity of the child's task.

[19] The term *theory of mind* was coined by Premack & Woodruff (1978), who examined to what extent chimpanzees exhibit an understanding of mental states in other persons.

our mental states or with the reality, to other people. The distinction between the state of affairs in the actual world and the different representations of that world is crucial for the child's understanding of the difference between facts and opinions. While facts are objective and not open to argument, opinions are subjective and may differ between people (Moore & Frye, 1991). In this section I will argue that theory of mind is a necessary, but not sufficient prerequisite for the acquisition of factivity. It is a necessary precondition, as without the distinction between facts in the actual world and different mental representations of this world the child cannot arrive at an adult-like representation of factive sentences. Theory of mind is not sufficient, though, for mastering factivity, since the acquisition of specifically linguistic facets of factivity including its representation at the level of LF and its repercussions on syntax does not directly result from the ability to attribute mental states to other people. Adam and Abe produce their first factive sentences at about age 4. According to the hypothesis advanced here, the development of a theory of mind is predicted to take place around the same age. This prediction is borne out by a number of studies that all find this ability to develop between the ages of 3;6 and 4. In Section 5.5.1 I briefly review the development of the theory of mind together with the standard procedures used to assess children's theory of mind reasoning. Two accounts of the nature of the relation between language and theory of mind development are discussed in Section 5.5.2. I will show that a version of linguistic determinism, proposed by de Villiers & de Villiers (2000) is best able to account for the data from longitudinal and experimental studies.

5.5.1 Development of the Theory of Mind

Theory of mind involves the ability to represent the difference between mental states and real events. As a result, it becomes possible to distinguish between appearance and reality, to discuss the contents of other minds, and to make behavioral predictions on that basis (cf. also Pérez-Leroux, 2001). A mental state results from the propositional attitude expressed by the matrix verb in connection with the propositional content of the complement clause (Olson & Astington, 1986). Accordingly, mental verbs are verbs that refer to thoughts, beliefs, opinions, and desires, such as *think, believe, want, know,* and *remember*. Note that the class of mental verbs comprises nonfactive propositional and volitive verbs including *think, want, wish,* and *hope* as well as factive verbs such as *know* and *remember*.

How does the theory of mind develop? It is well-known that children can distinguish between true and false statements at a very young age. Two-year-olds, for example, have no difficulty negating statements such as *This is a fish* when being shown a car (Leslie, 1987). At the same time, two-year-olds entertain themselves in pretend play, thereby distinguishing the immediate reality from some mental reality. Furthermore, young children understand that people's actions are driven by needs, desires, beliefs etc. and are thus able to draw conclusions based on the actions of another person (Feldman, 1988; Perner & Ogden, 1988). Still, it is not until the age of about 4 that children develop a mature theory of mind that enables them to attribute different mental states to different people and to represent these mental states accordingly.

Theory of mind reasoning is assessed using a variety of *false belief* tasks that all involve the beliefs of several characters only one of which has the requisite knowledge to know the actual state of affairs. The tasks used most frequently are the *unexpected content* task, the

unseen displacement task, and the *explaining action* task. In the unexpected content task (cf. Perner, Leekam & Wimmer, 1987), a familiar container, e.g. a CRAYOLA crayon box, is shown to the child. The child is then asked about the content of the container. After replying with the expected answer *crayons* the child opens the box and discovers the unexpected content – a plastic fork. The experimenter then closes the box again and asks the child *Before you opened it, what did you think was in the box?* In addition, the child is asked *If I show x the box, what will she think is in the box?* Children younger than age 4 respond to both questions with *plastic fork*, while older children correctly respond that they and her friend x thought that there were crayons in the box. Note that the design of this task is problematic, since the language used in the verbal prompt obscures linguistic and cognitive contributions to the task. By using mental verbs as well as complement structures in the test questions, a child's failure in a false belief task could be attributed to her lack of a mature theory of mind as well as to her non-adult interpretation of mental verbs embedding complement clauses.

The unseen displacement task assesses mental processes independently of the interpretation of mental verbs, thus allowing for separating the contributions of language and cognition to theory of mind (cf. Johnson & Wellman, 1980; Wimmer & Perner, 1983). A play character X hides an object, for example a cake, at place A and then leaves the room, while a second character changes the location of the cake to another place B. The child watches this scenario and is afterwards asked where the first character who hid the object will look for it when he comes back. The test prompt *Where will X look for the cake?* does not contain a mental verb and hence does not require the child to interpret a complex linguistic stimulus. Only after the age of 4 children named the place A where the object was initially hidden. Three-year-olds, in contrast, were unable to separate their knowledge from the not-knowing of the first character X and named the actual place B as the place for the character to look. Note that this result does not stand in contradiction to the observation that children as young as 2 entertain in pretend-plays, since these simply comprise representing something that differs from reality without reflecting on it.

Like the unseen displacement task, the explaining action task (cf. Bartsch, K. & Wellman, 1989) employs simple test questions rather than complex sentences involving mental verbs. While a puppet is asleep the contents from a familiar container – say eggs from an egg carton – are moved to an unmarked box. The puppet is then woken up and is made to manipulate the (empty) egg carton, because he wants to eat eggs. The child is asked *Why is he looking in here? Why isn't he looking in that other box?* If a child responds with a plausible explanation such as 'because they were in there' she is attributed an understanding of false beliefs. In the next section I will turn to the question of how theory of mind development is related to the child's linguistic development.

5.5.2 The Role of Language in Theory of Mind Development

This section presents two accounts of the nature of the relation between language and theory of mind development. It will be shown that a version of *linguistic determinism*, proposed by de Villiers & de Villiers (2000) is best able to account for the data from longitudinal and experimental studies. Developing this account of linguistic determinism further, I will argue that theory of mind is a necessary, but not sufficient prerequisite for the acquisition of factivity.

The time at which children master standard false tasks has been found to coincide with the use of complex linguistic expressions involving mental verbs and complement clauses (cf. Bartsch, K. & Wellmann, 1989; de Villiers, 1995a). More specifically, studies on the usage of mental verbs in spontaneous speech indicate that while mental verbs may already occur in the language of three-year-olds, they are used to actually express a reference to a mental state not before age 4 (cf. Bretherton & Beeghly 1982; Shatz, Wellman & Silber 1983; Furrow, Moore, Davidge & Chiasson, 1992). Between the ages of 2;6 and 3 mental verbs are used mostly to direct the interaction (e.g., *I thought we'd eat some cake*).[20] Around the age of 2;6 the first attempts are recorded to use mental verbs in a mental function, i.e. referring to a person's thought, memory, or knowledge. It is not until the end of the fourth year of age, however, that verbs are used to express a reference to a mental state. Shatz et al. hypothesize that relativization of statements by *think* as in *I think it's raining* could pave the way for the transition from assertions to propositional attitudes as in *I think he's an idiot*. One of the examined children, Abe, used *think* first at the age of 2;8 to express the certainty of his statement (cf. example (23) in Section 5.4.2). *Forget* and *remember*, conversely, first used in a mental function at 3;2 and 2;10, respectively, are reported to not appear at all before the end of the investigation at 4;0 in the function to modify an assertion. Even though the criteria for the above classification may be vague and some of the utterances may actually count as modifying an assertion (cf. Abe's use of *forget* at the age of 3;9 in example (34) in Section 5.4.2), the general picture that emerges still seems valid: The first occurrence of mental verbs is not to be equated with the adult-like uses of these verbs. Moreover, an analysis of the linguistic structures used in connection with mental verbs showed that many of the complex sentences embedding a *that-*, *wh-*, or *to-*complement initially contained a mental matrix verb in a non-mental function.

Besides emergence of complex sentences with mental verbs, understanding false belief has been found to coincide with other advances in linguistic development, including adult-like interpretation of complements of communication verbs (de Villiers, 1997), acquisition of specificity (Pérez-Leroux, 1997), correct use of the subjunctive mood in Spanish (Pérez-Leroux, 1998, 2001), acquisition of sequence of tense (Hollebrandse, 1997), mastery of referential opacity (de Villiers & Fitneva, 1999), and metalinguistic awareness (Doherty & Perner, 1998).

One conclusion that has been drawn from these data is that the understanding of beliefs and states of mind is a prerequisite for correctly using the linguistic forms to express those concepts, referred to as the *cognitive determinism of language* (e.g., Wellmann, 1990; Tager-Flusberg, 1993; for a general overview of the different proposals, see de Villiers & de Villiers, 2000). In the words of Bloom and colleagues:

> The acquisition of complementation depends upon the child being able to hold in mind two propositions, where one of the propositions is expressible in a simple sentence frame and the other in the mental attitude towards the contents of that proposition. (Bloom et al., 1989: 119)

Interactive models, on the other hand, emphasize the intricate connection between social, cognitive and linguistic development (e.g., Shatz, 1994), but like cognitive deterministic

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[20] In this regard, the inflationary use of *know* is very informative. For example, 65 % of all mental verbs produced by one child between the ages of 2;4 and 2;8 were instances of the verb *know*. In the beginning, *know* is used almost exclusively in the idiomatic phrase *I don't know*.

models do not attribute a leading role to language. de Villiers (de Villiers, 1995a, 1995b, 1997; de Villiers & de Villiers, 2000) has recently advanced the hypothesis that the language of complementation provides a representational structure for embedded propositions and thus for the representation of false beliefs.

> That is, perhaps the complex syntax that is used for describing mental events makes possible the representational changes that allow for understanding of false beliefs. The language for discussing mental events provides the child with a formal means of embedding propositions, and thus provides a necessary ingredient for representing false belief. (de Villiers & de Villiers, 2000: 7)

The key issue is how sentential complements embedded by verbs of desire, communication, and mental state are interpreted by the young language learner who has not yet mastered false belief. As hypothesized in de Villiers (1995a), the child acquires first the fundamental syntax of embedding but without accommodating the meaning within that structure. These sentential complements are taken to be true. Upon encountering events of lying or of mistaken statements, around the age of 3;6 the child then discovers semantic accommodation with report of speech verbs by comparing the statements with the reality (e.g., John said he ate an apple, but in fact he ate ice cream). The emergence of semantic accommodation is subsequently extended to verbs of mental states, where the internal state has to be inferred from actions or statements (e.g., John thought he ate chicken, but we know that he had pork), thus leading to the discovery that thoughts and opinions may differ between people and may be different from reality. To put it in a nutshell, the structural format of syntactic complementation provides the means for developing a theory of mind that in turn paves the way for mastering the semantics of mental verbs.

How do p-factive verbs fit the model of linguistic determinism delineated above? The first complex syntactic structures that the child produces are expected to lack the appropriate meaning while displaying target-like structural features. Mental verbs should thus be used initially not to specify the degree of truth of the embedded assertion, but rather to provide a means for extending the layers of the syntactic tree just as verbs of communication and verbs of desire do. This developmental step is the same for p-factive and nonfactive verbs: Complements of p-factive and nonfactive matrix predicates are simply taken to be true. However, the subsequent acquisition step applies to nonfactive, but not to p-factive verbs: Only upon encountering discrepancies between statements and facts is the child – in analogy to verbs of communication – expected to learn that beliefs expressed by mental verbs can be false. In other words, the language learner experiences that a complex sentence may be true, even if the embedded sentence is false. This property of mental verbs is captured by a feature in the CP of mental verbs stating that the proposition in its complement can be false. A defining property of factive complements, however, is that the complement clause – apart from defeasibility and presupposition failure – is true regardless of the truth-value of the matrix clause. Factive and nonfactive complement clauses thus share the property of having a truth-value that is independent of the truth-value of the matrix clause. Factive and nonfactive complements differ, however, with regard to the truth of the complement clause as presupposition failure only results with false complements of factive verbs. Consequently, the property of factive sentences to presuppose the truth of their complement clause requires a different representational feature whose instantiation may depend on more than the recognition that beliefs can differ from reality (cf. Section 6.2 for an integration of these findings into an acquisition model). Since the theory of mind paves the way

for mastering the semantics of mental verbs, we can conclude that theory of mind is a necessary prerequisite for the acquisition of factivity. However, since an adult-like representation of factive complements requires specifications different from nonfactive complements (e. g., regarding presuppositionhood, δ-binding, and syntactic restrictions), theory of mind is not sufficient for mastering factive sentences.

The position of linguistic determinism has been substantiated by findings from both longitudinal and experimental studies. In a longitudinal study of normally hearing children de Villiers & Pyers (1997) found that the spontaneous use of complements was predictive of false belief reasoning. The strongest support comes from recent work with deaf children (Gale et al., 1996; de Villiers & de Villiers, 2000). The reasoning is the following: If language is a catalyst for developing an understanding of false belief tasks and a theory of mind rather than a reflex of some general underlying cognitive change then false belief reasoning in intellectually normal but language-delayed deaf children is predicted to lag behind. de Villiers' et al. results show that deaf children are indeed significantly delayed in verbal and less verbal theory of mind reasoning. The performance on theory of mind tasks is moreover best predicted by complement production with verbs of communication or mental state rather than by general language ability.

Findings from experimental studies on *verba dicendi* suggest that children younger than about age 4 do not represent complement structures completely target-like (de Villiers & Roeper, 1991). Following a story in which a mother said that she bought paper towels, whereas in fact she had bought a birthday cake, the child was presented with the question in (39).

(39) What did the mother say she bought?

The four-year-olds, but not the three-year-olds correctly responded with *paper towels*, instead of *a cake*. de Villiers (1997) takes this result to indicate that the inability to distinguish between a false statement and the reality is due to an underarticulated clause structure. The representation of the clause lacks the feature crucial to allowing the complement clause to be false, without influencing the truth-value of the complex sentence. Note that this task requires the child to calculate truth-values, a task that is at the core of distinguishing complements of p-factive and nonfactive matrix verbs.

In addition, there is a wealth of experimental studies on the acquisition of mental verbs. However, these are only to some degree comparable to the studies mentioned above, because they are concerned with the whole range of meaning differences between specific verbs (e. g., reference to the present or the past in *remember vs. forget*, distinction between knowing and guessing) rather than focusing on the possible truth-values of embedded propositions. Findings by Miscione, Marvin, O'Brian & Greenberg (1978) demonstrate that younger children (aged 3 to 4) do not distinguish between knowing and guessing a hidden object's location. And the four- and five-year-olds still did not exhibit adult-like behavior: They said to have guessed if they had named the false location and to have known if they had chosen the actual location of the object. Only at around the age of 5 were the mental verbs used correctly. In a similar experiment, Johnson & Wellman (1980) showed that beginning at the age of 7 children distinguished between the verbs *know, remember,* and *guess*. The four-year-olds were able to relate mental verbs to internal states rather than to external states, but they failed to recognize the definitive distinctions between remembering, knowing, and guessing. Comparing children's understanding of *forget* and *remember*, Wellman & Johnson (1979) found that four-year-olds showed an initial ability to differen-

tiate between the two verbs. With increasing age the interpretation then gradually shifted from taking into account overt features of behavior to a later understanding in terms of internal mental states, proceeding well into the school years. A more recent study by Lyon & Flavell (1994) indicates that while responses of the younger children were at chance, four-year-olds seemed to understand the meaning of the two verbs *forget* and *remember*.

Summarizing, all above-mentioned findings confirm that at around the age of 4 important changes take place in the child's mind that have been circumscribed by the development of a theory of mind: the ability to distinguish between one's own state of knowledge and that of another person, that is to differentiate between internal and external world. According to the model of linguistic determinism, it is the structural format of syntactic complementation that provides the means for developing a theory of mind that in turn paves the way for mastering the semantics of mental verbs. Following this line of reasoning, I argued that the distinction between thoughts and facts is a *conditio sine qua non* for correctly interpreting factive structures, i.e. that theory of mind is a necessary prerequisite for the acquisition of factivity. That theory of mind is not a sufficient requisite for mastering factivity results from the multidimensionality of factivity. Beyond the emergence of a representational theory of the mind, mastery of factivity is determined by the acquisition of specific syntactic and (discourse-)semantic features. Note that this conclusion has implications for the age range that should be the focus of the study of the acquisition of factivity. As long as the child does not understand the extra-linguistic concepts of theory of mind such as differences between facts and beliefs, it is impossible to draw conclusions about her linguistic interpretation of p-factive and nonfactive matrix predicates. Imagine that in a comprehension study a child is found to not differentiate between the verbs *know* and *think*. This could be attributed equally either to lack of a theory of mind or to the semantic misinterpretation of factive and nonfactive verbs. Consequently, studies on the mastery of factivity with children younger than age 3;6 are likely to conflate theory of mind development and factivity acquisition. The question of how children acquire an adult-like understanding of factive sentences is addressed in the next section.

5.6 Comprehension of P-factive and Nonfactive Verbs

Looking at children's production data, we have seen that children are about 4 when they start producing factive sentences, after having used p-factive matrix predicates in nonfactive sentences and finite complement clauses embedded by nonfactive verbs for several months (cf. Section 5.4). Let us now turn to the comprehension of factive and nonfactive structures. I argued that development of the theory of mind paves the way for mastering the interpretation of factive sentences, just as theory of mind makes possible an adult-like understanding of the semantics of mental verbs in general. Before the theory of mind develops, children acquire the fundamental syntax of embedding but they do so without accommodating the meaning within that structure. Children younger than about 3;6 thus interpret the proposition in a complement clause as true, regardless of the type of matrix predicate. Children around age 4, in contrast, take into account that the truth-value of the complement of a mental verb does not contribute to the overall truth of the complex sentence. I proposed

that characteristics of factive sentences other than the interpretation of factive complements as presupposed to be true may take more time to be learned (e.g., correct representation of presuppositionhood, presence of the δ-binder Comp at the level of LF, and syntactic restrictions). Having established this type of interrelation between theory of mind reasoning and factivity acquisition, we can now reconsider hypothesis H2, repeated below.

(H2) Since p-factive and nonfactive matrix predicates differ in the possible truth-values that their complement clauses can receive, the language learner masters (some of) these nonfactive predicates at the same time at which she correctly interprets complement clauses of p-factive matrix predicates as presupposed to be true.

Assuming that theory of mind emerges during the second half of the fourth year of life and given that acquisition of factivity proceeds stepwise (cf. H0), we can state H2 more precisely as follows (for earlier versions of this hypothesis, cf. Schulz, 1997, 2000):

(40) Factivity Acquisition Hypothesis$_{Comp}$ (FAH$_{Comp}$)
   a. Before development of a theory of mind children interpret complements of factive and p-factive matrix predicates as true.
   b. After emergence of a theory of mind at about age 4, p-factive are distinguished from the various types of nonfactive matrix predicates according to the possible truth-value of their complement clauses.

In this section I pit the above hypothesis against findings from previous experimental studies on the comprehension of p-factive and nonfactive verbs. Research on factivity acquisition has a fairly long tradition originating with Kiparsky & Kiparsky's (1971) lexical-semantic account of factivity. To date studies on children's understanding of factivity have mainly followed two traditions. In line with Kiparsky & Kiparsky's lexical-semantic approach to factivity, children's interpretation of p-factive and nonfactive verbs is attributed to the (lack of) use of logical, core-semantic properties. Alternatively, children's interpretation patterns are ascribed to pragmatic mechanisms such as probability measures, which apply independently of truth-values. Discourse-semantic approaches to factivity were not taken into account. In view of the compositional approach to factivity proposed in Chapter 2 to 4, previous acquisition studies – whether semantically or pragmatically oriented – are limited in a number of ways. Let me point out four drawbacks that are common to all studies and that I regard as crucial when assessing the findings of these studies.

First, the range of matrix predicates and embedded structures tested is limited in that generally only *that*-complement clauses of p-factive and propositional predicates have been examined. With a few exceptions (Harris, 1975; Macnamara, Baker & Olson, 1976), neither nonfinite complement clauses nor positive-implicative, negative-implicative or *if*-matrix predicates were included in the experiments. More importantly, by using *that*-complements as the only complement type studies are restricted to examining the lexical-semantic properties of the matrix predicates. The role of the type of complement clause in achieving a factive interpretation of a complex sentence has not been examined. This runs counter to the compositional notion of factivity according to which it is the interrelation between a p-factive matrix predicate and a specific type of complement clause that triggers a factive interpretation of the entire sentence.

Secondly, previous studies employed a test design in which no discourse background was given for the test items, thus forcing the child to create an appropriate discourse refer-

ent on the spot while processing a factive sentence in isolation. This is just the case of accommodating a file by adding a new file card in order to create an antecedent to the event variable in the complement clause (cf. Section 3.4.4). In this way, one of the core features of factive constructions, referring back to some previously established event in the discourse, has been neglected.

Third, the diagnostics most frequently employed to distinguish between p-factive and nonfactive verbs is the test of constancy under negation. As noted before (cf. Section 3.3.1.1), the negation test is problematic from a linguistic perspective, since sentence negation in factive sentences has a second non-presuppositional reading. Moreover, by using constancy under negation as an indicator of factivity it becomes impossible to study acquisition of factivity separately from acquisition of negation. Non-adult-like responses may result from the child's immature representation of factivity or from incorrect understanding of sentential negation.

Finally, an evaluation of the studies on the acquisition of factivity is made difficult by use of different test designs, divergent methods, a variety of verbs tested and differing age ranges. In what follows I will first discuss semantically oriented studies on the acquisition of factivity (Section 5.6.1) and then pragmatically oriented studies (Section 5.6.2.). The main result will be that mastery of factivity is claimed to develop as early as 4 and as late as 14. I will argue that these studies remain inconclusive with regard to the FAH_{Comp}, because they have underestimated the complexity of the acquisition task.

5.6.1 Semantic Approaches

This section gives an overview of comprehension studies on the acquisition of factivity carried out in a semantic framework (Macnamara et al., 1976; Hopmann & Maratsos, 1978; Scoville & Gordon, 1980; Abbeduto & Rosenberg, 1985; Bassano, 1985; de Villiers et al., 1997).

Macnamara et al. (1978) adduced evidence that four-year-olds are able to understand presuppositions and assertions of semantically complex propositions and can deduce what those propositions imply. Using negated and affirmative sentences, children were tested with several types of predicates and asked yes/no questions afterwards. The classes of matrix predicates used were negative if (*pretend that*), negative-implicative (*forget to*), and p-factive (*know*). Macnamara et al. found that children gave more correct answers in the affirmative version than in the negated version of the test sentence. Moreover, children responded correctly to the majority of the questions, even though performance on *know* was significantly lower than on *pretend* and *forget*. The applicability of the results is limited for several reasons. Macnamara et al. did not provide an adult control-group and thus it remains unclear what adult-like performance would have been like. The design itself is questionable as each child was presented with the positive and the negative version of the sentence. This could have biased responses as well as the fact that a battery of several questions was presented after each test sentence.

Hopmann & Maratsos (1978) tested four-, five-, and seven-year-old children for their comprehension of presupposition and negation using an act-out task in a forced choice design. The following types of matrix predicates were included: p-factive (*know, it's surprising, be happy, it's nice, it's sad*) and nonfactive (*think, it's possible, desire, want, it's*

true). Their findings indicate that only seven-year-olds showed a fair mastery of the semantics of the predicates studied. In the test complex sentences containing a negated or affirmative p-factive or nonfactive matrix verb were followed by a *wh*-question, as illustrated in (41).

(41) *Bunny and fish are present.*
It is (not) surprising/true that the bunny eats dinner.
Who eats dinner?

The child had to choose one of the two dolls and act out the event depicted in the complement clause. For affirmative and negated p-factive verbs and for affirmative nonfactive verbs choice of the doll mentioned in the complement clause counted as correct, whereas in case of negated nonfactives the doll not mentioned in the complement clause was coded as correct. The four- and five-year-olds employed two different strategies, referred to as *overextended negation tendency* (42) and *overextended affirmation tendency* (43) (Hopmann & Maratsos, 1978: 297).

(42) Overextended Negation Tendency (ONT)
A negated predicate in the superordinate clause of a complex sentence always negates the proposition in the subordinate clause.

(43) Overextended Affirmation Tendency (OAT)
A negated predicate in the superordinate clause of a complex sentence has no effect on the interpretation of the proposition in the subordinate clause.

Children adhering to the ONT interpret nonfactive, but not p-factive verbs correctly, while children employing the OAT misinterpret nonfactive verbs in that they do not distinguish them from factive verbs. Note that the OAT is related to but not equivalent to the so-called *complement-only strategy* (COS), stated in (44) (cf. Harris, 1975).

(44) Complement-only Strategy (COS)
The last complement clause in a complex sentence is interpreted independently of the matrix clause, if the complement clause could receive an independent interpretation.

Under a COS, sentences with nonfactive matrix verbs receive an incorrect interpretation whether the predicate is negated or not. Employing the OAT, on the other hand, yields incorrect results for interpreting nonfactive verbs only when they are negated. Only at age 7 did the children respond to the p-factive predicates and the nonfactive predicates in an adult-like way. The results are to be regarded with caution for several reasons. The specific test design probably led to an underestimation of the children's competence. Moreover, the range of nonfactive verbs is not homogeneous as positive- and negative-implicatives (*be true* and *be false*) as well as volitives (*want*) are included. In addition, the coding for negated nonfactive matrix predicates is questionable, since the target response expected by the authors – choosing the doll not mentioned in the complement clause – is only one of several possibilities. Finally, the order of the test items (all factives were presented before or after all nonfactives) might have biased participants to not paying attention to the negation of the matrix predicate. Nonetheless, Hopmann & Maratsos' findings indicate (a) that factivity is acquired on a verb-by-verb basis, and (b) that negation of a p-factive matrix predicate initially leads to a negation of the embedded proposition.

Using a truth-value judgment task, Scoville & Gordon (1980) found a gradual increase of comprehension of factive and nonfactive verbs, extending into adolescence. Like Hopmann & Maratsos, they presented children between the ages of 5 and 14 with complex sentences, which contained an affirmative or negated factive or nonfactive matrix predicate, embedding an affirmative or negated complement clause. For p-factives they used *know, forget, be sorry, be happy, be surprised* and for nonfactives *be sure, think, figure, say, believe*, all of which embedded a finite complement clause. The task – set up as a television quiz show – was to judge the truth-value of a complement clause prompted by a yes/no question. A mind reader tries to guess while blindfolded the color of various ping pong balls, and each of his guesses is commented on by his assistant, as exemplified in (45).

(45) Test sentence: Dr. Fact believes (doesn't believe) that the ball is red.
Yes/no question: Is the ball red?
Correct answer: maybe (maybe)

Scoville & Gordon's findings seem to support the assumption that children up to age 8 tend to overgeneralize the scope of the matrix negation into the embedded clause of factive predicates (ONT). The use of correct responses to nonfactives and p-factives increased with age, but only the group of 14-year-olds could distinguish between these verbs types. And adults still did not always distinguish correctly between the two verb classes. Nonfactive *say* and *be sure* and factive *know* were interpreted as factive with an affirmative and as nonfactive with a negated matrix predicate. To summarize, the introduction of an omniscient mind reader, the use of visual stimuli and finally the presentation of the test sentences in isolation might have impeded the correct assessment of the truth-value of the factive and nonfactive complements. Regardless, this experiment confirms that acquisition of factivity is a gradual process proceeding on a verb-by-verb basis rather than across a whole verb class.

Parallel to Scoville & Gordon, Abbeduto & Rosenberg (1985) used truth-value judgments to test how three-, four-, and seven-year-old children interpret p-factive (*know, remember,* and *forget*) and nonfactive (*believe, think*) verbs. In addition, children's ability to match verbs with mental states and to state definitions of various verbs was examined. Abbeduto & Rosenberg's data indicate that children at the age of 4 are already aware of the distinctions between factive and nonfactive verbs and are thus able to assign truth-values to their complements accordingly. Comparing findings across the three tasks revealed considerable differences. The definition task for example was solved correctly only at the adult level. A nonfactive test item of the comprehension task is given in (46) below.

(46) Context: I have a friend named Mary. Mary has a cat.
Test sentence: Mary thinks (doesn't think) that the cat is slow.
Presupposition question: Is the cat slow?
Answer: maybe (maybe)

Three-year-olds interpreted all verbs as p-factives, that is they took the complements of *believe* and *think* to be presupposed in negative and affirmative versions of the matrix predicate. Put differently, children of this age could not give the correct *don't know* responses.[21] P-factive

[21] Note that this inability may be attributed to the failure to recognize the indeterminate truth-value or to the lack of knowledge necessary to transform the observed indeterminacy into the correct response option (cf. also Section 7.4.1 and 7.4.4).

verbs received an apparently target-like interpretation. The COS can account for both the low performance of the three-year-olds on nonfactives and their excellent performance on the p-factives. In contrast, these findings are not compatible with the assumption of the OAT since in that case the affirmative version should have led to a correct indeterminate response. There was no evidence for use of the ONT in any of the age groups, as negative answers only constituted a small number of the responses in the negated sentences. In sum, Abbeduto & Rosenberg's findings suggest that while three-year-old children use the strategy of COS for all verbs, four-year-old children are able to correctly assign truth-values to factive and nonfactive complements.[22] In light of its specific properties (cf. Section 2.6), it is not surprising that *believe* is still treated by the four- and seven-year-olds as factive.

In a recent study on the acquisition of mental predicates, de Villiers et al. (1997) investigated how six- and eight-year-old children interpret factive *remember* and *forget* and nonfactive *worry* and *think*. Presupposition questions were embedded in a larger story context; an abbreviated example is given in (47).

(47) Test sentence: She remembered that her birdcage was in the attic.
Presupposition question: Does that mean it was in the attic?

While six-year-olds correctly interpreted *think*, *worry*, and *remember*, the factive property of *forget* was recognized by the majority of the eight-year-olds only. In contrast to Abbeduto & Rosenberg (1985), these results suggest a later mastery of the presuppositional property of factive verbs at around the age of 7 or 8. However, the complex test design (a single story containing multiple questions to different verbs) might have placed high memory demands on the children.

Two conclusions emerge from the semantic approaches to the acquisition of factivity. One, young children's interpretation of complex sentences is guided by the complement-only strategy (COS), according to which the complement clause can be interpreted independently of the matrix clause. Three-year-olds thus take complement clauses generally to be true, resulting in an apparent adult-like understanding of p-factive but not of nonfactive verbs. Second, the studies suggest a gradual increase of mastery of factivity on a verb-by-verb basis, with p-factive and nonfactive matrix predicates being generally acquired at about the same time. However, semantically oriented studies remain inconclusive with regard to the age at which factivity is assumed to be mastered. The ability to assign truth-values to sentential propositions solely based on the semantics of the matrix predicate has been claimed to emerge as early as 4 (Macnamara et al., 1976; Abbeduto & Rosenberg, 1985), as late as 14 (Scoville & Gordon), and during the first school years (Hopmann & Maratsos, 1978; de Villiers et al., 1997). Thus, semantic studies provide only partial evidence for the Factivity Acquisition Hypothesis$_{Comp}$ stated in (40). Do studies on the acquisition of factivity in pragmatic frameworks arrive at the same conclusions?

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[22] Bassano (1985) reports slightly different results from a study with four- and five-year-old French speaking children on the comprehension of sentential complements of *savoir* (know) and *croire* (think, believe). 80% of the children correctly interpreted the complement of 'I know that p' as true, but only 40% correctly interpreted the complement of 'I think that p' as indeterminate. Bassano attributes both results to use of a COS in the four- and five-year-olds.

5.6.2 Pragmatic Approaches

This section gives an overview of studies on the acquisition of factivity that rest on the assumption that factivity is a pragmatic concept (cf. Harris, 1974, 1975; Moore, Bryant & Furrow, 1989; Moore & Davidge, 1989; Falmagne, Gonsalves & Bennett-Lau, 1994). Pragmatic approaches to factivity acquisition hold that children initially interpret verbs based on the perceived level of probability and on invited inferences rather than based on logical properties such as truth-values.

Harris (1974, 1975) tested children between the ages of 4 and 12 on their ability to judge the truth of affirmative and negated complex sentences and to detect different kinds of anomalies. The predicates tested were p-factive (*know, be happy*), nonfactive (*say, whisper*), and what Harris called counter-factive (*pretend, wish*)[23]. An adult-level comprehension of complex sentences was not found before the age of 12. While most responses to factives were adult-like, responses to nonfactives indicated that children treated them as equivalent to factives. Harris proposes a *pragmatic inference hypothesis* to account for these findings (cf. Harris, 1974: 628):

(48) Pragmatic inference hypothesis
The psychologically most likely interpretation (invited inference) is chosen, given a situation in which more than one truth-value is logically plausible.

When considering the range of selected verbs the use of that strategy does not come as a surprise: *Say* and *whisper* belong to the class of *verba dicendi* and their complements are likely to be interpreted as true. In the anomaly-detection task, children were required to judge sentences with so-called syntactic anomalies – based on negation or choice of matrix predicate –and with non-syntactic anomalies – based on world knowledge – as *funny* or *not funny*. Example items are given in (49) and (50) below.

(49) John pretended that chairs cannot fly.

(50) John knew that his father was a tree.

Harris found that non-syntactic anomalies as in (50) were easier to detect than syntactic anomalies as in (49) and concludes that when children make linguistic judgments their knowledge about the world is much more salient than linguistic knowledge. Note, however, that in order to judge a statement such as (50) as funny the child has to know that *know* is p-factive. In short, Harris showed that pragmatic inferences play a role in analyzing complex sentences up to age 12, depending on the specific task and the predicates selected. Since performance was not differentiated according to age groups, it is difficult to say anything about children younger than 12, however.

Using a forced-choice task, Moore & Davidge (1989) tested children between 3 and 6 years of age on their ability to distinguish the similar mental predicates *know* [+factive, +certain], *be sure* [-factive, +certain], and *think* [-factive, -certain]. The task for the child

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[23] Harris incorrectly assumes that counter-factives imply that the complement clause is false whether the matrix predicate is negated or not. From a sentence such as *John does not pretend that Bill is sick* it cannot be concluded that Bill is healthy. Thus, *pretend* belongs to the class of negative if-verbs. *Wish* belongs to the class of volitive verbs (cf. Table 2.3).

was to find a hidden object in one of two locations, guided by the statements of two dolls involving contrasting mental terms, as exemplified in (51).

(51) Figure 1: I think that the candy is in the red box.
Figure 2: I know that the candy is in the blue box.

At around the age of 4 to 5 children knew the difference between *know* and *think* and between *be sure* and *think*. However, *know* and *be sure*, which differ according to factivity but not according to certainty, were still treated as equivalent by the six-year-olds. Extending Harris' pragmatic inference hypothesis to p-factive verbs, Moore & Davidge stipulate that children's understanding of mental terms is guided by a *certainty strategy* (Moore & Davidge, 1989: 636).

(52) Certainty strategy
Children judge mental predicates not on the basis of factivity, but in terms of the expression of different degrees of certainty.

Relating these findings to the development of theory of mind, Moore & Davidge conclude that the understanding that beliefs can be held with differing degrees of certainty develops along with the theory of mind. Put differently, it is assumed that the function of mental verbs to express degrees of certainty is not related to the factive or nonfactive properties of the matrix predicates. In sum, their data suggests that up to age 6 children do not have the category of factivity at their disposal in interpreting different mental predicates. However, the obtained results may be attributed not to children's understanding of factivity and semantic distinctions, but to circumstantial factors of the experiment. Coding the responses was based on pragmatic criteria: A child's response was coded as correct only if she preferred the *sure*-statement to the *think*-statement. Moreover, the hidden object task asks the subject to look at the most likely place and can thus detect only the preferred choice but can say nothing about the interpretation of the location not chosen. Last, the formulation of the two test sentences in the first person requires the child to rely on the statement of one figure and dismiss the statement of the other. For those reasons the above findings do not refute the assumption that understanding of the mental verbs is based on their discourse-semantic properties.

A study by Moore, Bryant & Furrow (1989) based on the same forced choice paradigm revealed that the selection of verbs affected children's responses as well as the method. Testing for contrasts between *know, think*, and *guess* it was found that children at the age of 4 were able to distinguish factive *know* from the two other verbs, but were unable to differentiate the nonfactive verbs *think* and *guess* (for a similar finding, cf. Abbeduto & Rosenberg, 1985). The findings from these two studies provide grounds for the assumption that criteria of certainty are employed only if the distinction according to factivity of the verbs does not result in an unambiguous response.

Falmagne, Gonsalves & Bennet-Lau (1994) investigated whether judgment of the overall certainty is governed by pragmatic aspects of meaning or by logical properties of factivity. The verbs tested were p-factive (*know, be aware, make clear, recognize, notice, point out, emphasized*) and nonfactive (*be sure, say, think, assume, reason*). Responses of eight- and twelve-year-olds were found to reflect use of a pragmatic strategy, while factivity emerged only gradually as a logical component of verb meaning. It is hypothesized that a *confidence*

strategy, as stated in (53), guides children's interpretation of mental terms (Falmagne et al., 1994: 1).

(53) Confidence strategy
Discrimination of factive and nonfactive verbs reflects the subjective confidence conveyed by the verb rather than the logical property of factivity.

Children were asked to give truth-value judgments in negated and affirmative sentences and to distinguish p-factive and nonfactive predicates in a confidence task and in a certainty task. All tasks were presented in written form. The truth-value judgment task is exemplified in (54).

(54) *Pretend that you say this sentence:*
Carl knew/didn't know that Jeff bought a new skateboard.
If you say that, does that mean that Jeff really did buy a new skateboard?
_____ Yes
_____ No
_____ maybe and maybe not

The confidence task required the child to judge the confidence conveyed by the matrix predicate to the subject of the sentence, as illustrated in (55).

(55) *Pretend that you say these two sentences:*
John was sure that Rex paid the phone bill.
Pat recognized that Rex paid the phone bill.
Mark the person that feels more certain about this:
_____ John feels more certain.
_____ Pat feels more certain.

In the certainty task the child had to evaluate the degree of overall certainty that the matrix predicate confers upon the complement clause. In other words, focus was on how the child perceived the certainty conveyed by the specific matrix predicate. An example is given in (56).

(56) *Pretend that you say these two sentences:*
Lucy said that Julie made fudge yesterday.
Lucy was aware that Kate made fudge yesterday.
Mark the one thing that is more certain for you:
_____ Julie made fudge yesterday?
_____ Kate made fudge yesterday?

The results from the truth-value judgment task indicate that for some verbs the factive/nonfactive distinction is present in the child's lexicon at the age of 8, while stability of judgments and extension to a wider range of verbs develop well into late childhood. The findings do not provide evidence for overextended negation; in both age groups subjects gave the required indeterminate responses. A comparison of the results across the three tasks revealed that certainty and confidence judgments were correlated in the group of six- to twelve-year-olds, while no correlation was found for certainty and factivity. Falmagne et al. take these findings to indicate that only later in development does factivity become a distinct logical component of verb meaning. Initially, judgments of the overall certainty of

the complement clause are claimed to primarily rely on the confidence the verb conveys. This conclusion is questionable, however. First, lack of correlation between the factors factivity and certainty does not imply that confidence is the guiding factor in determining verb meaning. Secondly, the design of the truth-value judgment task suffers from several shortcomings. Besides the written format that might have increased the demands of the task itself, the presentation of the items in two blocks of negative and affirmative sentences as well as the appearance of a verb in a positive and in a negative sentence frame is likely to have biased the responses. Regardless of these limitations, the results are consistent with the assumption that factivity is a distinct component of verb meaning that is acquired on a verb-by-verb basis.

In summary, the findings of the pragmatic approaches to the acquisition of factivity provide only partial evidence for the Factivity Acquisition Hypothesis$_{Comp}$. It is claimed that children acquire the lexical-semantic concept of factivity rather late in acquisition. Like the semantic studies, the pragmatic studies suggest a gradual increase of mastery of factivity on a verb-by-verb basis, with p-factive and nonfactive matrix predicates being generally acquired at about the same time. However, depending on the kind of study, mastery of factivity was found to occur after 6 or at the age of 12. Since children younger than 4 were rarely tested, the question of whether three-year-olds interpret all complement clauses as true cannot be answered by these studies.

5.6.3 Summary

The findings from semantic and pragmatic studies on the acquisition of factivity suggest a gradual increase of mastery of factivity on a verb-by-verb basis, with p-factive and nonfactive matrix predicates being generally acquired at about the same time. Experiments in the lexical-semantic framework furthermore indicate that young children's interpretation of complex sentences is guided by the complement-only strategy (COS), according to which the complement clause can be interpreted independently of the matrix clause. However, conflicting findings are reported regarding the age of mastering factivity. Both lexical-semantic and pragmatic types of studies considerably vary with regard to the age at which they assume factivity to be mastered. The ability to assign truth-values to sentential propositions solely based on the semantics of the matrix predicate is claimed to emerge as early as 4 and as late as 14. Pitting these results against the Factivity Acquisition Hypothesis$_{Comp}$, repeated in (57), we find its predictions only partially confirmed.

(57) Factivity Acquisition Hypothesis$_{Comp}$ (FAH$_{Comp}$)
   a. Before development of a theory of mind children interpret complements of factive and p-factive matrix predicates as true.
   b. After emergence of a theory of mind at about age 4, p-factive are distinguished from the various types of nonfactive matrix predicates according to the possible truth-value of their complement clauses.

I argued that previous studies remain inconclusive with regard to the hypothesis above for two main reasons. First, they have underestimated the complexity of the acquisition task. The FAH$_{Comp}$ is derived from a compositional model of factivity that integrates lexical-semantic, syntactic, and discourse-semantic aspects of factive sentences. The studies re-

viewed above, in contrast, follow purely lexical-semantic or pragmatic accounts, which do not consider the multidimensionality of factivity. All studies focused on the interpretation of p-factive and nonfactive matrix predicates embedding *that*-complement clauses. As a consequence, the role of the type of complement clause in achieving a factive interpretation of a complex sentence has not been examined. Moreover, to date research on the acquisition of factivity has exclusively employed accommodation scenarios where an appropriate discourse referent has to be created when processing a factive sentence in isolation. Thus, one of the core features of factive constructions, referring back to some previously established event in the discourse, has been neglected.

Second, the underlying rationale of the study as well as test material and experimental design might have affected the results considerably. Regarding the rationale of the study, most researchers employed the negation test as a criterion for distinguishing factive and indeterminate verbs. Results may thus reflect children's understanding of sentential negation rather than their interpretation of factive sentences. Moreover, choice of verb classes and of the specific matrix predicates differed. Some nonfactive matrix predicates such as *say* or *be true*, for example, suggest or even imply that the complement clause is true, while others such as *guess* more clearly convey that the truth-value of the complement clause is indeterminate. The experimental technique and the test design have important consequences for the outcome of the study as well. The act-out technique prompts neglect of the matrix predicate and potentially of the entire matrix clause. The forced verb choice method seems inappropriate for the objective at hand in that coding of responses was *a priori* based on pragmatic criteria. Last, the presentation of the test sentences with or without a context puts different interpretational demands on the child.

Are the results on the acquisition of the syntactic restrictions of factive sentences more conclusive? At what age do children become sensitive to the syntactic restrictions of p-factive matrix predicates? These questions are addressed in the next section.

5.7 Mastering Weak Island Effects of Factive Sentences

In Chapter 4 we saw that p-factive predicates always prohibit long adverbial *wh*-movement, negation-raising, ECM infinitival complements, subject-to-subject raising, and postposing. I demonstrated that these restrictions result from the different event structures of factive and nonfactive sentences. Comp δ-binds the embedded event variable in factive complements, triggering the interpretation of the factive complement as presupposed and giving rise to the well-known barrierhood effects. By contrast, in nonfactive complements the event variable propagates up to IP or CP and is existentially bound there. I hypothesized that children recognize these syntactic restrictions of factive complements only after they have established rf Comp as a δ-binder of the embedded event variable at the level of LF (cf. H4). Put differently, only once they have discovered that factive sentences presuppose the truth of their complement clause are they able to recognize the weak island effects of factives. Previous research has focused on long adverbial *wh*-movement and negation-raising as well as on semantic inferences. This section examines hypothesis H4 with regard to these three phenomena. Section 5.7.1 reviews the findings on long *wh*-movement. Section 5.7.2 dis-

cusses the data on negation-raising, and Section 5.7.3 contains a brief note on semantic inferences. Section 5.7.4 summarizes the results. The findings from these areas of study indicate that weak island effects are mastered around age 7 or 8. I will argue that syntactic restrictions of factives are learned rather late, because they are weak rather than defining properties of factives, thus giving rise to ambiguity of the input data.

5.7.1 Long Adverbial *wh*-Movement

Long movement of *wh*-adverbials in child English has been studied extensively by de Villiers and Roeper and colleagues (cf. de Villiers, Roeper & Vainikka, 1990; Philip & de Villiers, 1992; Roeper & de Villiers, 1992b, 1994; de Villiers, 1995c; de Villiers, Curran, DeMunn & Philip, 1997) and also by Thornton, Wexler & Leszek (1992).[24] Philip & de Villiers (1992) investigated children's interpretation of long extractions of *wh*-adverbials such as *how* and *why*. Recall that a long-distance reading of adverbials is always blocked with rf-predicates (cf. Section 4.2.9). Children between the ages of 4 and 7 were presented with short stories followed by *wh*-questions containing a p-factive (58) or a nonfactive (59) matrix verb.

(58) $\text{Why}_{i/j}$ did Mary forget t_i her Mom was picking her up $*t_j$?

(59) $\text{Why}_{i/j}$ did the zookeeper think t_i the monkeys took the rope t_j?

While children responded to questions such as (59) with a long distance answer in 50% of the cases, overall they gave less long distance responses to test prompts as in (58) that contain a p-factive matrix verb. The number of the ungrammatical long responses varied between 52% and 6% depending on the specific matrix verb used: *be sorry* and *be glad* yielded more correct responses than *forget*. The authors speculate that the observed disparity between adjectival and verbal predicates could reflect a general developmental pattern, according to which adjectives facilitate acquisition of weak island effects. This would also agree with our assumption that long movement out of complements of adjectivals seems to be very restricted (cf. also Section 6.3). Abstracting away from the difference between verbal and adjectival predicates, this finding suggests that while younger children are sensible to the difference between p-factive and nonfactive verbs, they have not yet fully acquired the adult-like restrictions.

An earlier study on long movement of *wh*-adverbials (Roeper & de Villiers, 1992b) found that children between the ages of 3 and 6 allowed long distance readings of *wh*-phrases as frequently with p-factive verbs such as *know that* as with nonfactive verbs like *say that*. In a recent study, de Villiers et al. (1997) confirmed that by the age of 6;9 ungrammatical long distance responses with p-factive verbs such as *forget* are very rare. Similarly, a study by Thornton et al. (1992) showed that four-year-old children allowed long distance readings of the adverbial *how* over p-factive verbs like *find out* almost as often as short distance readings (78% vs. 88%). Adults, however rejected the long distance reading, regardless of the presence or absence of the complementizer *that*.

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[24] For German and French, see Weissenborn, Roeper & de Villiers (1991); for Spanish, see Pérez-Leroux, (1991, 1993).

I propose that these interpretation patterns can be attributed to a child's grammatical representation at LF from which the relevant features of factive Comp are absent, leaving Comp unfilled and as a result allowing the *wh*-adjunct to move out of the embedded clause. Alternatively, rather than adducing factivity, one could argue that these experimental results are a consequence of children's general insensitivity to barriers to *wh*-movement of adjuncts. In other words, if children do not exhibit any restrictions on long distance readings of *wh*-adverbials, then it is expected that a p-factive matrix verb does not function as a barrier either. Note that in this case, rather than arguing that some feature of p-factive verbs is not yet mastered, we would have to state that it is the concept of barriers that poses difficulties to the language learner. de Villiers et al. (1990) and Roeper & de Villiers (1992b), however, could show that children aged 3;7 to 6;11 acknowledged other barriers to long *wh*-movement of adverbials including presence of a medial *wh*-phrase, as illustrated in (61) with a nonfinite complement and in (62) with a finite complement clause.

(60) How $_{i/j}$ did the father ask t_i to cook the pie t_j?

(61) How $_{i/j}$ did Kermit ask t_i who to help $*t_j$?

(62) When $_{i/j}$ did the boy know t_i how he hurt himself $*t_j$?

To (60) children responded with the possible long distance answer in about 77% of the cases. Conversely, questions (61) and (62) were only interpreted in 8% and 6% of the cases, respectively, as if the fronted *wh*-phrase referred to the embedded sentence.[25]

In other words, not factivity of the matrix verb *know* but presence of a medial *wh*-complementizer was acknowledged as a barrier to long *wh*-movement. Note that the responses to (61) with a nonfinite complement clause and to (62) with a finite complement clause do not differ significantly. In other words, children do not allow long distance readings when a medial *wh*-complementizer is present, independently of the finiteness of the complement clause. de Villiers & Roeper (1991) account for the different effects of factivity on the one hand and presence of a medial *wh*-complementizer on the other hand by assuming that restrictions based on lexical distinctions are acquired later than syntactically motivated restrictions. According to their acquisition model, lexical idiosyncrasies are learned when embedded under V'. Since they further assume that complements are initially adjoined at VP by default (Roeper & de Villiers, 1994), relevant verb-specific properties such as barrierhood are not accessible in early child language (for details see Section 6.2.2).

In sum, while four-year-olds already acknowledge barriers to long adverbial *wh*-movement such as medial *wh*-phrases, the barrierhood of factives is only mastered around age 7.

5.7.2 Negation-Raising

Children's interpretation of negation-raising has been studied by Phinney (1981b) in English and by Bassano and colleagues (Bassano & Champaud, 1983; Bassano, 1985) in French. The main finding is that the barrierhood of factives is noted around age 8.

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[25] Interestingly, (61) was interpreted only in 23% of the cases as the question *How did Kermit ask.* 68% of the responses adressed the medial *wh*-complementizer, as though the question had been *who to help.* For an explanation of this response pattern, see de Villiers et al. (1990).

Phinney (1981b) studied the types of strategies available to children between the ages of 5 and 9 for interpreting negation in complex sentences with p-factive matrix verbs. Children were presented with complex sentences and asked two yes/no questions about the main and the embedded clause afterwards. Two example sentences are given in (63) below.

(63) a. Fred didn't know that Miss Piggy loves Kermit.
b. Fred knew that Miss Piggy doesn't love Kermit.
Question 1: Did Miss Piggy love Kermit?
Question 2: Did Fred know what happened?

Up to the age of 8;5, 40% of the children interpreted the matrix negation in sentences such as (63a) as referring to the embedded clause. In other words, they did not take the complement clause as presupposed to be true when the matrix predicate was negated. Conversely, the negation in (63b) was taken to refer to the matrix clause in 28% of the responses. That is, with regard to negation the p-factive verb was interpreted as a negation-raising verb (cf. Section 4.2.6). Note that two aspects are confounded in this study: negation-raising and constancy of the embedded presupposition under matrix negation. The overextended negation tendency, discussed in Section 5.6.1, refers to the second aspect of the same phenomenon.

Incorrect interpretation of matrix negation with p-factive verbs has also been documented in studies with French children (Bassano & Champaud 1983; Bassano, 1985). Children were presented with the matrix verbs *savoir* (know) and *croire* (believe, think) in different structures including *I know that p, I know that not-p, I do not know if p,* and *I think that p*. While 80% of the responses to the positive p-factive verbs were correct, only 40% of the responses to the negated p-factive verbs were adult-like. In 45% of the responses, *I know that not-p* was treated as equivalent to *I do not know that p*. These errors occurred in the age group of four- and five-year-olds and remained until about 7 to 8 years of age.

In sum, Phinney's and Bassano's studies indicate that children incorrectly interpret negation-raising in factive complements up to the age of 8.

5.7.3 Semantic Inferences from a Subset to a Larger Set

To complete the picture let me sketch some results on semantic inferences, even though in Section 4.2.13 we saw that inferences are neither a defining nor a weak property of p-factive matrix predicates. Besides testing children's interpretation of long *wh*-extractions, Philip & de Villiers (1992) studied the same group of children regarding their understanding of semantic inferences. Contrasting p-factive (*forget, be sorry*) and nonfactive (*think, be sure*) verbs, children were presented with the following scenarios:

(64) Bobby forgot his aunt was coming to town by airplane. So he went to the train station.
Question: Did Bobby forget his aunt was coming to town?
Answer: No

(65) Michelle thought her uncle was coming by train so she went to the train station.
Question: Did Michelle think her uncle was coming to town?
Answer: yes

The possible inference from a subset to a larger set (65) was recognized by the majority of children (81 % to 97 % correct responses), while blocking of upward entailment (64) was detected by only some of the children (38 % to 69 % correct responses). Philip & de Villiers (1992) took these results as evidence for the complexity of p-factive verbs. In contrast, a more recent study by de Villiers et al. (1997) demonstrated that older children at the ages of 6 and 8 gave fewer correct responses for *think* than for *forget*. This result draws into question the earlier mastery of inferences with nonfactives, as reported in the former experiment. Recall that inference from a subset to a larger set is not blocked by the matrix verb being p-factive, but by the presence of intervening negative elements. Thus it remains an open question as to why semantic inferences are difficult to draw for children.

5.7.4 Summary

This section examined the hypothesis H4 that syntactic restrictions of factive complements are detected only after children have established rf Comp as a δ-binder of the embedded event variable at the level of LF. The studies on long adverbial *wh*-movement and negation-raising indicate that weak island effects are recognized around age 7 or 8, that is after the children may have mastered the presuppositional interpretation of factive sentences. The evidence for a delayed acquisition of semantic inferences was inconclusive. I argued that the syntactic restrictions of factives regarding long adverbial *wh*-movement and negation-raising are learned rather late, because they are weak rather than defining properties of factives, giving rise to ambiguity of the input data.

5.8 Conclusion

This chapter made a start with relating the theoretical framework developed in the first half of the book to the question of how children acquire the lexical-semantic, syntactic, and discourse-semantic aspects of factivity. Guided by the general hypothesis of a stepwise acquisition pattern, four specific hypotheses regarding the acquisition of factivity were identified, which are repeated here for convenience.

(H1) A target-like understanding of factivity requires recognition of the compositional character of factivity, i.e. the interrelation of a potentially factive matrix predicate with a tensed/aspect marked complement clause.

H1.1 Since the complementizer *that* is not obligatory in factive complements, *that* does not play a leading role in acquiring the target-like interpretation of factive and nonfactive sentences.

H1.2 Production of finite complement clauses does not coincide with mastery of factive structures.

H1.3 Acquisition of factive nonfinite complements is delayed, as it is more difficult to infer their non-overt tense/aspect marking from the surface structure than for factive finite complement clauses.

H1.4 Response stance complements occur rather late in children's speech, resulting from the specific property of r-predicates to δ-bind the embedded event variable without inducing a presupposition.

H1.5 Children are sensitive to the contributing factors 'type of matrix predicate' and 'type of complement clause' from early on.

(H2) Since p-factive and nonfactive matrix predicates differ in the possible truth-values that their complement clauses can receive, the language learner masters (some of) these nonfactive predicates at the same time at which she correctly interprets complement clauses of p-factive matrix predicates as presupposed to be true.

(H3) Given that within a discourse-semantic framework p-factive predicates are linguistic presupposition triggers, children assign truth-values to complement clauses based on this linguistic property rather than according to pragmatic measures such as probability. In calculating a sentence's interpretation, language learners take into account the previously established discourse background.

(H4) Children recognize the syntactic restrictions of factive complements (prohibition of long adverbial *wh*-movement, negation-raising, ECM structures, subject-to-subject raising, and of postposing) only after they have established rf Comp as a δ-binder of the embedded event variable at the level of LF.

Starting with some general remarks on language acquisition research, I called attention to the general indeterminacy of the data and reviewed the characteristics of the most common methods for studying the acquisition of factivity: longitudinal case studies and comprehension experiments. Subsequently the above acquisition hypotheses were compared with a range of findings from longitudinal studies on the acquisition of complex sentences and from experimental studies on the comprehension of p-factive and nonfactive predicates.

Regarding H1, previous longitudinal studies focused on the syntax of complementation and dSid not explicitly address the issue of factivity. It was found that children begin to produce complex sentences in their third year of life, starting with nonfactive matrix predicates. The range of complement types initially comprises *wh*- and *to*-complements as well as *that*-complements, typically without the overt complementizer. In order to examine more specifically the lexical-semantic and syntactic aspects of factive sentences, I analyzed the longitudinal Adam- and Abe-corpora from the CHILDES database for the first occurrences of a range of p-factive and nonfactive matrix predicates and their complements. My case studies revealed that – as implied by H1.2 – production of finite nonfactive complements precedes the production of finite factive complements, which starts around age 4. Based on these data I proposed the Factivity Acquisition Hypothesis for production FAH_{Prod}, which states that factive complement clauses are produced later than nonfactive complement clauses. Furthermore, the complementizer *that* was found to be often absent in the children's speech, confirming H1.1. Only one factive infinitival complement occurred, supporting H1.3, and as predicted by H1.4 response stance verbs are not attested before the age of 5.

Relating the first occurrence of factive sentences at age 4 to the development of a theory of mind, I argued that theory of mind is a necessary, but not sufficient prerequisite for acquiring factivity. This assumption is supported by the findings from a number of studies that all report theory of mind to develop between the ages of 3;6 and 4. It is a necessary

precondition, as without the distinction between facts in the actual world and different mental representations of this world the child cannot arrive at an adult-like representation of factive sentences. Theory of mind is not sufficient, though, for mastering factivity, since the acquisition of specifically linguistic facets of factivity including its representation at the level of LF and its repercussions on syntax does not directly result from the ability to attribute mental states to other people. This proposal is an extension of the model of linguistic determinism, according to which it is the structural format of syntactic complementation that provides the means for developing a theory of mind that in turn paves the way for mastering the semantics of mental verbs.

This proposal also allowed specifying the developmental path for the comprehension of factive and nonfactive sentences, implied by H2. I put forth the Factivity Acquisition Hypothesis for comprehension FAH_{Comp}, stating that (a) before development of a theory of mind children interpret all complement clauses as true, and (b) after emergence of a theory of mind, p-factives are distinguished from the various types of nonfactive matrix predicates according to the possible truth-value of their complement clauses. The pattern in (a) was argued to be equivalent to use of a complement-only strategy, according to which the complement clause can be interpreted independently of the matrix clause.

The findings from semantic and pragmatic studies on the acquisition of factivity suggest a gradual increase of mastery of factivity on a verb-by-verb basis, with p-factive and nonfactive matrix predicates being generally acquired at about the same time. Experiments in the lexical-semantic framework furthermore indicate that young children's interpretation of complex sentences is indeed guided by the complement-only strategy. However, conflicting findings are reported regarding the age of mastering factivity. Both lexical-semantic and pragmatic types of studies vary considerably with regard to the age at which they assume factivity to be mastered. The ability to assign truth-values to sentential propositions solely based on the semantics of the matrix predicate is claimed to emerge as early as 4 and as late as 14. I argued that previous studies remain inconclusive with regard to the FAH_{Comp} for two reasons. First, they have underestimated the complexity of the acquisition task. All studies focused on the interpretation of factive and nonfactive verbs embedding *that*-complement clauses and did not examine the role of the type of complement clause in achieving a factive interpretation of a complex sentence. In addition, previous studies exclusively employed accommodation scenarios that neglect the crucial property of factive complements to refer back to an already established discourse background. Second, the underlying rationale of the study as well as test materials and experimental design might have affected the results considerably. Most importantly, the majority of researchers employed the negation test as a diagnostics for distinguishing factive and indeterminate matrix predicates. Results may thus reflect children's understanding of sentential negation rather than their interpretation of factive sentences. Note that as a result the hypotheses H1.5 and H3 could not be assessed, as they make claims regarding the interpretation of complex sentences with various types of complement clauses and against a previously established discourse background.

Finally, H4 regarding the syntactic restrictions of factive complements was examined. Previous studies on long adverbial *wh*-movement and negation-raising indicate that weak island effects are recognized around age 7 or 8, that is after the children may have mastered the presuppositional interpretation of factive sentences. I argued that the syntactic restrictions of factives regarding long adverbial *wh*-movement and negation-raising are learned

rather late, because they are weak rather than defining properties of factives, giving rise to ambiguity of the input data.

Concluding, some of the previous acquisition studies on the comprehension of factive and nonfactive sentences suggest that children initially take all complement clauses to express true propositions. This interpretation pattern is abandoned when nonfactive and p-factive matrix predicates are distinguished by the child. Previous studies differ, however, with regard to the age at which this developmental step is assumed to take place. There is evidence that it occurs as early as age 4, at the same time at which theory of mind develops and at which the first factive sentences occur in children's speech. Alternatively, some results suggest that the developmental shift takes place during the first school years, at around the same time at which the weak island effects of p-factive matrix predicates are recognized, or even later, during adolescence. Results may be influenced by the fact that these studies tested only *that*-complements and exclusively employed accommodation scenarios. In Chapter 7 I will present my own two experimental comprehension studies, which take into account these factors, and reexamine the question of at which age children master factivity. Reconsidering the three general questions of language acquisition research posed at the beginning of this chapter, the hypotheses and findings presented above primarily bear on the first question of what children know at certain ages. The questions of how children acquire that knowledge and how and why they modify their language systems will be the focus of the next chapter, which attempts to incorporate the findings presented here into a developmental model of development.

6. Towards a Developmental Model

6.1 Introduction

Guided by four acquisition hypotheses, in the last chapter I discussed the development of the concept of factivity from a syntactic, cognitive, lexical-semantic, and pragmatic perspective. The hypotheses as well as the findings mainly bear on the question of when the child acquires which aspects of factivity and in which order. So far I have said only little about how factivity is acquired and how and why children advance in their understanding of the concept of factivity. These issues are at the heart of any language acquisition theory of factivity, which has to account for the logical and the developmental problem of language acquisition. That is, children acquire their mother language in a relatively short time and in a fairly uniform fashion despite impoverished input, and at the same time their language acquisition is not instantaneous but gradual. As a first step towards a developmental model of factivity, in this chapter I attempt to integrate the acquisition hypotheses along with the findings from longitudinal and experimental studies into a developmental path.

One of the central findings of the previous chapter is that children below a certain age understand finite complement clauses as if they expressed true propositions. This interpretation pattern was reported in studies on the comprehension of nonfactive verbs as well as in studies on the relation between theory of mind development and acquisition of complementation within the framework of linguistic determinism. How can the language learner arrive at an interpretation of complement clauses as always being true? I argued that this kind of interpretation reflects use of a complement-only strategy (COS), according to which the complement clause can be interpreted independently of the matrix clause. In other words, children are claimed to process complex sentences differently than adults. What is the relation between the childlike processing strategy COS and general assumptions on language processing? Do we know how adults process factive and nonfactive sentences? In order to address these questions, I will introduce a psycholinguistic perspective to our model of factivity, before outlining the developmental path towards mastering factivity.

The chapter is organized as follows. Section 6.2 contains an overview of main aspects of processing of (non)-factive sentences and relates them to the interpretation strategies guiding children's comprehension processes. Section 6.3 integrates the acquisition hypotheses and previous findings on the acquisition of factivity into a sequence of development that encompasses cognitive, lexical, syntactic, and discourse-semantic factors. Section 6.4 summarizes the findings and points to open questions.

6.2 The Psycholinguistic Perspective

To date few studies have examined the question of how children process sentences (e.g, Trueswell, Sekerina, Hill & Logrip, 1999). In contrast, there is a bulk of research into

different aspects of language processing in adults. In this section I give a brief overview of those aspects of language processing that pertain to factive and nonfactive sentences and relate them to the interpretation strategies guiding children's comprehension processes such as the COS.

Following Fodor (1983) I assume that the mind includes among its modules a module of the language processor, and furthermore, that there is modularity within the language processor itself. For ease of exposition, let us assume the following model of language processing (in adults).

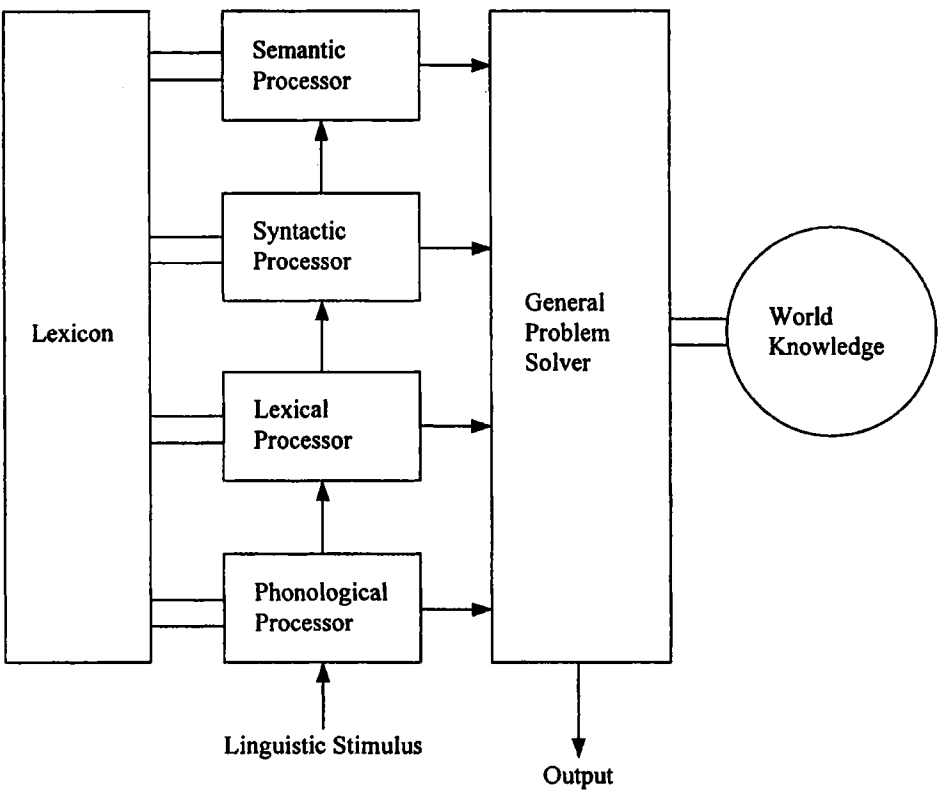

Figure 6.1 Model of language processing (after Forster, 1979)

Language processing is regarded as a sequence of operations transforming a mental representation of a linguistic stimulus into more abstract representations. The General Problem Solver – a highly generalized and flexible central computing system – consists of a device for collecting information from the four subsystems. In contrast, the subsystems, i.e. the phonological, lexical, syntactic, and semantic processors, are assumed to perform highly limited and specific tasks in an inflexible manner. They each segment the input and assign structures according to the rules specific to their module and according to the information present in the lexical entries. The listener structures each linguistic input during comprehen-

sion rather than delaying an interpretation until the end of a phrase or an utterance (for evidence, see Fodor, Bever & Garrett, 1974; Frazier, 1978; Forster, 1979; Frazier & Rayner, 1982; Rayner, Carlson & Frazier; 1983, Ferreira & Clifton, 1986; Frazier, 1987; and Frazier & Clifton, 1996). Leaving aside for now the question of whether initially all possible analyses are calculated or whether only one structure is assigned at each subprocessor I assume that in case of false processing decisions reanalysis is possible (i.e. the case of the so-called garden-path sentences). Processing factive and nonfactive sentences bears especially on the lexical, syntactic, and semantic levels of processing. Section 6.2.1 briefly addresses each of these aspects with respect to language processing in adults. In Section 6.2.2 the assumptions about language processing in adults are related to the child processing strategy of COS.

6.2.1 Mechanisms of Language Processing in Adults

Little research has explicitly addressed the question of how adults process factive and nonfactive sentences (but see Rullmann, 1991; Inhoff, 1985). Nonetheless, some studies on lexical, syntactic, and semantic aspects of processing dealing with topics other than factivity bear on factivity-related issues. These will be sketched in turn. I will show that only with respect to the syntactic parsing strategies are the theoretical assumptions strict and the empirical evidence for processing in adults strong enough to make clear predictions regarding children's sentence processing.

Regarding the lexical level of processing, we may ask how sentences with matrix predicates such as *forget*, which can subcategorize more than one type of complement clause, are processed. Are all possible thematic grids of a verb initially activated upon processing this verb or is only the most salient (e.g., frequent) thematic grid made available? Work on lexical processing provided evidence of parallel activation of all senses of ambiguous words independent of biasing context.[1] Extending this line of research, Carlson & Tannenhaus (1988) conducted experiments on thematic roles measuring reading times of temporarily ambiguous sentences. They stipulated that the thematic grids of a verb behave like senses or meanings of a word. Processing thematic roles is assumed to proceed as follows. Lexical access makes first available all the senses of an ambiguous verb in parallel and the sets of thematic roles associated with each sense. Only the sense of the verb that is contextually most appropriate (or, in the absence of biasing context, the most frequent one) remains active along with its thematic grid(s). Thematic roles are provisionally assigned to the arguments of the verb as soon as possible; any active thematic role incompatible with such an assignment becomes increasingly inactive. In their study, subjects heard sentences that contained verbs with multiple thematic grids such as *load* or verbs with only one thematic grid such as *fill*. Assuming that thematic assignments differ in preference,[2] Carlson &

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[1] See for example Swinney (1979), Tannenhaus et al. (1979), Seidenberg et al. (1982), but see Rayner & Frazier (1989) and Frazier & Rayner (1990) for a different view. Based on results from eye-movement studies Frazier and her colleagues argue that immediate interpretation takes place. Words with multiple meanings (*ball, ring*) are first interpreted by assigning a default (i.e. the preferred reading according to frequency or plausibility); words with multiple senses (*library, poem*) are partially interpreted by assigning the features shared by both senses.

[2] For example, *load the truck with bricks* should be preferred to *load the truck onto the ship.*

Tannenhaus found only slightly longer reading times for the less-preferred assignments than for the preferred assignments, both of which were longer than for the unambiguous verbs. This finding agrees with the authors' assumption that initially all thematic grids available for a verb are activated. However, it does not refute the alternative hypothesis that first the preferred thematic grid is assigned and is reanalyzed immediately after encountering the disambiguating phrase. Common to both proposals is the possibility of reanalysis in case the less preferred thematic grid or the thematic grid that is initially not activated turns out to be the correct one. With the results from processing of non-complement-taking verbs in adult listeners being inconclusive, hypotheses about the on-line assignment of thematic roles of complement-taking verbs in adults and language learners can only be speculative. Nonetheless, in Section 7.5.2 I will hypothesize how a child who encounters a sentence with a presupposition failure could arrive at a non adult-like interpretation via reanalysis of the thematic grid of the complement-taking matrix predicate.

Turning to the syntactic level of processing, the question arises of what syntactic structure is assigned to complement clauses embedded by p-factive and nonfactive matrix predicates. As this question pertains to the COS argued to guide young children's interpretation of complex sentences, the studies on syntactic processing are reviewed in more detail. Based on results from eye-movement studies, Frazier and collaborators assume that a syntactic analysis is assigned upon encountering a sentence and that rather than initially calculating all possible analyses only one structure is assigned (cf. Frazier, 1978; Frazier & Fodor, 1978; Frazier & Rayner, 1982; Rayner, Carlson & Frazier, 1983; Frazier & Clifton, 1996). The maxim of postulating at each step the minimal number of nodes required by the grammar is reflected in the interpretation principles of *minimal attachment* and *late closure* stated in (1) and (2) (Frazier, 1987: 562).

(1) Minimal attachment
Do not postulate any potentially unnecessary nodes.

(2) Late closure
If grammatically permissible, attach new items into the clause or phrase currently being processed (i.e. the phrase or clause postulated most recently).

Minimal attachment predicts selection of the attachment site requiring the fewest number of nodes if two attachment sites are available in the grammar. Consider example (3).

(3) John hit the girl with the book.
a. John hit [the girl] [with the book].
b. John hit [the girl [with the book]].

Minimal attachment can account for the finding that the preferred reading of (3) is (3a), where the PP is attached to the VP instead of being attached to the NP as in (3b) (Rayner et al., 1983). The former reading postulates fewer nodes than the latter. Late closure comes into play if two equally minimal attachment sites exist, favoring the integration of the currently processed item into the lower phrase-structure tree rather than to phrases higher up. This is exemplified in (4) below.

(4) Bill said that John died yesterday.
a. Bill said [that John died yesterday].
b. Bill said [that John died] yesterday.

Due to the late closure strategy, *yesterday* is interpreted as modifying the complement clause as in (4a) rather than modifying the main clause as in (4b) (Kimball, 1973; Frazier, 1978). What is more, the late closure strategy is corroborated by the fact that the preferred structure of ambiguous sentences such as (5) contains a complement clause rather than a relative clause; the reading in (5a) is preferred, with the NP *the story* being attached to the lower clause instead of to the main clause as in (5b).

(5) John told the girl that Bill liked the story.
    a. John told the girl [that Bill liked the story].
    b. John told the girl [that Bill liked] the story.

Only if the input supplies the intonation and pauses appropriate for the relative clause reading is the relative clause structure assigned in the initial parse. Frazier contends that the two strategies of minimal attachment and late closure apply independently of specific structures and independently of the specific language:

> Assuming that the need to structure material quickly is related to restrictions on human immediate memory capacity, we might expect humans to adopt the first available constituent structure analysis. If so, we expect the minimal attachment and the late closure strategies to be universal. (Frazier, 1987: 565)

Supposing that the child's interim grammars do not fall outside the scope of Universal Grammar as implied by continuity approaches to language acquisition, the statement above predicts that the language learner's structural representation does not violate these strategies either. In light of the proposed COS the question arises of whether this prediction is actually borne out. This issue will be examined in the Section 6.2.2.

As for the semantic and pragmatic level of processing, the question arises of whether the meaning assigned to a factive sentence is calculated in terms of truth-values or probabilities. While to date no study has directly assessed this issue, a self-paced reading study by Rullmann (1991) examined the interpretation of semantic-syntactically factive and pragmatically factive sentences (for the distinction of pragmatic and semantic-syntactic factivity, see Section 2.5). Assuming psychological reality of the two kinds of factivity, we expect differences in processing. Rullmann investigated response times to yes/no questions following semantic-syntactically factive (6) and pragmatically factive (7) sentences.

(6) The US envoy to Yugoslavia did not forget that the Romanian diplomat was suspected of spying.
    Was the Romanian diplomat suspected of spying? YES

(7) The US envoy to Yugoslavia did not report that the Romanian diplomat was suspected of spying.
    Was the Romanian diplomat suspected of spying? YES

Response times were expected to be faster in case of semantic-syntactic factivity, because only knowledge about language had to be taken into account in order to answer the yes/no questions correctly. It should take longer to determine the answer following a pragmatically factive sentence, because knowledge about the language and the world and the specific context had to be considered. However, response times were found to not differ significantly, with slightly longer response times for the pragmatically factive sentences. In addi-

tion, the overall error rate to responses was extremely low. According to Rullmann, the lack of significant differences could be explained by assuming that the task was too easy for small differences in complexity to show up. Moreover, one could argue that processing of semantic-syntactically factive sentences also involves considerable steps of interpretation, including taking into account the verb class of the matrix predicate, the possible thematic grids and the proposition of the embedded clause, arriving at a factive interpretation only if the complement clause is tensed/aspect marked. In any case, this data reveals that processing pragmatic information is not necessarily easier or faster than accessing semantic-syntactic or lexical information. Note that this result stands in contrast to pragmatic approaches to the acquisition of factivity claiming that access to pragmatic information is easier for children (cf. Section 5.6.2).

To conclude, only with respect to the syntactic parsing strategies are the theoretical assumptions strict and the empirical evidence for processing in adults strong enough to make clear predictions regarding children's sentence processing. These predictions will be spelled out in the next section.

6.2.2 Implications for Sentence Processing in Children

This section demonstrates how the syntactic principles of minimal attachment and late closure can be employed to spell out the complement-only strategy (COS) observed in young children. I will argue that while the child's interim grammar is not in concordance with the grammar of the target language, the universality of the processing principles remains unaffected. Comparing the interpretation of finite and nonfinite complement clauses, I will propose that both can undergo the COS, but that only finite complement clauses receive a semantic interpretation as true. The discussion of possible attachment sites for the complement clause will reveal that the empirical evidence is not yet strong enough to decide between the alternatives.

The definition of the complement-only strategy is repeated in (8) below.

(8) Complement-only strategy (COS)
The last complement clause in a complex sentence is interpreted independently of the matrix clause, if the complement clause could receive an independent interpretation.

First consider finite complement clauses. Given that in English finite complements can be interpreted independently of the matrix clause,[3] the COS predicts that upon perceiving a complex sentence with a finite complement clause younger children process the comple-

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[3] In German, matrix verbs permitting verb-second complements could constitute a test case for the COS (Reis, p.c.). Only sentences of type (i) are predicted to undergo the COS, while verb-final complements as in (ii) should not be subject to the COS.

(i) Ich glaube, er hat Recht.
I believe he has right
'I believe he is right.'

(ii) Ich glaube, dass er Recht hat.
I believe that he right has
'I believe that he is right.'

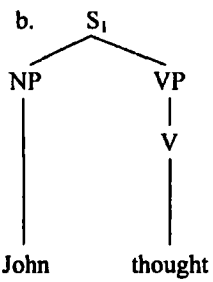
ment clause independently of the matrix clause. Leaving aside for the moment the question of how to deal with overt complementizers, *that*-complements such as in (9) can receive an independent interpretation. *Bill liked the story* can be interpreted without the matrix clause, arriving at a semantic interpretation of the sentence in which it is true that Bill liked the story.

(9) John thought that Bill liked the story.

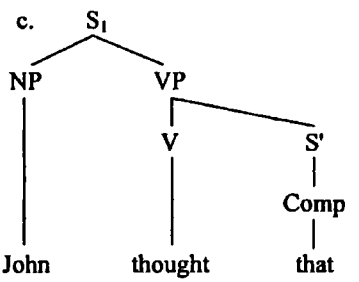
How does the corresponding structural representation emerge? Suppose the language learner hears the sentence in (9). Given that the words are incorporated into a constituent structure as each item is encountered, the language learner roughly carries out the steps of analysis illustrated in (10). I leave aside for the moment the question of whether and how the incoming items are labeled. For ease of comparison with approaches in the literature, the structural representation is restricted to lexical nodes and S and S'.

(10) a.

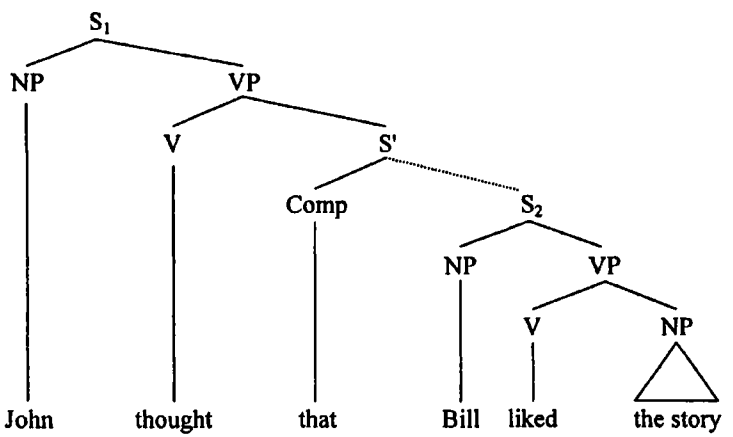
b.



c.



d.



The detachment of the finite complement from the matrix clause is only possible in case the S_2 node is not attached to S'. Detaching S_2, however, contravenes the principle of late closure, according to which the items *Bill liked the story* have to be integrated into the phrase just being postulated, that is into S'. This contradiction can only be resolved by assuming that the late closure principle is not at work at all here. In other words, we have to argue that postulation of an S node automatically opens up a new independent processing unit for the language learner. Now we are left with the question of how the complementizer *that* is interpreted in this case. Using findings from production and comprehension studies in

Chapter 5 I argued that young children are not sensitive to presence of the complementizer (cf. H1.1). Consequently, I contend that the complementizer *that* is simply not analyzed by younger children when building a representation of the incoming sentence. Alternatively, we could assume that only if the complementizer *that* is not lexically realized can the embedded clause S_2 be interpreted as independent. Since this hypothesis predicts that the comprehension of finite complement clauses is different for complement clauses with and without overt complementizer, this hypothesis is not pursued here. For the same reasons, a third alternative is discarded. The language learner could interpret the complementizer *that* as a demonstrative pronoun yielding the structure *John thought that – Bill liked the story.* In order to maintain this assumption one had to assume that disambiguating intonation and pauses are ignored by the child or not incorporated into the structure accordingly. What weighs more, however, is the undesirable consequence that sentences with and without the complementizer differ in their structural representation.

In short, I assume that children up to the age of about 4 employ the COS in processing complex sentences containing a finite complement clause and that they do not structurally represent the complementizer *that* if present in the input. As for the semantic interpretation, finite complement clauses are interpreted as expressing a true proposition, whether the matrix predicate is actually p-factive or not. As a result, while the child's interim grammar is not in concordance with the grammar of the target language, the universality of the processing principles remains unaffected. Note that these assumptions concern the syntactic and semantic interpretation of the complement clause only. No claim is made about the interpretation of the matrix clause and about the interpretation of the kind of *wh*-questions studied extensively by Roeper, de Villiers and collaborators (cf. Section 5.7.1). Their findings indicated two different answering patterns. On the one hand, children's answers to questions such as *How did Kermit ask who to help* frequently addressed the medial *wh*-complementizer as if the question had been *who to help.* On the other hand, children answered questions such as *What did he say he drank* as if they had been asked *What did he drink.* While the former type of response pattern was found in children up to age 6, the latter response pattern was found in children below age 4. It has to be left for further research whether and how these findings bear on the complement-only strategy proposed for the interpretation of complement clauses in assertions.

Let us now turn to nonfinite complement clauses. Recall that the COS has initially been stated to account for the interpretation of *that*-complements embedded by nonfactive matrix predicates. Only if nonfinite complement clauses can be interpreted independently of the matrix clause are they subject to the COS. The existence, albeit limited, of matrix infinitives in English (11) suggests that infinitival complements as in (12) can be interpreted on their own.

(11) a. To be rich and beautiful!
b. Me eat meat? No way!

(12) a. I want to be rich and beautiful!
b. You saw me eat meat? No way!

Which semantic interpretation does the child assign to nonfinite complements? Are nonfinite complement clauses – parallel to finite complements – taken to express true propositions? In Chapter 2 we saw that factive infinitival complements occur only with a limited

range of matrix predicates in English. Given that the language learner adheres to learning principles such as avoiding overly broad interim grammars, it seems unlikely that children would start with a default of interpreting nonfinite complement clauses as true. If the child supposes that complement clauses – whether finite or nonfinite – express a true proposition, then she has to learn that for each nonfinite complement clause it is probably not interpreted as factive. Moreover, nonfinite matrix clauses are most frequently used to express questions, desires, or commands and are only rarely used in a declarative function, i.e. to comment on on-going activities (for nonfinite matrix clauses in German, see Lasser, 1997; for Russian see Avrutin, 1997, 1999). Therefore, it seems unwarranted from the point of view of the target grammar to initially assign a factive interpretation to nonfinite complement clauses. Further research is needed, however, to examine whether this assumption can be confirmed.

In sum, while both finite and nonfinite complement clauses can be interpreted independently of the matrix clause, under the COS finite but not nonfinite complement clauses receive a semantic interpretation as true.

Given that under a COS complement clauses are interpreted independently of the matrix clause, the question arises of how the matrix and the complement clause are connected. Note that the question of the semantic interpretation has to be regarded separately from the attachment site of complement clauses, which *per se* does not make any predictions about the semantic features of the complement. In what follows I will briefly discuss five possible structural relations:

(a) The two clauses do not bear any structural connection.
(b) The two clauses are coordinated.
(c) The complement clause is adjoined to VP.
(d) The complement clause is adjoined to V'.
(e) The complement clause is correctly attached as a sister of V^0.

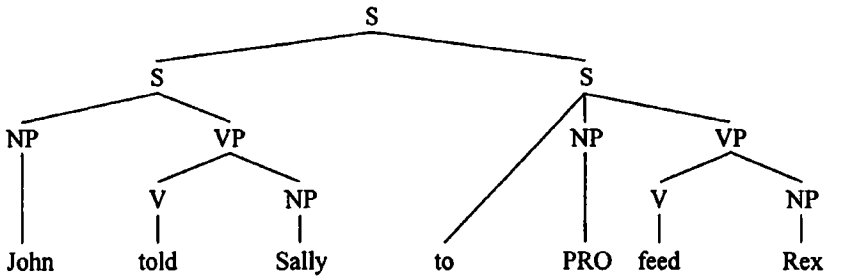
Proposals (a) to (d) share the assumption that upon encountering a structure not yet generated by the learner's grammar (e.g., nonfactive sentences embedding a false complement) the language learner attaches the respective items too high within the structural representation. By contrast, (e) assumes correct attachment of the complement and holds other grammatical modules responsible for misinterpretation. The discussion will show that at this point the empirical evidence is not strong enough to decide between these hypotheses.

To my knowledge, the first structure has not been considered. The coordination structure (b) has been suggested by Tavakolian (1977). She calls this *conjoined-clause analysis* (13).

(13) Conjoined-clause analysis
Where an adult will have one sentence dominating another, a child's analysis will ignore such hierarchical relationships between clauses and arrange them as conjoined clauses. In a child's reanalysis of the string, the two clauses are related only as sisters and have no other structural relationship to each other.

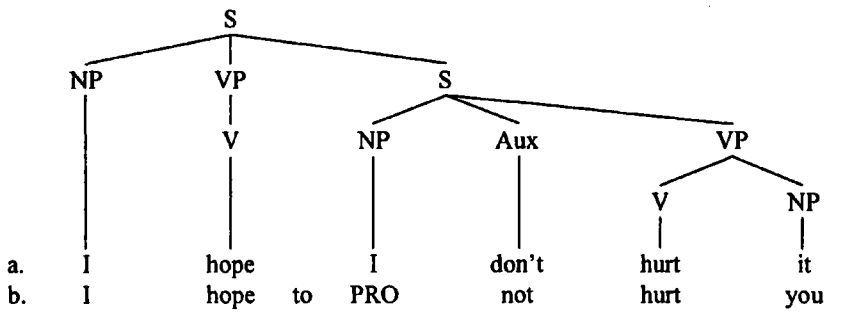
Applying the conjoined-clause analysis to infinitival complements, she proposes the structure exemplified in (14) below to hold for three- and four-year-olds. According to Tavakolian, the observation that children initially permit an arbitrary reference for the unrealized subject of the embedded clause can be attributed to the conjoined-clause analysis (but see for example Sherman & Lust, 1993, for an alternative account of the data).

(14)



Structure (c) has been proposed for example by Phinney (1981a) in terms of the *S-attachment hypothesis*. She holds that sentential complements (infinitives, tensed clauses, relative clauses) are interpreted as sisters of VP until subcategorization principles are activated. The following example illustrates the structure.

(15)



Phinney (1981a) remarks that while studies on the interpretation of infinitives, particularly on the interpretation of PRO, can shed some light onto the underlying structure adopted by the child, the interpretation of finite complement clauses presents a problem in that no obvious false responses emerge from adopting the above structure. This is in contrast to our assumption that children favoring a too high attachment interpret finite complement clauses as true.

Roeper & de Villiers (1994) put forth a version of the fourth hypothesis: the *default adjunction hypothesis* according to which the complement clause is adjoined to VP. Default adjunction occurs whenever the child cannot determine whether the complement she has identified in the input is an argument or an adjunct. In contrast to the adult's representation of a complement clause as subcategorized by a matrix verb shown in (16a), the child adjoins the complement clause to VP as illustrated in (16b) (Roeper & de Villiers, 1994: 11).

(16) a. adult representation b. child representation

Moreover, the attachment level is claimed to explain the presence or absence of certain feature specifications of sentential complements. Roeper & de Villiers hold that it is at the

VP level that verb-class characteristics are expressible, including the property of mental verbs to select propositional complements. At the V' level, on the other hand, idiosyncratic properties such as optional *that*-deletion are expressible. Roeper & de Villiers consequently predict that as long as the child mistakenly adjoins the complement clause to V' she does not have access to idiosyncratic verb properties. The assumption that the adjunction option is overextended as a default as long as the respective language specific representation is not yet acquired agrees well with recent accounts that describe children's interim grammatical representations as *minimal default grammars* (cf. Roeper, 1996).

Contrary to the aforementioned hypotheses some researchers have argued for proposal (e). Müller & Penner (1996) for example contend that children's initial omission of complementizers cannot be attributed to the child's grammar being different from the adult's with respect to the availability of syntactic positions. Arguing within the strong continuity hypothesis they claim instead that child grammar is a complete licensing system at any stage of development, differing only in that certain language- and item-specific components are initially inaccessible for the child. As a result, the rule of complementizer insertion is applied later in acquisition when certain features of the syntactic position Comp are fully specified.

Assessing the five attachment hypotheses, it has become clear that the empirical evidence gathered up to this point is not conclusive enough to refute or comprehensively support any of the hypotheses. For this reason I assume that the COS forms the basis of comprehension at the early stage of acquisition – leaving open the question of where the complement clause is attached.

6.2.3 Summary

This section added a psycholinguistic perspective to the discussion of the acquisition of factivity. I gave a brief overview of those aspects of language processing that pertain to factive and nonfactive sentences and related them to the interpretation strategies guiding children's comprehension processes such as the complement-only strategy (COS). Siding with those who assume that the language processor is organized in a highly modular way, consisting at least of a phonological, a lexical, a syntactic, and a semantic processing submodule, I illustrated how these levels pertain to the processing of (non)factive sentences in adults and possibly in children.

Regarding the level of lexical, more specifically of thematic processing, I noted that the empirical evidence assembled so far is compatible with both the assumption that initially only the preferred thematic grid is activated and the assumption that initially all possible thematic grids available to a verb are activated. Common to both accounts is the possibility of reanalysis in case the favored structure turns out to be inadequate. In the discussion of my second experiment (cf. Section 7.4.5), I make use of this mechanism of reanalysis to explain how four- to six-year-olds may arrive at a non-adult-like interpretation of factive complements containing a failed presupposition.

As for the syntactic level of processing, I demonstrated how the syntactic principles of minimal attachment and late closure can be employed to spell out the complement-only strategy (COS) observed in young children. While the child's interim grammar based on a COS is not in concordance with the grammar of the target language, the universality of the

processing principles remains unaffected. Comparing the interpretation of finite and nonfinite complement clauses, I proposed that both can undergo the COS, but that only finite complement clauses receive a semantic interpretation as true. The discussion of possible attachment sites for the complement clause revealed that the empirical evidence is not yet strong enough to decide between the alternatives.

Regarding the semantic and pragmatic level of processing, the comprehension of pragmatically and semantic-syntactically factive sentences in adults was considered. While the experimental results did not conclusively confirm the difference between these two types of factivity, it has become clear that processing pragmatic information is not necessarily easier or faster than accessing semantic-syntactic or lexical information. This finding stands in contrast to pragmatic approaches to the acquisition of factivity claiming that access to pragmatic information is easier for children. Assuming a semantic-syntactic approach to factivity and its acquisition, the open question is how we can characterize the developmental path towards factivity. This question will be addressed in the next section.

6.3 Acquiring Factivity: A Developmental Path

In this section I propose a developmental path towards mastery of factivity that attempts to integrate the four acquisition hypotheses derived from the compositional model of factivity, the findings from longitudinal and experimental acquisition studies, and the observations on language processing. The hallmark of this developmental course is that it takes seriously the assumption that acquisition of factivity proceeds stepwise and not in an all-or-nothing fashion (cf. hypothesis H0). I have argued that both factivity and acquisition of factivity are anchored at more than one level of grammar. Consequently, the description of the developmental sequence will comprise cognitive, lexical-semantic, syntactic, and discourse-semantic aspects. The central assumptions are summarized below:

- Factivity is a complex phenomenon that places cognitive, lexical-semantic, syntactic, and discourse-semantic demands on the language learner.
- Cognitive development interacts with language development. Theory of mind is a necessary, but not a sufficient prerequisite for the understanding of factivity.
- Mastering factivity comprises the correct analysis and target-like production of factive and nonfactive sentences with regard to all relevant aspects.

This stepwise acquisition pattern as well as the acquisition hypotheses imply that correct feature specifications may occur in the various subsystems at different times and may vary in order across learners. This acquisitional picture agrees with learning-theoretical accounts according to which a given parameter cannot be set early if the relevant triggers are found in different modules (e.g., Penner & Roeper, 1998). Put differently, cross-modular triggering gives rise to a stepwise learning procedure.[4]

[4] See also d'Avis & Gretsch (1994), who describe the acquisition of complementizers in a building block model, in which the language learner has to correctly specify the features of a complementizer at the phonetic, syntactic, and semantic level in order to master a complementizer.

The chapter is organized as follows. Section 6.3.1 portrays the developmental stage 1 of simple sentences and simple events. In Section 6.3.2 the developmental stage 2 of acquiring the syntax of embedding is described. Section 6.3.3 depicts in detail the developmental stage 3, marked by the emergence of the theory of mind. In particular, it is discussed how we can account for the fact that children at this age may correctly distinguish between factive and nonfactive sentences, while violating the barrierhood properties of p-factive matrix predicates. The developmental stage 4, the recognition of barrierhood of factive Comp, is sketched in Section 6.3.4. Section 6.3.5 summarizes the developmental path. Each of these sections is structured in the same way. I start by briefly reconsidering the previous findings regarding the respective developmental stage and by spelling out the discourse-semantic interpretation underlying the children's utterances at that stage. The main characteristics of the respective developmental stage are then summarized in terms of which features are present and which are lacking. Addressing the questions of how factivity is acquired and how and why children advance in their understanding of the concept of factivity, in a next step I hypothesize what triggers the change of the child's knowledge system at that specific point in development. Following Roeper & de Villiers (1992a), I assume that a triggering experience involves a representation of the structure and an epistemologically prior analysis of context. The correspondence of both then allows a triggering experience to alter the current state and to advance the grammar.

Note that because of the limitations of previous acquisition research into the comprehension of factive and nonfactive sentences the suggested developmental course for the acquisition of factivity will contain certain gaps. First, the function of the type of complement clause in achieving a factive reading of a sentence cannot be considered here. In addition, calculation of a sentence's interpretation in relation to a given discourse background cannot be taken into account. As a result, the question of whether mastery of factivity occurs at the same time at which theory of mind develops can be answered only tentatively. These issues will be taken up in the two experimental studies discussed in Chapter 7.

6.3.1 Stage 1: Simple Sentences and Simple Events

The main characteristic of the first stage in the acquisition of factivity is the absence of p-factive verbs (cf. Section 5.4.1). When mental verbs first appear in children's speech around age 2, they exclusively receive a conversational interpretation. They are used to direct the interaction, as in *I guess, I'll go for a ride*, and they are not used to express reference to a mental state before age 4 (cf. Section 5.5.2). As for the syntactic formats, at around 2 years of age the child produces main clauses that exhibit functional projections including articles as well as tense and agreement paradigms and hence can be taken as evidence for the emergence of the IP. Complement clauses do not yet occur (cf. Section 5.4.1), i.e. the layer of CP is absent from the child's structural representation.[5]

[5] Note that some nonfinite complements such as raising infinitives have been characterized as IPs. Since at this stage neither finite nor nonfinite complement clauses are attested, it has to be assumed that presence of the layer of IP does not automatically trigger the production of infinitival complements with an IP structure (cf. Section 2.4.4.2), but that additional features trigger the emergence of infinitives.

Regarding the level of discourse-semantics, the event-variable introduced by a main clause is added to the existing file cards in the discourse frame without further modification. In terms of discourse-binding, the event variable is existentially bound by tensed Infl within the discourse frame. An exemplary structure is given in (17) below.

(17) a. Mary visited Lucy.
b. [$\exists e \varepsilon D_E$: visit (M,L,e)]

A simple sentence is thus mapped onto a simple event (de Villiers & de Villiers, 2000) and is therefore assumed to match reality. Consequently, children neither distinguish between facts and thoughts or beliefs nor between their point of view and the point of view of others. In other words, theory of mind has not yet developed (cf. Section 5.5.1). The main properties of stage 1 are summarized in Table 6.1 below.

Table 6.1 Characteristics of stage 1 (2;00 to 2;04)

Dimension	**What is there?**	**What is lacking?**
Cognitive		theory of mind
Lexical-semantic	production of mental verbs with non-mental interpretation	production of p-factive verbs
Syntactic	production of simple sentences	production of complement clauses
Discourse-semantic	for finite main clauses: [$\exists e \varepsilon D_E$: VERB (1,2,...,e)]	a discourse-model that takes into account dependent event variables

How is the next developmental stage kicked off? Upon encountering mistakes or false statements such as *This is Daddy* when pointing to the mother, the child learns that a simple sentence can be at odds with reality. This way the difference between true and false statements is recognized. In addition to lies and mistakes, pretense is recognized upon engaging in role plays that require the child to take on the role of some other character, for example a dog or the mother or a car, all of which are clearly different from the child's self (cf. Section 5.5.1).

The extension of the structural representation to CP is triggered by the analysis of sentences in the child's input that require a structural layer above IP. For example, utterances that contain complementizers (e.g., *I know that you're tired*) or interrogatives displaying inversion (e.g., *What can he do?*) force the language learner to project the complementizer and the *wh*-phrase respectively onto a new functional position C^0.[6]

[6] For the time being I remain non-committal as to how structure-building initially proceeds. It could occur according to some *merge* operation that draws on the classification of two items as head versus complement or specifier (cf. Chomsky, 1994; Roeper, 1994). Alternatively, a newly encountered item could be matched to a new minimal projection comprising the IP (cf. Radford's *minimal projection principle*, 1994).

6.3.2 Stage 2: Acquisition of the Syntax of Embedding

From a cognitive perspective, the second stage is characterized by the first usages of mental verbs with actual mental reference, i.e. the verbs refer to somebody's thought, memory or knowledge as in *She doesn't know all this* referring to an absent child (Shatz, Wellman & Silber, 1983). *Think, remember, wonder,* and *know* are reported to be among the first matrix verbs used in this function. Production of these verbs, however, does not go hand in hand with an adult-like understanding of the respective verbs. Distinctions between *know* and *guess* for example, and between *know* and *remember* are not recognized by children at this stage (cf. Section 5.5.2). In acquiring a range of mental verbs, the child's verb lexicon is extended so as to also comprise p-factive verbs such as *forget* and *remember*.

The triggering effect of the analysis of sentences headed by complementizers or by *wh*-phrases with inversion leads to the extension of the structural tree, adding the layer of CP. Consequently, the language learner is able to produce embedded clauses: *To*-, *wh*-, and *that*-complements occur at this stage of development (cf. Section 5.4.1). It is noteworthy, however, that even though p-factive verbs are in the child's repertoire and the format of *that*-complements is available to her, we only find finite complement clauses embedded by nonfactive matrix predicates, including verbs of propositional attitude (*think*), communication (*tell, say*), and desire (*hope, wish*) (cf. the analysis of the Adam- and Abe-corpus in Section 5.4.2). In other words, in concordance with the Factivity Acquisition Hypothesis for production, factive complements are not produced at this stage.

While at this stage the syntax of embedding is gradually mastered, the interpretation of complement clauses is not yet adult-like. Nonfactive verbs such as *think* and *believe* are treated as factive, as predicted by the Factivity Acquisition Hypothesis regarding comprehension (cf. Section 5.6). More specifically, the embedded complement retains its truth-value as a simple sentence regardless of the matrix verb. I attributed this interpretation pattern to the use of a complement-only strategy (cf. Section 6.1.2). In terms of discourse binding, for finite complement clauses the following structure is proposed: Tensed Infl in the embedded clause existentially binds the event variable just as in root clauses, as illustrated in (18).

(18) a. John forgot/thought that Mary visited Lucy.
b. $[\exists e \varepsilon D_E$: visit (M,L,e)]

I assume that the embedded event variable is always bound existentially in finite complements and that δ-binding is not yet available to the child. Note that the absence of δ-binding is in compliance with the fact that children at this age do not produce factive complements. Nonfinite complement clauses also undergo the COS, but are not interpreted as true. As no binder such as tensed Infl is present to existentially bind the event variable, I speculate that in this case the embedded sentence is interpreted as indeterminate or false. In short, the event variable introduced by the embedded verb is represented as an independent variable in finite and nonfinite complement clauses regardless of the matrix predicate. Table 6.2 below lists the main properties of this stage.

How is the child to learn that finite complements, unlike finite main clauses, can be false without influencing the overall truth of the sentence? First in combination with communication verbs, the child might encounter situations in which what is said is different from what is true. For example, the child hears someone say *Mother said that the book is on the*

Table 6.2 Characteristics of stage 2 (2;05 to 3;06)

Dimension	What is new?	What is lacking?
Cognitive	recognition of pretense; difference between true and false statements	theory of mind
Lexical-semantic	production of p-factive verbs	variety of matrix verbs
Syntactic	production of *to*-, *wh*-, and *that*-complement clauses embedded by nonfactive verbs	production of complements embedded by p-factive verbs
Discourse-semantic	COS – for finite complements: [$\exists e \varepsilon D_E$: VERB(1,2,...,e)] – (for nonfinite complements: indeterminate or false)	a discourse model that takes into account dependent event variables

table, whereas in fact the book is not on the table, but on the cupboard. When pitting this statement against reality the child finds that embedded statements can be false without changing the truth of the statement as a whole. Put differently, communication verbs such as *say that* require the child to interpret the complement as quotative. This discovery is then transferred to verbs of mental state. Consequently, if for example a parent catches his child watching TV and says *I thought you were playing in your room* the child can infer that her parent's thought is false. Inferences of this kind pave the way for the theory of mind.

6.3.3 Stage 3: Emergence of the Theory of Mind

The newly acquired syntax of embedding, which allows for the representation of propositional attitudes, evokes the main cognitive achievement of stage 3. Between the ages of 3;6 and 4, theory of mind develops, i.e. the ability to understand false beliefs and to distinguish between thoughts and reality. Consequently, differences between verbs such as *know* and *think* are recognized. Moreover, the use of mental verbs to refer to mental states increases distinctly, and a variety of mental verbs occurs in children's speech (cf. Section 5.5.2).

From a syntactic perspective, the child now produces finite complement clauses embedded by p-factive verbs like *forget* (cf. my analysis of the Adam- and Abe-corpus in Section 5.4.2). Nonfinite factive complement clauses are not yet produced by the language learner, as predicted by H1.3. P-factive matrix predicates are not yet regarded as a barrier to long adverbial *wh*-movement and to negation-raising (cf. hypothesis H4 and Section 5.7). At the same time, other barriers to *wh*-movement including medial *wh*-phrases are recognized by children at this age.

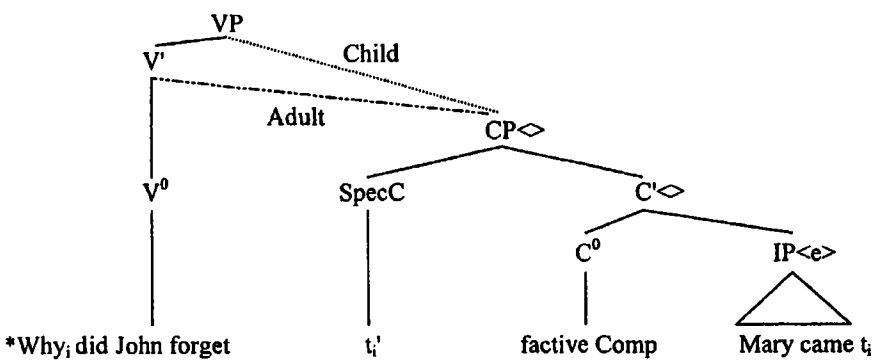
Following the model of linguistic determinism, the structural format of syntactic complementation provides the means for developing a theory of mind that in turn paves the way

for mastering the semantics of mental verbs. The discovery that, in contrast to facts, thoughts and beliefs can be false brings about the recognition that complements of communication and attitude verbs can be marked as true or false. According to this theory, complements of factive verbs should also be correctly interpreted as true at this stage. This prediction was borne out by some but not all of the experimental studies. I pointed out that the results might be influenced by the specific test design. For sake of concreteness, I will assume for now that four-year-old children begin to differentiate factive and nonfactive complements according to their truth-values. This assumption will be reexamined in Chapter 7 in light of the findings from my own experimental studies.

The crucial question to be asked then is how the child can succeed in assigning the correct truth-values to factive and nonfactive complements, while she fails to recognize that factive complements are islands for adverbial *wh*-movement and negation-raising. According to the discourse-semantic account developed in Section 4.3, propositional and speech report verbs involve existential quantification of the event variable relative to the mental model of the subject of the matrix clause. Factive complements, on the other hand, involve δ-binding of the event variable relative to the discourse frame of the subject, yielding an anaphoric reading of the complement clause. Recall that it is by virtue of δ-binding the embedded event variable that factive Comp is present at LF. Due to its presence at LF, factive Comp functions as a barrier to long *wh*-movement and to negation-raising by way of blocking the required antecedent government of the adjunct trace. In the child's knowledge system, however, the recognition that p-factive matrix predicates embed true (presupposed) complements does not coincide with the acknowledgment of their syntactic repercussions. In what follows, I will discuss three possible ways to account for this inconsistency: VP-attachment, as suggested by Roeper & de Villiers in a different context, misrepresentation of factives as positive-implicative, and dissociation of discourse-semantics and LF. I will argue that the last proposal best accounts for the empirical data.

First consider the proposal of VP-attachment. In light of the fact that children at this age acknowledge weak islands invoked by intervening *wh*-phrases but not by p-factive matrix predicates, Roeper & de Villiers (1994), claim that distinctions based on lexical items are acquired later than syntactic distinctions. They claim that children initially attach the complement clause too high and therefore do not have access to lexical idiosyncrasies, which are captured at the level of V' rather than at the level of VP. However, as illustrated in (19), it is evident that the attachment site of the complement clause does not affect the antecedent government relation between the intermediate and the original adjunct trace.

(19)



Factive Comp blocks the antecedent government of t_i by t_i' and renders the structure ungrammatical, regardless of the height of attachment. Therefore, without additional assumptions the VP-attachment hypothesis cannot explain why adverbial *wh*-movement is allowed given this structural representation.

Let us consider next the possibility of a misrepresentation of factive complements as positive-implicative complements. More specifically, let us suppose that children interpret factive and positive-implicative structures as being existentially bound within the discourse frame and that the δ-binding mechanism is not yet in place. In what follows, I will first sketch what this implies for the representations of the different verb classes and then contrast these representations with the empirical data.

Upon encountering triggering experiences such as conflicts between what is said and what is true, children recognize that the event variable of propositional verbs is evaluated relative to a mental model, while the event variable of factive verbs is evaluated relative to the actual file obtaining in the discourse. In consequence, existential binding of the embedded event variable takes place either relativized to the mental model (M_E) or relative to the discourse frame (D_E) of the subject of the matrix clause. Propositional verbs involve binding relative to the mental model. P-factive, positive-implicative and negative-implicative verbs involve binding within the discourse frame. The latter verb class has to be marked as embedding a false complement, while p-factive and positive-implicative verbs have to be marked as embedding true complements. Under this assumption, children assign the following discourse-semantic interpretations to complements embedded by attitude verbs (20), communication verbs (21), p-factive verbs (22), positive-implicative verbs (23), and negative-implicative verbs (24).

(20) a. John thinks that Bert visited Lucy.
b. $[\exists e \varepsilon M_E$: visit(B,L,e)] think(J,e), M_E = the set of events in John's mental model

(21) a. John said that Bert visited Lucy.
b. $[\exists e \varepsilon M_E$: visit(B,L,e)] said(J,e), M_E = the set of events in John's mental model

(22) a. John forgot that Bert visited Lucy.
b. $[\exists e \varepsilon D_E$: visit(B,L,e)] forget(J,e), D_E = the set of events in the discourse frame

(23) a. Bert happened to visit Lucy.
b. $[\exists e \varepsilon D_E$: visit(B,L,e)], D_E = the set of events in the discourse frame

(24) a. Bert forgot to visit Lucy.
b. $[\exists e \varepsilon D_E : \neg$ visit(B,L,e)], D_E = the set of events in the discourse frame

In the target-like representations (20) and (21), the indeterminate complements are interpreted as true or false depending on John's mental model. In (22), on the other hand, the factive complement is interpreted as true, but not as referring to an event file card already present in the discourse frame, because the embedded event variable is not δ-bound. The positive-implicative structure (23) and the negative-implicative structure (24) are again target-like. The former representation ensures that the embedded event is added to a new file card, and the latter representation states that the embedded event is not added to a new file card.

The distinction between evaluating the embedded event variable relative to a mental model or relative to the discourse frame is reminiscent of the feature [± point of view],

suggested by de Villiers & de Villiers (2000) for the CP specification of propositional and factive complements. In factive complements, C^0 is specified as [-point of view] and in nonfactive complements as [+point of view]; the matrix verb then selects a CP with the appropriate feature specification. However, this proposal is not yet comprehensive enough to account for the whole range of verb classes delineated above. Negative-implicative verbs, for example, while being also marked as [-point of view], have to be further specified as embedding a false complement. The feature specification [-point of view] has thus to be annotated either as [-point of $\text{view}_{\text{TRUE}}$] for p-factive and positive-implicative verbs or as [-point of $\text{view}_{\text{FALSE}}$] for negative-implicative verbs. For p-factive matrix predicates, a further feature is needed, since otherwise p-factive verbs would not be distinguishable from positive-implicative verbs. Moreover, the feature [± point of view] must not be present at LF, because it would incorrectly block *wh*-movement out of positive-implicative complements.

Let me now examine whether the proposed representations are corroborated by the language acquisition data. As soon as the distinction between evaluation relative to a mental model and relative to the discourse frame is introduced to the complement, the default COS is superseded by the performance of actual logical operations. The embedded event variables are evaluated dependent on the specific matrix verb rather than relative to the actual world. In contrast to complements of nonfactive verbs like *believe* and *think*, the complements of p-factive verbs like *forget* are interpreted as true (cf. Section 5.6.1), which is compatible both with a truly factive and with a positive-implicative representation. Furthermore, the structure of complements embedded by communication verbs is represented correctly. The embedded complement clause can be false without affecting the truth-value of the matrix clause. In short, the distinction between M_E and D_E determines the calculation of the embedded event variable, i.e. this variable is no longer represented as an independent variable regardless of the matrix predicate. Finally, the structure in (22b) agrees with the observation that long *wh*-movement and negation-raising are allowed by children at this stage. Since factive Comp is not regarded as a δ-binder, it is not present at LF. In turn it does not function as a barrier to long *wh*-movement or to negation-raising.

However, the analysis of factives as positive-implicatives suffers from three drawbacks. First, previous language acquisition experiments in fact cannot uncover whether the four-year-olds have a positive-implicative or a presuppositional reading of factive complements. If we ask the child whether the event stated in the complement clause occurred and she gives an affirmative answer, this can result from a representation as both a positive-implicative and a factive complement (cf. Section 2.6). Second, if factive complements are analyzed as involving existential binding of the embedded event variable, it is not clear why this type of complement does not occur earlier. Existential binding has been argued to be present already at stage 2, whereas factive complements occur only at stage 3. Last, if children interpret factive complements as positive-implicative, they will take a matrix negation to negate the embedded clause, resulting in the incorrect interpretation illustrated in (25b) below.

(25) a. Mary didn't happen to visit Lucy. ⊨ Mary didn't visit Lucy
b. Mary_i didn't forget that she_i visited Lucy. * ⊨ Mary didn't visit Lucy

However, this prediction is only partially borne out, as an overextended negation tendency (ONT) is not reliably attested for children of this age (Section 5.6.1). More importantly,

since acquisition of negation and acquisition of factivity are confounded, it is difficult to decide whether certain interpretation patterns result from the non-target-like comprehension of factivity or of negation.

Let us therefore explore the third proposal regarding the child's representation of factive complements at this stage that I refer to as the *dissociation of discourse-semantics and LF*. This proposal rests on the assumption that children at this age correctly interpret factive complements as presupposed, but do not represent the relevant features at LF, thus allowing long adverbial *wh*-movement and negation-raising. In other words, children at this stage correctly identify factive Comp as a δ-binder of the embedded event variable. They fail, however, to link this specific discourse-semantic property of factive Comp to the level of logical form at which the factive Comp features have to be represented syntactically. In short, the remaining task of the language learner is to render the discourse-semantic properties into syntactic features. How does the language learner discover that factive complementizers δ-bind the embedded event variable, i.e. select a definite description? I contend that the definite description reading is realized upon encountering unambiguous input that is analyzed according to the child's current structural representations. Suppose that the child's current representational system begins to distinguish between propositional verbs that are interpreted relative to a specific mental model and verbs that are interpreted relative to a discourse frame. However, the language learner does not yet distinguish positive-implicative from factive verbs. This distinction may by triggered by evidence of the following kind. Imagine a situation in which a mother has given her child some ice-cream for desert. Absentmindedly the mother might offer the child some more ice-cream later that day and then say something like:

(26) Oops, I totally forgot (that) you already had ice-cream for dessert. You cannot have ice-cream twice a day.

Upon the child's protest the mother might elaborate on her answer by reminding her child of the specifics of the situation of eating ice-cream at lunch. The child then realizes or knows that the proposition expressed in the complement clause is true. She moreover grasps that the ice-cream eating in the complement clause does not refer to any ice-cream eating event but to a specific event, which is already established as part of what happened before, i.e. as part of the discourse file of mother and child. As a result, the child might reanalyze the existential binding of the event variable as δ-binding and arrive at the correct discourse-semantic interpretation given in (27) below.

(27) a. I forgot (that) you had ice-cream.
b. [regarding δe: have(child, ice-cream, e)] mother forgot that it occurred

A similar kind of evidence could be provided by the explicit contrast between a p-factive and a nonfactive matrix predicate. Imagine a dialogue in which the child asks her father *Do you think that Mom made a cake?* If the father responds with something like *I do not only think, I know that she made a cake* and shows the child the cake, the child may infer that *knowing* is different from *thinking*. If we assume that the embedded event variable of factive complements is correctly δ-bound in this stage of development, we can explain why various types of nonfactive but no factive complement clauses are produced in the second developmental stage. The existential binding of the embedded event variable is present from early on. As soon as the syntax of embedding is acquired, nonfactive complements

can be produced and are assigned an existential reading relative to the discourse frame. Then, in the third developmental stage the evaluation of propositional complements is relativized to the subject's mental model as sketched above. In the second stage the δ-binding mechanism is not yet in place. Consequently, factive complements are not produced since otherwise a possibly irreversible wrong interpretation would be assigned to the structure, i.e. existential binding of the embedded event variable.[7] In short, factive complements are produced and correctly interpreted by the child as soon as the δ-binding mechanism has come into place, i.e. around the age of 3;6. A further important piece of evidence for a child's presuppositional reading of factive complements would be the reaction to a failed presupposition. While a false positive-implicative complement can simply be negated, a false factive complement has to be rejected explicitly (cf. Section 3.3.2). This issue will be addressed in one of the experimental studies (cf. Chapter 7).

Before proceeding, let me briefly reconsider which element may δ-bind the embedded event variable. Without further argument I have assumed that the event variable is correctly bound by factive Comp at this developmental stage. Alternatively, the child could assume that any Comp can δ-bind an embedded event variable, or that the p-factive matrix predicate can trigger δ-binding. The first alternative can be discarded because previous experimental studies demonstrated that at this stage factive and nonfactive complements do not receive the same interpretation. The second alternative, that the p-factive verb triggers δ-binding regardless of the type of complement clause cannot be discarded, because in the studies conducted so far, the type of complement clause was not varied across different types of matrix verbs. Therefore, the interrelation between the type of complement and type of matrix predicate will be examined in both experiments in Chapter 7.

Given that in this stage the embedded event variable in factive complements is δ-bound by factive Comp, why is factive Comp not present at LF? Recall that only an element that does not contribute to the (discourse-)semantic interpretation can be deleted at LF (cf. Section 4.3.2). Factive Comp, however, clearly contributes to the interpretation by virtue of δ-binding the event variable. The language acquisition task, then, is to make the knowledge already operating with regard to the discourse-semantic interpretation available to other relevant aspects of the system, i.e. to the level of LF. This is in concordance with the representational redescription model proposed by Karmiloff-Smith:[8]

> It involves a cyclical process by which information already present in the organism's independently functioning, special-purpose representations is made progressively available, via redescriptive processes, to other parts of the cognitive system. (Karmiloff-Smith, 1992: 17f)

This task is difficult, however, because the child is exposed to ambiguous input in at least three different ways and for this reason delays anchoring factive Comp at LF. First, while the presuppositional reading, i.e. δ-binding at the top level of representation, is exclusive for p-factive matrix predicates, the δ-binding mechanism also applies to complements of

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[7] It has been suggested that the underlying principle 'avoid irreversible wrong decisions' causes the language learner to resort to interim grammars, so-called minimal default grammars, whenever the trigger evidence necessary to set a parameter is inaccessible for reasons of ambiguity (cf. Roeper & de Villiers, 1992a, 1994; Penner, 1996).

[8] See also Tracy's (1995) hypothesis of UG-assisted self-regulation. She claims that system-internal conflicts arise through the necessity to establish mappings across representational levels and to cope with competing analyses and inconsistencies.

response stance matrix predicates. Syntactic restrictions including prohibition of long adverbial *wh*-movement and of negation-raising can be derived from the property of δ-binding the embedded event variable rather than from the property of presupposing the truth of the complement clause (cf. Section 4.4). It may be that only if response stance verbs are correctly interpreted does the language learner realize that the δ-binder factive Comp has to be present at LF. The implications of this view are not pursued here any further, as to date the acquisition of response stance verbs has not been studied.

Second, the syntactic restrictions that hold for factive (and response stance) sentences are weak rather than defining properties of p-factive matrix predicates. I showed that for each of the syntactic phenomena there is some nonfactive matrix predicate exhibiting the same pattern (cf. Section 4.2). Put differently, a syntactic restriction such as prohibition of adverbial *wh*-movement may be reflected differently at LF for factive complements and for nonfactive complements. Complements of negative-implicative verbs, for example, prohibit adverbial *wh*-movement without δ-binding the embedded event variable.

Third, the input data regarding the complementizer itself is ambiguous for the child. P-factive matrix predicates do not generally require the presence of the complementizer *that* (cf. Section 4.1.12). Therefore, I proposed that the relevant features of factive Comp including [$t_{CC}\leq$] rather than the overt complementizer have to be present at LF (cf. Section 4.3.2). Rendering this observation in terms of language acquisition, presence of the overt complementizer *that* does not signal factivity to the language learner. Rather the child is exposed to ambiguous input of the following kind:

(28) a. I said that we make popcorn later.
b. You said you don't want any dessert.

(29) a. I forgot that I left the door open.
b. You forgot you already had some ice-cream.

(30) a. Daddy agreed that the soup tasted good.
b. I agree I was in a bad mood this morning.

From data such as the ones above the child cannot infer that the complementizer in (29) and (30), but not in (28) plays a role at LF, since the complementizer can be left out in all these sentences.[9] Thus, the features of factive Comp are not represented at LF. This assumption agrees with the finding that the complementizer is ignored by younger children (see hypothesis H1.1 in Chapter 5). In consequence, the barrierhood of factive Comp is not yet acknowledged, and long *wh*-movement and negation-raising out of nonfactive and factive complements are predicted to be permitted in the child's grammar. As shown before, these predictions are borne out by the data. On the other hand, given the principles of deletion at LF, elements such as medial *wh*-phrases are present at the level of Logical Form. Hence they constitute barriers to movement in children of the same age (cf. Section 5.7.1). Once elements are represented at LF they cannot be deleted, and therefore the child is expected to delay representing factive Comp features at LF to avoid irreversible wrong decisions.

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[9] Note that this line of reasoning also holds true for German. Since the complementizer *dass* (that) is – *modulo* verb-second complements – obligatory in all complement clauses, the child cannot infer that only the factive complementizer plays a special role at LF.

In sum, neither the VP-attachment hypothesis nor the misrepresentation of factives as positive-implicatives withstands close examination. In contrast, the third proposal resting on the dissociation between discourse-semantic properties and their realization at LF can account for the findings of previous language acquisition studies. Note that this proposal predicts that children at this age interpret sentences such as (31a) target-like as presupposing (31b), while incorrectly allowing a long distance reading.

(31) a. $\text{Why}_{i/j}$ did John forget t_i Mary came late $*t_j$?
b. Mary came late

It has to be left to further research to examine whether this prediction is actually borne out in a test design such as the one sketched above. In sum, the following properties are assumed to characterize stage 3:

Table 6.3 Characteristics of stage 3 (3;06 to 7;00)

Dimension	What is new?	What is lacking?
Cognitive	theory of mind	
Lexical-semantic	production of a variety of mental verbs in mental interpretation	
Syntactic	production and comprehension of finite complement clauses embedded by factive verbs	factive nonfinite complements; factive Comp barrier to long *wh*-movement and to negation-raising i. e. presence of factive Comp at LF
Discourse-semantic	calculation of dependent event variables:[a] – factive (finite) [δe: VERB (1,2,...,e)] X VERB that e occurred – indeterminate (finite, nonfinite) [$\exists e \varepsilon M_E$: VERB (1,2,...,e)] VERB(X,e) – pos.-implicative (nonfinite) [$\exists e \varepsilon D_E$: VERB (1,2,...,e)] VERB(X,e) – neg.-implicative (nonfinite) [$\exists e \varepsilon D_E$: ¬VERB (1,2,...,e)] VERB(X,e)	probably: δ-binding mechanism for r-complements

[a] X refers to subject of the matrix clause

How does the language learner discover that factive Comp blocks long *wh*-movement as well as negation-raising? In general, I assume that these barrierhood properties may be

acquired for verb classes rather than on a strict verb-by-verb basis, as the child at this stage already distinguishes factive from nonfactive verbs according to the status of the embedded event variable.[10] de Villiers' et al. (1997) results from a study on the semantic and syntactic properties of factive and nonfactive verbs confirm the assumption adopted here that recognition of presupposition alone does not suffice to block long adverbial *wh*-movement. As for the instantiation of this restriction, they conclude the following:

> Some pattern of language use and meaning must inform the child about the appropriate classification, at which point *wh*-movement will be barred. All we can say at present from both child and adult data is that neither presupposition nor entailment patterns are sufficient triggers for the reclassification of the verbs in the present study. (de Villiers et al., 1997: 164)

The main difficulty with regard to the prohibited long distance reading of the *wh*-adverbial pertains to the problem of the poverty of the stimulus (cf. Chapter 5), more specifically to the problem of no negative evidence. Even if all fronted *wh*-structures the child is exposed to only suggest a short distance reading, she cannot conclude that long *wh*-movement is barred in general. Imagine a child hears the sentence *Why did you forget that it's my birthday today?* Even though it is obvious that there is no sensible answer to the question of why the speaker's birthday is today, this does not mean that all sentences to come will exhibit the same pattern.

At this point, the source of this triggering experience cannot be determined conclusively. It may be that negated structures can provide the child with some of the information necessary to reanalyze the factive structures as islands to movement. Suppose a situation in which a child had ice-cream for dessert and after the next meal the mother offers the child some more ice-cream, saying:

(32) I did <u>not</u> forget (that) you already had ice-cream for desert. I'm wondering whether you want some more.

Even though in general the child treats p-factive verbs as negation-raising verbs, in this case the negation cannot have been raised from the embedded clause as illustrated in (33).

(33) *I did not$_i$ forget [$_{CP}$ t$_i$' (that) [$_{NegP}$ t$_i$ [$_{IP}$ you had ice-cream]]].

The interpretation in (33) is excluded, because the child knows that the mother knows that she had ice-cream, i.e. that the proposition 'not(you had ice-cream)' is false. Since in the child's grammatical system complement clauses embedded by p-factive verbs refer to true events in the discourse frame, she rejects this interpretation. Since in negation-raising structures the meaning of the sentence does not vary with the position of the negation, patterns of language use such as that exemplified above could inform the child that the moved structure is not permissible. This could trigger the instantiation of the δ-binder factive Comp as a barrier, i.e. presence of factive Comp at LF. In that case factive Comp blocks antecedent-government of the original trace t$_i$ created by the moved negation via the intermediate trace t$_i$', and the event position of *not* cannot be θ-identified with the event position of the complement clause. Consequently, the language learner bars negation-raising for *forget*. In turn, this barrier could be extended to other verbs classified as p-factive as well as to other syntactic structures, including long adverbial *wh*-movement.

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[10] Newly acquired verbs may still be treated first as nonfactive to avoid irreversible wrong decisions.

In a different vein, one might speculate that p-factive adjectival predicates play a role in discovering the barrierhood properties. Philip & de Villiers (1992) noted that children between the ages of 4 and 7 detect the barrierhood of adjectival predicates like *be glad* more easily than the barrierhood of verbs like *forget* (cf. Section 5.7.1). This finding might be attributed to the following observation. While adjectival matrix predicates allow matrix questions headed by *why* (34), this structure is ungrammatical for verbal matrix predicates, unless they are interpreted as elliptic (35).

(34) a. Why$_i$ are you surprised t_i that I did the dishes *t_i?
b. Why$_i$ are you surprised t_i?
Answer: Because you never do them.

(35) a. Why$_i$ did you forget t_i that I did the dishes *t_i?
b. */?Why$_i$ did you forget t_i?
Answer: because it didn't look like it.

Assume that the language learner starts out by allowing both long and short distance readings of the *wh*-word for sentences such as (34a) and (35a). If the child encounters input of the form (34b) she bans the long distance reading for adjectival predicates from her grammar. At this point it has to remain open how this change is applied to p-factive verbs. Further research is also required to spell out how adjectival matrix predicates such as *be afraid* or *be sure* are dealt with under this account, since they pattern on *be surprised* without being factive.

In sum, in order to represent factive Comp features at LF, the language learner has to overcome the ambiguity of the input data. Ambiguity arises from three sources. The δ-binding mechanism is not exclusive to presuppositional complements, but applies to complements of factive and response stance matrix predicates. Syntactic restrictions of factive (and response stance) complements are weak rather than defining properties of p-factive matrix predicates, as for each of the syntactic phenomena there is some nonfactive matrix predicate exhibiting the same pattern. Last, the optionality of the complementizer *that* gives rise to ambiguity. The grammatical reanalysis is triggered by unambiguous input of the kind speculated on above.

6.3.4 Stage 4: Barrierhood of Factive Comp

In this acquisition stage the language learner expands her vocabulary to include a broader range of p-factive, negative-implicative, and propositional verbs. As a consequence of representing the δ-binding features of factive Comp at LF, the barrierhood of factives for long adverbial *wh*-movement is recognized and factive matrix predicates are no longer treated as negation-raising predicates. As for the other developmental changes, at this point I can only speculate. Since all syntactic repercussions are a result of the same blocking mechanism, I expect the other syntactic repercussions of factive and response stance sentences (prohibition of ECM infinitival complements, of subject-to-subject raising, and of postposing) also to be recognized at this stage. Moreover, response stance complements may occur in children's speech. In addition, it may be that factive infinitival complements are interpreted correctly at this stage. This would require the language learner to differentiate between

factive and nonfactive nonfinite complements – parallel to the differentiation of finite complements according to factivity. Finally, the principles of presupposition projection and defeasibility may be learned during this time. Table 6.4 lists the main properties of this developmental stage.

Table 6.4 Characteristics of stage 4 (after 7;00)

Dimension	What is new?	What is still lacking?
Cognitive		
Lexical-semantic	production of a variety of matrix verbs (probably also including response stance verbs)	
Syntactic	factive Comp as a barrier to long *wh*-movement and to negation-raising	
Discourse-semantic	probably: mechanism of δ-binding for r-complements and for nonfinite factive complements	

6.3.5 The Developmental Path in a Nutshell

Extending de Villiers and de Villiers' (2000) model of linguistic determinism, I have detailed four acquisition stages that characterize a child's developmental path towards mastery of factivity and have pinpointed possible triggers for development. In stage 1 the language learner starts out with simple sentences that are mapped onto simple events. In stage 2, in the course of acquiring the syntax of embedding, the child's representational system is being equipped with the structural format necessary to represent embedded propositions, thus paving the way for the mastery of the theory of mind. The resulting distinction between facts and thoughts enables the child in stage 3 to correctly interpret propositional verbs as well as implicative verbs. In propositional complements the embedded event variable is evaluated relative to the subject's mental model and accordingly interpreted as true or false, while in negative-implicative and positive-implicative complements the embedded event variable is evaluated relative to the discourse frame and interpreted as false or true, respectively. I argued that at this stage factive complements are correctly interpreted as involving an embedded event variable that is δ-bound. Evidence for this assumption comes from my production study, which showed that factive complements are first produced around the age of 4, and from several comprehension studies, which indicated that factive complements are understood in a target-like manner by children at this age. In other words, the presuppositional reading of a factive complement clause is mastered. At the same time, syntactic restrictions on factive structures including barrierhood regarding *wh*-movement and negation-raising are not recognized at stage 3. I argued that this asynchrony results from a dissociation of discourse-semantic and logical form properties. Factive Comp δ-binds the embedded event variable, but is not present at LF. Neither of the two alternatives, the

VP-attachment hypothesis and the hypothesis of misrepresenting factive as positive-implicative complements, could account for the empirical findings. I argued that the δ-binding features of factive Comp are not yet part of the child's grammatical representation at LF due to multiple ambiguities of the input data. As for a possible triggering experience, I speculated that the representation of factive Comp at LF may be triggered by the analysis of factive sentences with matrix negation in unambiguous contexts. It may also be triggered by the analysis of adverbial *wh*-questions with adjectival matrix predicates. I conjectured that, as a result, factive Comp will be recognized as a barrier to negation-raising and *wh*-movement as well as to the other syntactic restrictions including prohibition of ECM infinitival complements, of subject-to-subject raising, and of postposing.

6.4 Conclusion

In this chapter I addressed the questions of how factivity is acquired and how and why children advance in their understanding of the concept of factivity. I proposed a developmental path towards mastery of factivity that integrates the acquisition hypotheses and the findings from longitudinal and experimental studies discussed in Chapter 5.

I argued that children's use of interpretation patterns such as the complement-only strategy indicates that they process complex sentences differently than adults. Therefore, a psycholinguistic dimension was added to the compositional model of factivity. Siding with those who assume that the language processor is organized in a highly modular way, consisting at least of a phonological, a lexical, a syntactic, and a semantic processing submodule, I illustrated how these levels pertain to the processing of factive and nonfactive sentences in adults and possibly in children. Regarding the level of lexical, more specifically of thematic processing, I noted that the empirical evidence assembled so far is compatible with both the assumption that upon encountering a verb initially only the preferred thematic grid or all thematic grids of the verb are activated. Common to both accounts is the possibility of reanalysis in case the favored structure turns out to be inadequate. In the discussion of my second experiment (cf. Section 7.4.5), I will make use of this mechanism of reanalysis to explain how four- to six-year-old children may arrive at a non-adult-like interpretation of factive complements containing a failed presupposition. As for the syntactic level of processing, I demonstrated how the syntactic principles of minimal attachment and late closure could be employed to spell out the complement-only strategy observed in young children. It was argued that while the child's interim grammar based on a complement-only strategy is not in concordance with the grammar of the target language, the universality of the processing principles remains unaffected. Comparing the interpretation of finite and nonfinite complement clauses, I proposed that both can be subjected to a complement-only strategy, but that only nonfinite complement clauses receive a semantic interpretation as true. The discussion of possible attachment sites for the complement clause revealed that the empirical evidence is not yet strong enough to decide between the alternatives. Regarding the semantic and pragmatic level of processing, the comprehension of pragmatically and semantic-syntactically factive sentences in adults was considered. While the experimental results do not conclusively confirm the difference between these two types

of factivity, it has become clear that processing pragmatic information is not necessarily easier or faster than accessing semantic-syntactic or lexical information. This finding stands in contrast to pragmatic approaches to the acquisition of factivity claiming that access to pragmatic information is easier for children.

Incorporating the observations from processing, I proposed a developmental path of mastering factivity. This developmental course takes seriously the assumptions that a) factivity is compositional in nature comprising cognitive, lexical-semantic, syntactic, and discourse-semantic aspects, and that b) acquisition of factivity proceeds stepwise and not in an all-or-nothing fashion. Anchoring the acquisition task at multiple levels allowed expressing the connection between cognitive and language development as well as the interrelation between the lexical-semantics of the matrix predicate and the syntactic type of complement clause. As a further consequence of the multidimensionality of this concept, I took that mastering factivity comprises the correct analysis and target-like production of factive and nonfactive complements with regard to all relevant aspects. Before age 4 children entertain a complement-only strategy arriving at an apparently target-like interpretation of factive, but not of nonfactive complements. The next stage is marked by the emergence of theory of mind as a result of which children seem to correctly interpret factive complements as presupposed. As one of the central issues in the acquisition of factivity I identified the question of how we can explain that children at the age of about 4 seem to produce and correctly interpret factive complement clauses, while failing to recognize that factive complements are islands to extraction. Discarding two alternative hypotheses, I argued that this asynchrony results from a dissociation of discourse-semantic and logical form properties. Factive Comp δ-binds the embedded event variable, but is not present at LF. I claimed that the δ-binding features of factive Comp are not yet part of the child's grammatical representation at LF due to multiple ambiguities of the input data. I speculated that the representation of factive Comp at LF may be triggered upon the analysis of factive sentences with matrix negation in unambiguous contexts or upon analyzing adverbial *wh*-questions with adjectival matrix predicates.

This developmental path contains certain gaps resulting from the limitations of previous research into the comprehension of factive and nonfactive sentences. The function of the type of complement clause in achieving a factive reading of a sentence could not be considered, because studies only tested *that*-complements. In addition, calculation of a sentence's interpretation in relation to a given discourse background could not be taken into account, as only accommodation scenarios were employed in these studies. As a result, the question of whether mastery of presuppositional aspects of factivity occurs at the same time at which theory of mind develops could be answered only tentatively. Moreover, children's reaction to presupposition failure, which could shed light on the question of whether factive complements are interpreted as positive-implicative, was not tested. The two experimental studies to be discussed in the next chapter aim at filling these gaps and recasting the developmental course accordingly.

7. Experimental Studies

7.1 Introduction

Previous research on the acquisition of factivity has focused on the interpretation of factive and nonfactive sentences embedding *that*-complement clauses presented in accommodation scenarios. This chapter presents and discusses two experimental studies examining preschool children's comprehension of factive and nonfactive sentences in different syntactic and discourse contexts. Both experiments were designed in a way that allowed testing the acquisition hypotheses that could not be assessed in previous studies. The findings from these studies will allow filling some of the gaps in the developmental path sketched in the previous chapter and recasting the developmental course accordingly. It will be shown that four- to six-year-old children are able to correctly assign truth-values to factive and nonfactive complement clauses by taking into account the factors 'type of matrix predicate' and 'type of complement clause' and by considering the given discourse background. By contrast, reaction to presupposition failure will turn out to be a further aspect of factivity that is not learned before age 7.

The chapter is organized as follows. Section 7.2 outlines the rationale of the experiments and gives an overview of the acquisition hypotheses to be tested. Section 7.3 presents the data from Experiment 1. The data from Experiment 2 is presented in Section 7.4. Section 7.5 compares the results from both experiments and speculates on how children interpret failed presuppositions. Based on the results from both experiments, in Section 7.6 the developmental path is recasted. Section 7.7 contains a summary.

7.2 Rationale of the Experimental Studies

This section outlines the rationale of the two comprehension experiments and gives an overview of the acquisition hypotheses that the two experimental studies tested. Focusing on the third developmental stage, the main objective of the experimental studies was to investigate whether preschool children in interpreting factive and nonfactive complex sentences take into account all contributing factors: the type of matrix predicate, the type of complement clause, and moreover the previously established discourse background if there is one.

Experiment 1 tested whether four- to six-year-old children assign truth-values to complement clauses based on discourse-semantic properties rather than according to pragmatic measures. It also assessed whether children take into account, when calculating a sentence's interpretation, the previously established discourse background, as hypothesized in H3, repeated below in (1).

(1) Hypothesis 3
Given that within a discourse-semantic framework p-factive predicates are linguistic presupposition triggers, children assign truth-values to complement clauses based on

this linguistic property rather than according to pragmatic measures such as probability. In calculating a sentence's interpretation, language learners take into account the previously established discourse background.

This hypothesis cannot be evaluated in an experimental design that is based on accommodation scenarios. Therefore, I developed an experiment that required processing the complex sentences in relation to different discourse backgrounds, modeled by the factor story-event (henceforth s-event) with the values [s-event/non-s-event]. This way children's reaction to presupposition failure could also be tested. Including cases of presupposition failure can shed light on the question of whether factive complements are indeed interpreted as presuppositional or whether they are incorrectly interpreted as positive-implicative matrix predicates, which implicate the truth of their complement. In Section 6.3.3 I argued that questions about the truth of the complement clause in absence of a discourse background cannot distinguish between a positive-implicative and a factive interpretation. In the case of failed truth, however, both verb classes give rise to different answers. While a false positive-implicative complement can simply be negated, a false factive complement has to be rejected explicitly. From the Factivity Acquisition Hypothesis regarding comprehension, repeated in (2) below, it follows that complement clauses of p-factive matrix predicates should not be interpreted as positive-implicative by children older than age 4.

(2) Factivity Acquisition Hypothesis$_{Comp}$ (FAH$_{Comp}$)
   a. Before development of a theory of mind children interpret complements of factive and p-factive matrix predicates as true.
   b. After emergence of a theory of mind at about age 4, p-factive are distinguished from the various types of nonfactive matrix predicates according to the possible truth-value of their complement clauses

Furthermore, by including cases of presupposition failure in the test design we can examine whether – next to the barrierhood regarding long *wh*-movement and negation-raising – reaction to presupposition failure is a further aspect of p-factive verbs that is not mastered by children between the ages of 3;6 and 7;0. Given that reaction to a failed presupposition requires more computational ressources than interpreting a factive complement as presupposed to be true, I hypothesize that children between the ages of 4 and 7 are not yet able to master this aspect of factivity. This I call the Discourse-Semantic Hypothesis, which is stated in (3) (cf. also Schulz, 1997, 2000).

(3) Discourse-Semantic Hypothesis (DSH)
   The analysis of complements of p-factive matrix predicates is more complex[1] than the analysis of (finite or nonfinite) complements of nonfactive matrix predicates, if the presupposition of the complement clause conflicts with the discourse background already established, i.e. in case of presupposition failure.

Both, Experiment 1 and Experiment 2 tested whether children are sensitive to the compositional character of factivity, as predicted by H1.5, which is repeated in (4) below.

[1] See Section 7.3.4 for an operationalization of the term 'more complex'.

(4) Hypothesis 1.5
Children are sensitive to the factors 'type of matrix predicate' and 'type of complement clause' contributing to the factivity of a sentence from about age 4.

Consequently, the design of both experiments contained complex sentences with p-factive and nonfactive matrix predicates embedding finite or nonfinite complement clauses. These experiments also allowed me to reexamine the question of whether factive complements are correctly interpreted as presupposed at about age 4, as predicted by the Factivity Acquisition Hypothesis$_{Comp}$, or whether they are misinterpreted up to age 7 or 8. The second experiment examined children's understanding of complements of p-factive and nonfactive matrix predicates in isolation of other comprehension factors such as the discourse background.

I have argued that acquisition of factivity proceeds stepwise. Therefore, target-like interpretation of factive structures is predicted to emerge gradually rather than in an all-or-nothing fashion. This is captured by the Developmental Hypothesis in (5).[2]

(5) Developmental Hypothesis$_{Comp}$ (DH)
The understanding of factive and nonfactive complement clauses develops progressively until adult-like language competence is reached.

Note that the DH is not as obvious as it might seem at first sight. In the second experiment, which does not contain cases of presupposition failure, the DH nevertheless predicts children's performance to differ from adults' performance. The null hypothesis, claimed to hold for adults, is stated in (6).

(6) Null Hypothesis$_{Comp}$ (H_0)
The analysis of complements of factive and nonfactive matrix predicates does not differ in complexity as to the complement-type and the s-event-type [s-event/non-s-event].

In addition, the set up of Experiment 1 and 2 allowed reviewing the usage of the complement-only strategy, repeated in (7) (cf. Sections 5.6.1, 6.2.2).

(7) Complement-only strategy (COS)
The last complement clause in a complex sentence is interpreted independently of the matrix clause if the complement clause could receive an independent interpretation.

According to the COS, complements of p-factive matrix predicates containing a presupposition failure are not more complex than complements of p-factive matrix predicates with the presupposition fulfilled. Assuming that finite complements are analyzed as independent, the intended presupposition is not present at all. As an assertion the proposition can be affirmed as well as negated according to the given discourse background. Complements of nonfactive matrix predicates, however, are predicted to be incorrectly interpreted as true. The design of Experiment 2 moreover allowed reexamining the pragmatic inference hypothesis (cf. Section 5.6.2) repeated in (8) below.

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[2] Progression in development could proceed in steps or more gradually, for example on a verb-by-verb basis. Since this question can only be addressed in studies that compare performance of children from different age groups, this question is left for further research.

(8) Pragmatic inference hypothesis
The psychologically most likely interpretation (invited inference) is chosen, given a situation in which more than one truth-value is logically plausible.

According to the pragmatic inference hypothesis, propositional matrix predicates should be interpreted incorrectly, while p-factive and negative-implicative matrix predicates should be analyzed adequately.

To conclude, I argued that the DSH and the FAH hold true at the third stage in the acquisition of factivity, thereby discarding alternate hypotheses including the COS and the pragmatic inference hypothesis. The FAH_{Comp} along with hypothesis H1.5 is tested in Experiment 1 and 2. The DSH and H3 are tested in the first experiment only. H_0 and the DH are tested in both experiments as performance of children and adults is compared in each study.

7.3 Experiment 1

Experiment 1 focused on the question of whether preschool children assign truth-values to complement clauses based on discourse-semantic properties rather than according to pragmatic measures such as the perceived level of probability. Since this prediction cannot be evaluated in an experimental design that is based on accommodation scenarios, I developed an experiment that required processing the complex sentences in relation to different discourse backgrounds. Section 7.3.1 describes the participants of both experiments. Section 7.3.2 explains the test design and the materials, and Section 7.3.3 illustrates the testing procedure. Section 7.3.4 contains the predictions, derived from the hypotheses. In Section 7.3.5 the results of the experiment are presented, which are then discussed in Section 7.3.6.

7.3.1 Participants

Fifty-five children aged 3;3 to 6;11 (*MEAN* = 5;4; *SD* = 10.6 months) were tested. There were 2 three-year-olds, 12 four-year-olds, 14 five-year-olds, and 12 six-year-olds. The age range corresponds to stage 3 of the developmental path, delineated in Section 6.3.3. The children were drawn from three semi-rural day care centers in Massachusetts, USA. Five of these children participated in pilot tests, nine children left without completing both experiments, and one child was excluded from analysis because in the practice session he failed to respond to any of the questions. The children, who according to the teachers came from different social backgrounds, spoke English as a first language and were all free of hearing or speech defects. Of the 40 children taking part in the analysis, 23 were boys and 17 girls. Each subject participated in both experiments in an interval of two to six days, with order of experiments counterbalanced across subjects. Twenty-four adults with a mean of about 22 years were tested as a control group. The adults, 9 men and 15 women, were undergraduate students enrolled in introductory linguistics classes, who received course credit for their participation. All adults spoke English as a first language and were free of speech and hearing defects.

7.3.2 Materials for Experiment 1

In this section I discuss the method of truth-value judgments used in both experiments and explain the design of the test materials for Experiment 1. As the understanding of factive and nonfactive sentences draws on subtle differences regarding the type of matrix matrix predicates and complement type, the technique of truth-value judgments seems most appropriate for testing the developmental hypotheses. As test stimuli I used affirmative sentences to rule out the possibility that investigation into the understanding of factivity is confounded with the acquisition of negation.

The truth-value judgment (TVJ) task works as follows. The child is asked to make a bipolar judgment about whether a statement correctly describes a particular situation depicted in the preceding context. The statement is usually made by a puppet. It can be either an assertion (reward/punishment task) or a yes/no question (cf. also Abrams, Chiarello, Cress, Green & Ellelt, 1978; Crain & McKee, 1985). The child then judges the truth-value of the statement by rewarding or punishing the puppet for what it said or by responding to a puppet's yes/no question. In both versions of the TVJ task a context is supplied that unambiguously describes the relevant events. Making use of the fact that presuppositions are constant under yes/no question (cf. Section 3.3.1.2), the test stimuli in Experiment 1 were phrased as yes/no questions. In contrast to the assertive statements in the reward/punishment version of the TVJ task, yes/no questions seem to facilitate negative and positive responses. In addition, the simplicity of the subject's response minimizes the processing demands placed on the child. What is more, while providing fairly direct access to the linguistic competence of the child, the TVJ task does not draw on metalinguistic abilities such as judging grammaticality.[3]

In Experiment 1 the subjects heard eight stories describing adventures of one or two Sesame Street characters. The role of the discourse background was modeled as follows. Half the stories described an event that took place (s-event) and half described an event that failed to happen (non-s-event). Each story was followed by a yes/no question varying in verb type (*forget, tell*) and in complement type (*to, that*). The same story served as a preamble either to the *that*- or to the *to*-question.

A successful use of the yes/no version of the TVJ task places the following requirements on the test design (for similar considerations see Gordon, 1996):

(R1) Story and question must provide a plausible context allowing for positive and negative responses to the question.

(R2) It must be possible to identify a non-target-like response as such and to distinguish it from a target-like response.

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[3] For use of the method of *wh*-questions in testing children's understanding of finite and nonfinite complements, see de Villiers & Roeper (1991). Example questions are given in (i) and (ii).
(i) What did Kermit forget to buy? (eggs)
(ii) What did Kermit forget that he bought? (butter)
This method requires a rather complex structure of the story involving a planned event that fails to happen and an event that happens but is later forgotten by the story characters. What is more, in addition to the complement type the interpretation of the *wh*-word is tested. This complexity may have contributed to the results according to which four- and five-year-olds responded to both questions purely by chance.

(R3) World knowledge and story context must not provide clues regarding answers to the yes/no questions.
(R4) It must be possible to control for responses based on guessing.

Let us look at each of the prerequisites in turn. Imagine that after hearing a story about going shopping the subject is presented with the question in (9).

(9) Did Kermit forget to buy eggs?

If an adult responds with *yes* we take that to mean that in the story Kermit did not buy eggs, although he had the plan to; a *no* response means that in the story Kermit bought eggs. Even though the nonfinite complement of *forget* can only be interpreted as negative-implicative, (R1) is met in that another interpretation is possible were the child to have an incorrect grammar, which allowed the interpretation of the nonfinite complement clause as factive. A factive interpretation of *forget to* leads to responses that are at odds with those, which would arise from the correct grammar in line with (R2).[4] Let us review the possibilities one by one. In story 1 Kermit buys the eggs. A positive response to question (9) then suggests that the nonfinite complement was incorrectly interpreted as factive, whereas a negative response suggests a correct negative-implicative interpretation. In story 2 Kermit does not buy eggs. From a *yes* response to question (9) we can infer that the complement is interpreted as negative-implicative; from a *no* response we can infer that the complement is incorrectly analyzed as factive.[5]

Even when providing a context that makes two interpretations of the test question possible, as stated in (R1), we cannot conclude that incorrect or correct responses to the test question are based on a target-like interpretation of the s-event depicted in the story. Consequently, in order to meet (R2), we have to ensure that correct or incorrect responses are not caused by a misconception of the story in the first place. While a direct inspection of the child's analysis is impossible, we can attempt to unveil the child's understanding of the story by asking a further yes/no question inquiring about the truth of the embedded proposition as in (10). This I refer to as the story-comprehension question.

(10) Did Kermit buy eggs?

Responses to the story-comprehension question above reveal whether the subject understood the central content of the story. Following story 1, the response to (10) should be positive, following story 2 the response to (10) has to be negative. Consequently, we arrive at the following response patterns for nonfinite complements of *forget*, illustrated in Table 7.1, and for finite complements in Table 7.2.

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[4] Note that this interpretation of *forget to* requires either that the feature [± finite] can be ignored by the child or that finiteness is not yet conclusively connected with the discourse-semantic feature [±p-factive] (see Section 7.5.2 for spelling out this hypothesis).

[5] Note that this is simplifying somewhat, since the listener has to consider two aspects in interpreting the test questions: the evidence possessed by the person whose mental state is at issue, and the truth of the proposition (cf. also Abbeduto & Rosenberg, 1985). My experimental stories were designed so that the semantics of the matrix verbs *forget* and *tell* alone could not determine the response (see Table 7.6 for an overview of alternative scenarios).

Table 7.1 Correct responses for nonfinite complements of 'forget'

Questions	[s-event]	[non-s-event]
Did Kermit forget to buy eggs?	no	yes
Did Kermit buy eggs?	yes	no

Table 7.2 Correct responses for finite complements of 'forget'

Questions	[s-event]	[non-s-event]
Did Kermit forget that he bought eggs?	yes	no![6]
Did Kermit buy eggs?	yes	no

Response patterns that consist of one correct and one incorrect answer are most instructive. If the second story-comprehension question, but not the test question, is answered correctly, then it can be inferred that the child misanalyzed the complement structure given in the test question, while understanding whether the event had happened or not. Similarly, from an incorrect answer to the story-comprehension question we can conclude that an apparently correct response to the test question resulted from an incorrect understanding of the story. In addition, the number of correct responses to the story-comprehension question can reveal how the test items were overall understood by the child.

Recall that the matrix verb *forget* lends itself to this experimental design in that the presuppositional properties change depending on the subcategorized complement type, yielding a factive or a negative-implicative interpretation, which in turn gives rise to opposite responses to the two questions. Besides *forget* I included the matrix verb *tell*, which subcategorizes both finite and nonfinite complements as well. While both complements receive an indeterminate truth-value (cf. Section 2.6), their meaning differs nonetheless. When embedding a nonfinite complement, *tell* is interpreted as volitive (11). When embedding a finite complement, *tell* is interpreted as quotative (12).

(11) Did Oscar tell Bert to watch Cookie Monster?

(12) Did Oscar tell Bert that he watched Cookie Monster?[7]

Unlike with *forget*, the meaning difference between the finite and nonfinite complement does not rest on presuppositional distinctions. The structure *tell that p* generally implies that the embedded proposition is true unless one assumes that the subject does not tell or know the truth. The structure *tell to p* generally implies that p has not happened yet, but is desired to happen. The test stories either contained a request and the s-event did not happen, or the

[6] Besides explicit rejection of the presupposition such as *no, that's not true* (i.e. overt denial, cf. Section 3.3.2), simple negation is judged as a correct response. I opted for this conservative measure to also include subjects who expressed their recognition of the failed presupposition in some other way (for a discussion, see Section 7.3.5).

[7] Note that the pronoun *he* can refer to both story characters. The narrative as well as the pictures generally sufficed to disambiguate the reference of *he*. One of the test items might have been influenced by this ambiguity, however (cf. the discussion of the results in Section 7.3.5).

story depicted an s-event while no request was made. In the former case, for example if Bert had been asked to watch Cookie Monster but had not yet done so, the response to (11) is *yes*, while the response to (12) is *no*. In the latter case, i.e. if the event of watching Cookie Monster did happen while no request had been made, the response to (11) is *no*, and the response to (12) is *yes*.

As in case of *forget*, a story-comprehension question can reveal whether the subject understood the central content of the story. Due to the meaning of *tell*, the stories center around the request for something or the report of something, rather than around an event actually taking place or not. Therefore, *wh*-questions were included to test subject's understanding of the story. The response patterns for the nonfinite complements of *tell* are displayed in Table 7.3 and for the finite complements in Table 7.4.

Table 7.3 Correct responses for nonfinite complements of 'tell'

Question	[s-event]	[non-s-event]
Did Oscar tell Bert to watch CM?	no	yes
What did Big Bird say?	that he watched CM	to watch CM

Table 7.4 Correct responses for finite complements of 'tell'

Question	[s-event]	[non-s-event]
Did Oscar tell Bert that he watched CM?	yes	no
What did Big Bird say?	that he watched CM	to watch CM

Table 7.5 below summarizes the independent variables verb type, complement type, and type of s-event, resulting in eight different conditions for Experiment 1.

Table 7.5 Independent variables in Experiment 1

Verb	Type of complement	Story-event (s-event)
forget	*to*-complement	s-event
		non-s-event
	that-complement	s-event
		non-s-event
tell	*to*-complement	s-event
		non-s-event
	that-complement	s-event
		non-s-event

The combination of *forget that* and the non-s-event condition yields the case of presupposition failure, which was predicted to cause difficulties in interpretation in the developmental stage 3. Note that *tell that* in the non-s-event-condition does not result in an instance of

presupposition failure as the complement clause is interpreted as quotative, allowing for false statements. The following scenario illustrates the *forget*/non-s-event condition:

(13) Sample story: *forget*/non-s-event
Grover called Ernie on the phone and said: "I got a new game of marbles and I want to play it with you." Ernie said: "Oh, yes, sure, come over!" First, they played hide-and-seek. But they didn't play with the marbles, because Grover didn't remember about the new game. Then it was time for Grover to go home and he just went home.

Test question (version A):	Did Grover forget to play marbles with Ernie?
Test question (version B):	Did Grover forget that he played marbles with Ernie?
Text-comprehension question:	Did Grover play marbles with Ernie?
Optional question:	What did Grover do with Ernie?

The last question was optionally asked to gain additional information about the child's interpretation patterns. Answers were however not included in the statistical analysis. Note that the test question in experiment version A contains the case of presupposition failure. The target-like answer would be *No (since he didn't play marbles with Ernie at all)*. An example of the *tell*/s-event condition is supplied in (14) below.

(14) Sample story: *tell*/s-event
Big Bird got up and took the cake out of the fridge. Then he called the Cookie Monster and said to him: "Come and visit me this afternoon. I made a big cake." Cookie Monster said: "That sounds good. I'll come."

Test question (version A):	Did Big Bird tell CM that he made a cake?
Test question (version B):	Did Big Bird tell CM to make a cake?
Story-comprehension question:	What did Big Bird say?
Optional question:	Who made the cake?

The correct response to the test question in experiment version A is *yes*, in experiment version B *no*.

The matrix verbs *forget* and *tell* as well as the verbs used in the complement clauses (*bring, buy, invite, look for, make, play, watch*) are reported to occur in children's speech as of age 4 (cf. Hart at al, 1977; see also Section 5.4). The three or four line stories described adventures of one or two Sesame Street characters.[8] Due to the fictional status of the characters the test question could only be answered correctly on the basis of the story background and not on the basis of world knowledge, thus meeting requirement (R3). The test questions were counterbalanced across stories for the type of complement in order to avoid a possible story effect, arriving at experiment versions A and B. If the context of the story biases a certain response, i.e. favoring *yes* or *no* responses,[9] then the two versions A and B will significantly differ in their number of correct responses. To avoid biases of the matrix verbs the test verb was not used in the story itself. The act of forgetting was expressed by *not remember* plus an NP; the act of telling was expressed by using direct speech. A con-

[8] A pilot study had revealed that Sesame Street characters are familiar to most children and hence the names are easier to remember than the names of arbitrary male or female figures.

[9] For a positive bias in verification tasks in adults, see Wason (1961).

cluding sentence was added to each story to minimize the influence of these structures on the subject's response. Each story was accompanied by three pictures illustrating the main content of the story (for an example, see Appendix). The pictures provided visual clues to the understanding of the story thus minimizing the memory load of the children (cf. also de Villiers & Roeper, 1996; Gordon, 1996).

Having addressed the requirements (R1), (R2), and (R3), we are left with requirement (R4): taking care that responses are not simply guided by guessing the answers. By calculating the correlation between the number of correct answers to the story-comprehension question and the number of correct responses to the test question we can infer how many of the responses might be due to chance. If no correlation is found, then we can assume that responses are not due to chance.

In conclusion, the test design of Experiment 1 is characterized by the following features. The proposition contained in the complement clause is expressed verbally and visually. The response to the test question draws on the interpretation of the matrix verb and the complement clause. Expected responses are *yes* and *no*, as the generally indeterminate truth-value of the finite and nonfinite complements of *tell* is supplied by the content of the story. The experimental condition *forget that* [non-s-event] contains the case of presupposition failure. Note that the test design is not exhaustive, since the positive and negative responses are compatible with states of affairs other than those depicted in the stories. Table 7.6 gives an overview of other scenarios compatible with the conditions.

Table 7.6 Experiment 1. Relation of questions, response patterns, and situations

Testquestion	Response	Scenario	Alternative scenario
Did x forget to p?[a]	yes	$\neg p \wedge$ x planned to p	—
	no	p	no plan to p
Did x forget that p?	yes	p $\wedge$ x forgot that p	—
	no	$\neg$ p	p $\wedge$ x didn't forget that p
Did x tell y to p?	yes	$\neg p \wedge$ x wants y to p	—
	no	p	$\neg p \wedge \neg$ [x told y to p]
Did x tell y that p?	yes	p $\wedge$ x told y that p	—
	no	$\neg$ p	p $\wedge \neg$ [x told y that p]

[a] x and y: names of story characters; p: complement

The story backgrounds were designed to clearly set up the situation as depicted in the left column of Table 7.6. Children's responses to the story-comprehension question can reveal whether they agreed on the central situation of the story.

7.3.3 Procedure for Experiment 1

As mentioned above, each subject participated in both experiments over an interval of two to six days, with order of experiments counterbalanced across subjects. Order of items and version of experiment were also counterbalanced across subjects. Therefore eight lists were composed to each of which five children were assigned randomly. Permission to work with the children was obtained from the parents of all children. After becoming acquainted with the experimenter and the hand puppet the children were tested individually in a quiet room in their school with a teacher close by. Children's responses were tape-recorded to later check against the on-site transcription, which besides the verbal responses of the child contained non-linguistic reactions such as pointing to or looking at a picture. The sessions, all of which were conducted by the author, lasted about 15 to 20 minutes.

The procedure for Experiment 1 was as follows. A warm up session was followed by four practice items and eight test items. In the beginning, the child was asked whether she would like to hear stories and play with the hand puppet Evelyn the crocodile. The child was then placed at a table facing the experimenter who held the hand puppet. The hand puppet asked the child's name and age and told her that it liked to listen to stories but had a problem with its memory. The experimenter asked the child whether she could help the hand puppet if it had questions about the stories to be told because it was so old and already very forgetful. All children readily volunteered to help. By having the experimenter tell the stories and the hand puppet ask the questions it was hoped to make it easier for the child to entertain both positive and negative responses. The warm up session consisted of four yes/no questions that contained the test verbs with a nominal complement to confirm children's knowledge of the verbs and to acquaint the child with the format of yes/no questions asked by the hand puppet (15).

(15) a. Do you like to listen to stories?
b. Do you like to tell stories?
c. Do you sometimes forget your name?
d. Do you sometimes forget your second nose?

Question (15d) moreover tested how the children react to a question containing a false presupposition within a nominal complement.

In the subsequent practice session, the experimenter presented four stories to the child, each accompanied by two pictures and followed by a yes/no question inquiring about the truth of an event mentioned in the story. The questions were comprised of simple sentences, containing matrix verbs other than *forget* and *tell* (16).

(16) Sample of a practice item
Grover called Bert on the phone because he wanted to play with him. Bert had a cold, but he played with Grover anyway.
Question: Did Bert play with Grover?

The practice items required that the child use the two responses *yes* or *no*, based on her interpretation of the story. Corrective feedback was provided for the child's answers.

In the practice session and the test session, the subjects were told the stories while they were successively presented with the pictures. After a short pause the puppet asked the test question and the story-comprehension question. The puppet added explanations such as *I'm*

sorry. I still don't understand to provide a natural context for the second question. In addition, interruption of the story telling by children's comments or questions was not discouraged to keep up their attention (cf. also de Villiers & Roeper, 1996). Before presenting the next test item it was ensured that the child was still interested in the task. At the end of the test session the puppet and the experimenter thanked each child and complimented her for helping the puppet to understand the stories better.

Adults were tested together in a single test session. They were told that they would hear stories accompanied by pictures and be asked questions afterwards. To motivate students to cooperate they were informed that the general purpose of the experiment was to gain more insight into how children understood certain sentences in comparison to adults. The response alternatives were explained and the practice items were demonstrated and answered by the experimenter. Adults saw the accompanying pictures as overheads and had to write their answers on a questionnaire. The test items as well as the questions were read by the experimenter.

7.3.4 Predictions for Experiment 1

In this section the hypotheses stated in Section 7.2 are rendered into testable predictions captured by the dependent variable 'number of correct responses' (henceforth also CR). Before specifying the statistical predictions, let me briefly remark on the reasoning behind the operationalization of the complexity of a linguistic structure as the number of correct responses.

First of all, it is assumed that linguistic complexity of a given structure is reflected in the complexity of its analysis. The complexity of the analysis of the structure in turn is understood as the number of mental processing steps necessary to arrive at an interpretation of the structure. Put simply, the assumption is that an analysis is more complex than another one if it requires more steps in processing the structure. A higher cost of processing in turn increases the probability of incorrect analyses for the language learner, which could give rise to incorrect responses to questions regarding the interpretation of that structure. That this consequence is by no means compelling results from a fact I have stressed before. The interrelation between a response to a question and the interpretation of a linguistic structure is necessarily indirect.

What is more, our notion of complexity is based on the analysis performed by adult speakers. We cannot exclude that a structure that seems complex to adults is less complex in the child's grammatical system, because the child assigns a diverging analysis to the input, as for example assumed by the COS. The child seems to understand factive complement clauses correctly because – simplifying the structure of the input – she analyzes the complement clause independently of the matrix clause. Thus, when analyzing the experimental results it should be kept in mind that all findings draw on the assumption that complexity of a linguistic structure can in fact be operationalized more or less in the way described above.

Let us now turn to the predictions for Experiment 1. The research design is summarized in Table 7.7 below.

Table 7.7 Independent and dependent variables in Experiment 1

Verb	Type of complement	Story-event (s-event)	Σ Correct responses (CR)
forget	*to*-complement	s-event	CR_1
		non-s-event	CR_2
	that-complement	s-event	CR_3
		non-s-event	CR_4
tell	*to*-complement	s-event	CR_5
		non-s-event	CR_6
	that-complement	s-event	CR_7
		non-s-event	CR_8

According to the DSH, *that*-complements of p-factive verbs in the non-s-event condition should cause less correct responses than all other conditions. This is stated in (17).

(17) Prediction of the DSH
$CR_4 < CR_1, CR_2, CR_3, CR_5, CR_6, CR_7, CR_8$

Furthermore, according to H1.5 children at this stage in development are sensitive to the type of the matrix predicate (*forget* vs. *tell*) and to the type of complement (*to* vs. *that*-clause). Assuming H3, children take into account the given discourse background in calculating a sentence's interpretation. These two hypotheses in concert with the FAH_{Comp} predict that the other conditions do not significantly differ from each other. This is stated in (18).

(18) Prediction of the FAH_{Comp} (incl. H1.5 and H3)
$CR_1 = CR_2 = CR_3 = CR_5 = CR_6 = CR_7 = CR_8$

The predictions (17) and (18) apply to the third developmental stage. The null hypothesis captures the stage of mastery of factivity (19).

(19) Prediction of H_0:
$CR_4 = CR_1 = CR_2 = CR_3 = CR_5 = CR_6 = CR_7 = CR_8$

The COS predicts that all finite complements are interpreted as independent clauses, which can be evaluated against the established discourse background given in the story. Therefore, as stated in (20), performance on finite complement clauses should not differ depending on the matrix predicate.

(20) Prediction of the COS
$CR_3 = CR_4 = CR_7 = CR_8$

Note that the COS and H_0 overlap with respect to the finite complement clauses.

7.3.5 Results of Experiment 1

This section presents child and adult data on the story-comprehension questions, the test questions and on the analysis of individual response patterns. Special emphasis will be placed on the condition of presupposition failure. While the responses to the test questions are central to the evaluation of the data, it is beneficial to first analyze the responses to the story-comprehension question that measured overall story understanding. If it turned out that many of the stories were interpreted incorrectly, a viable analysis of the responses to the test question would be severely limited. Note that division of the group of children into two age groups of four- and five year-olds and five- and six-year-olds did not yield significant differences. Therefore all child data are evaluated together.

Story-comprehension questions
Correct responses were coded as 1 and incorrect responses as 0. For the *forget* items the correct response was either *yes* or *no*, depending on the story; for the *tell* items the correct response was a repetition of the statement of the story character. False and unanalyzable responses (e.g., *I don't remember him saying anything* or *I don't know*) were judged as incorrect. The subjects received a single test item for every verb × complement × s-event condition, so the mean for every cell of the experimental design corresponds not only to the mean of correct responses but also to the proportion of subjects responding correctly. The mean number correct for the s-event condition and the non-s-event version of each verb and complement combination are presented, by age group, in Table 7.8 below.

Table 7.8 Experiment 1. Mean number of correct responses (and standard deviation) to the story-comprehension question by verb, complement, s-event, and age group

Verb	Complement	S-event[a]	Children	Adults
forget	*to*	+e	0.98 (0.16)	0.96 (0.2)
		-e	0.90 (0.30)	1.00 (0.0)
forget	*that*	+e	0.96 (0.22)	1.00 (0.0)
		-e	0.85 (0.36)	1.00 (0.0)
tell	*to*	+e	0.74 (0.45)	1.00 (0.0)
		-e	0.92 (0.28)	1.00 (0.0)
tell	*that*	+e	0.88 (0.32)	1.00 (0.0)
		-e	0.83 (0.38)	1.00 (0.0)

[a] +e = s-event condition; -e = non-s-event condition

Each of the means was compared to the proportion anticipated by chance (0.5) using the binomial test ($\alpha = .05$). It was found that the proportion correct was significantly higher than chance level for all responses. Overall, 88.25% of the children and 99.5% of the adults gave correct responses to the story-comprehension question.

Regardless of the high number of correct responses, the extent of story understanding could still have biased responses to the test question: The more difficult the story the more difficult it might have been to respond correctly to the first test question. Therefore, a correlation between general story understanding and correctness of first responses had to be explicitly excluded. The interdependence between responses to the story-comprehension question and to the test question was examined by calculating the correlation between correct responses to the story-comprehension and to the test question for those subjects who responded correctly to the story-comprehension question (henceforth *comprehension passers*). Exclusion of all subjects who responded incorrectly to the story-comprehension question ensured that apparently correct responses to the test question were not based on an obvious misunderstanding of the central content of the story.[10] There was no correlation between the correctness of responses to the story-comprehension question and to the test question for the comprehension passers, both for children ($r = .14$) and for adults ($r = -.14$). Consequently, responses to the test question do not merely reflect the level of overall understanding of the story, as can also be inferred from Figure 7.1.

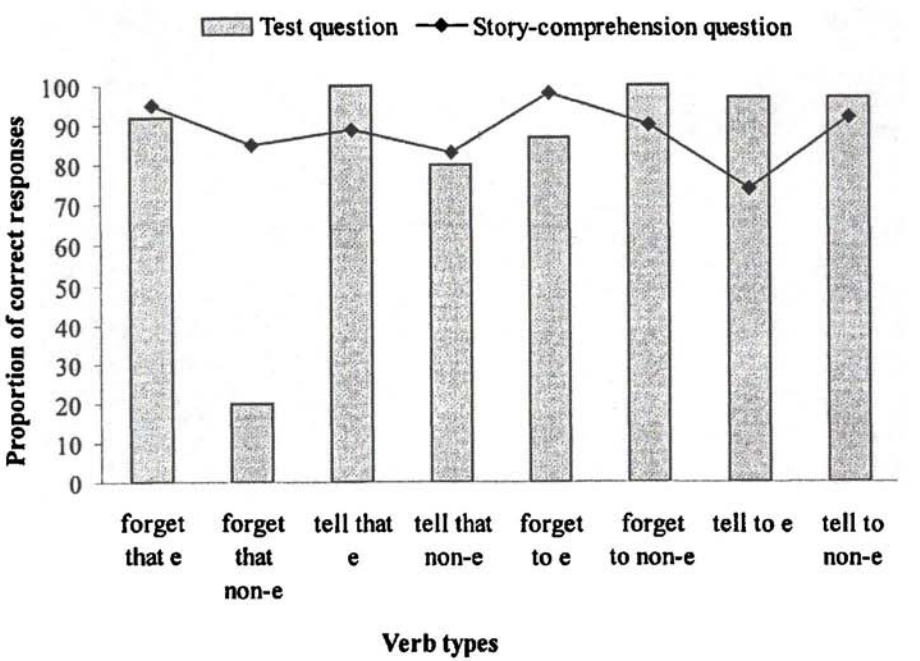

Figure 7.1 Experiment 1. Proportion of children's correct responses to the test question and the story-comprehension question by condition

Due to the high degree of overall story understanding, in the subsequent analysis of the responses to the test question all subjects were included.

[10] This response pattern occurred in only 7 of the 320 response patterns, i. e. in 2.2 % of the answers.

Test questions

Correct responses were again coded as 1 and incorrect responses were coded as 0. Reaction to presupposition failure (i.e. to *forget that* in the non-s-event condition) was coded as correct if the test-question was negated or explicitly rejected (for a motivation see the analysis of the individual responses below). To test for the between subject control factors, children's responses to the test question were analyzed by a (2) version of experiment × (2) order of story × (2) order of experiment × (2) verb × (2) complement × (2) s-event ANOVA, with the final three factors as repeated measures.[11] There were no significant effects for any of the between subjects control factors ($\alpha = .05$). Version of experiment was not significant, $F(1, 32) = 0.04$, $MS = 0.00$, $p = .838$; order of story was not found to be significant, $F(1, 32) = 1.75$, $MS = 0.18$, $p = .220$; and order of experiment was not significant, $F(1, 32) = 1.02$, $MS = 0.12$, $p = .321$. Therefore, the control factors were neglected in the ensuing analysis.

Child and adult responses to the test question were analyzed by a 2 (age) × 2 (verb) × 2 (complement) × 2 (s-event) ANOVA, with the last three factors as repeated measures. The mean number correct for the test question are presented in Table 7.9 by verb, complement, s-event, and age. As in Table 7.8, the mean for any given cell corresponds not only to the mean number of correct responses but to the proportion of subjects responding correctly as well.

Table 7.9 Experiment 1. Mean number of correct responses (and standard deviation) to the test question by verb, complement, s-event, and age group

Verb	Complement	S-event[a]	Children	Adults
forget	*to*	+e	0.85 (0.36)	1.00 (0.0)
		-e	1.00 (0.0)	1.00 (0.0)
forget	*that*	+e	0.93 (0.27)	1.00 (0.0)
		-e	0.18 (0.39)	0.92 (0.28)
tell	*to*	+e	0.85 (0.36)	1.00 (0.0)
		-e	0.98 (0.16)	1.00 (0.0)
tell	*that*	+e	0.98 (0.22)	1.00 (0.0)
		-e	0.73 (0.45)	1.00 (0.0)

[a] +e = s-event condition; -e = non-s-event condition

There was a significant main effect of age, $F(1, 62) = 51.12$, $MS = 3.9$, $p < .001$, indicating improvement in performance with age. This is confirmed by the significant two-way interactions of age with all of the within subject factors. There was a significant interaction of age and complement, $F(1, 62) = 24.08$, $MS = 1.18$, $p < .001$, and a significant interaction of age and verb, $F(1, 62) = 8.78$, $MS = 0.45$, $p < .01$. The interaction of age and s-event was significant at $p < .001$, $F(1, 62) = 14.84$, $MS = 0.77$.

[11] Note that the analysis of variance can be applied to repeated measures designs with dichotomous dependent variables (cf. Abbeduto & Rosenberg, 1985, and references therein).

The mean number correct was higher for *to*-complements than for *that*-complements, $F(1, 62) = 35.28$, $MS = 1.72$, $p < .001$. Moreover, the factor verb yielded a significant main effect, $F(1, 62) = 15.74$, $MS = 0.81$, $p < .001$; performance on *forget* (*MEAN* = .74) was worse than performance on *tell* (*MEAN* = .88). In addition, there was a main effect of s-event, $F(1, 62) = 23.55$, $MS = 1.23$, $p < .001$, because the mean of condition non-s-event (*MEAN* = .72) was lower than the mean of condition s-event (*MEAN* = .90).

There were significant effects for all two-way interactions, which were due to the fact that the mean of *forget that* in the non-s-event condition in the children's group (*MEAN* = 0.18) was lower than the means of all other items (ranging from *MEAN* = .73 to *MEAN* = 1.0).

Age in interaction with all two-way interactions of the within subject factors yielded significant effects. The age × event × verb interaction was significant at $p < .05$, $F(1, 62) = 5.53$, $MS = 0.29$. The interaction of age, event and complement was significant at $p < .001$, $F(1, 62) = 31.59$, $MS = 2.66$. Finally, there was a significant age × verb × complement interaction, $F(1, 62) = 10.03$, $MS = 0.55$, $p < .01$. Figure 7.2 illustrates the difference between the group of children and the adults.

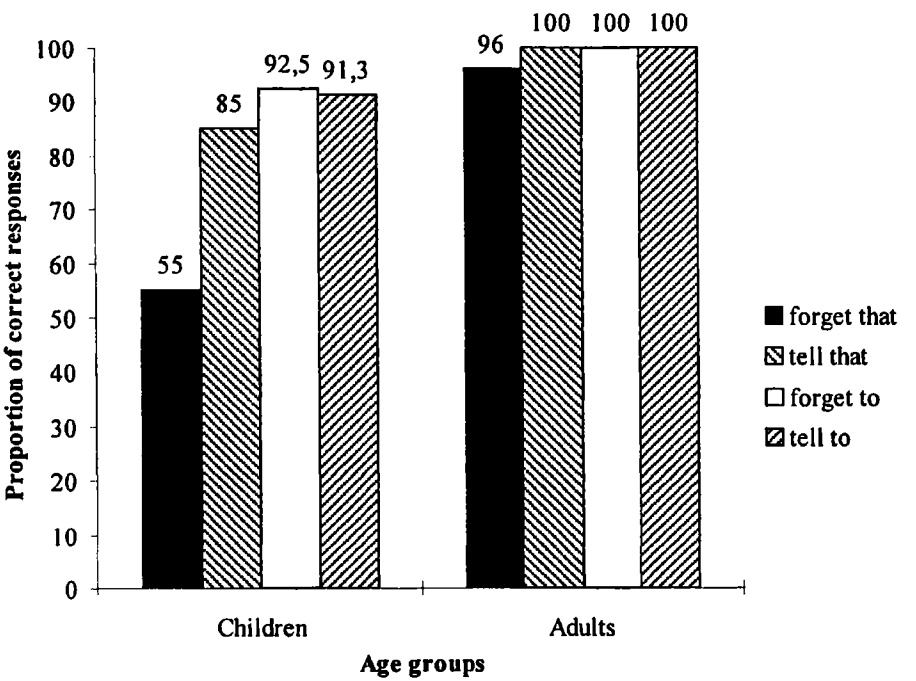

Figure 7.2 Experiment 1. Mean number correct in the test question by verb and age

As can be inferred from Table 7.9 and Figure 7.2, the mean number correct in the adult group reached ceiling (*MEAN* = 1.0) for all items except for *forget that* in the non-s-event condition (*MEAN* = .92). A *post hoc* comparison using the Scheffé procedure ($p < .05$) confirmed that the means of all items in the adult group did not significantly differ from each

other. This ceiling effect was responsible for the two-way and three-way interactions described previously. Hence the child data were analyzed further.

A (2) verb × (2) complement × (2) s-event ANOVA was performed, with the three factors as repeated measures. There was a significant interaction of s-event and complement, $F(1, 32) = 54.51$, $MS = 7.45$, $p < .001$. The interaction of s-event and verb was also significant, $F(1, 32) = 14.52$, $MS = 0.87$, $p < .01$. The interaction of complement and verb was found to be significant at $p < .001$, $F(1, 32) = 18.15$, $MS = 1.41$. Finally, there was a significant verb × complement × s-event interaction, $F(1, 32) = 10.12$, $MS = 1.03$, $p < .01$, which was due to the fact that the verb × complement interaction was limited to the non-s-event condition. Figure 7.3 below illustrates the response patterns for the s-event condition, Figure 7.4 below shows the responses for the non-s-event condition.

A *post hoc* comparison using a Scheffé procedure ($p < .05$) confirmed that in the child group the mean of the p-factive verb *forget that* in the non-s-event condition was significantly lower than the means of all other conditions, with no differences among the other items except for *forget to* in the non-s-event condition because of the ceiling performance (*MEAN* = 1.0). The following table gives an overview of the results for the Scheffé procedure.

Table 7.10 Experiment 1. Results of the Scheffé procedure by condition for the group of children

Condition	1.	2.	3.	4.	5.	6.	7.	8.
1. [forget that,-e]								
2. [tell that,-e]	*							
3. [forget to,+e]	*							
4. [tell to,+e]	*							
5. [forget that,+e]	*							
6. [tell that,+e]	*							
7. [tell to,-e]	*							
8. [forget to,-e]	*	*						

* indicates significant differences appearing in the lower triangle ($p < .05$)

A weighted analysis of contrast confirmed that *forget that* in the non-s-event condition was significantly different from *forget that* in the s-event condition and from negative-implicative *forget to* in the non-s-event condition ($p < .001$). This finding suggests that neither the fact that an event failed to happen nor the property of being factive *per se* caused incorrect responses. Moreover, *tell that* in the non-s-event condition differed significantly from *forget to* in the non-s-event condition, the item with the highest mean. This deviation is probably due to an unclear pronoun referent in one of the stories. This assumption is supported by the fact that the number of incorrect responses differed for the two test items containing *tell*. It is evident from Table 7.9 and Figure 7.2 that adults performed well on all items. It is less clear, however, whether performance with regard to the p-factive verb in the non-s-event condition was better than chance for the child group. Thus, each of the means for the children in Table 7.9 was compared to the proportion anticipated by chance (0.5) using the binomial test ($\alpha = 0.5$). It was observed that performance with regard to the

p-factive verb in the non-s-event condition was significantly lower than chance, whereas performance on all other items was significantly better than chance.

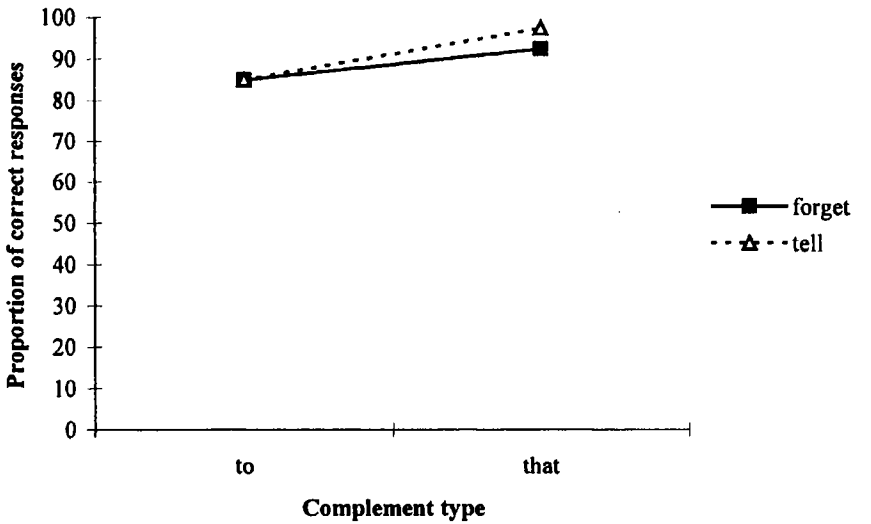

Figure 7.3 Experiment 1. Proportion of children's correct responses in the s-event condition by verb and complement

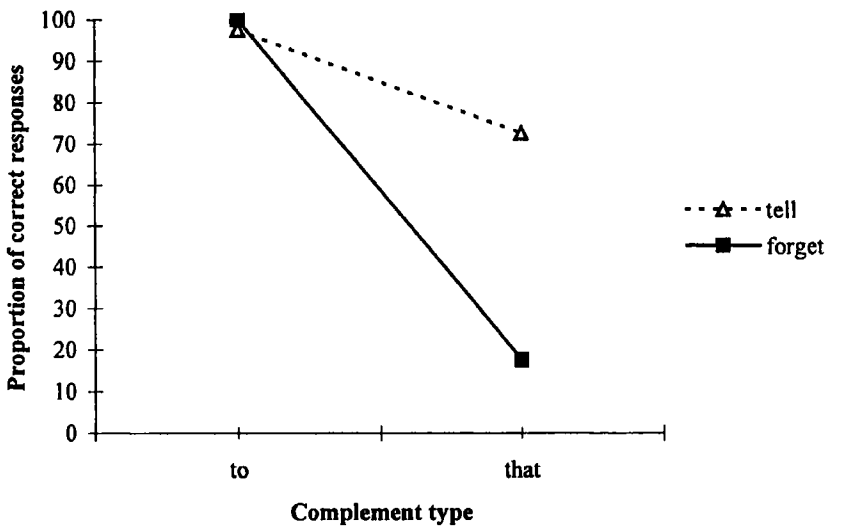

Figure 7.4 Experiment 1. Proportion of children's correct responses in the non-s-event condition by verb and complement

Individual Responses

Examination of the individual response patterns confirmed the group analyses. If a child gave correct responses to both the s-event and the non-s-event condition of the items *forget that, tell that, forget to,* and *tell to* she was considered to have mastered that structure. Then, the frequency with which patterns of verb mastery occurred was calculated. Before presenting the individual data let me comment on the coding of the responses to the failed presupposition. Adults most frequently gave *no* responses (83.3%) rather than explicitly rejecting the failed presupposition as in *No, he never invited him* (8.3%). Therefore, both a simple negation and explicit rejection were coded as a correct response to the condition of presupposition failure for children and adults.

Only three children, aged 4;5, 4;6 and 4;9, responded as if they had mastered all four structures. Of the seven children who had mastered the p-factive verb in the non-s-event condition, four children aged 3;11 to 6;7 rejected the false presupposition explicitly[12] and three negated the question. Thus, overt denial is an infrequent response pattern for both children and adults. A child's overt denial of a failed presupposition is exemplified in (21).[13]

(21) *Grover met Ernie, but he did not play marbles with Ernie.*

Test question:	Did Grover forget that he played marbles with Ernie?
Child A (6;7):	No, because he didn't play with marbles.
Story-comprehension question:	Did Grover play marbles with Ernie?
Child A:	No.

Sixteen children had mastered all verbs except *forget that* in the non-s-event condition. This finding along with the above observations suggests that mastery of presupposition failure follows mastery of the standard properties of being p-factive, i.e. presupposing the event as true.

Another 10 children responded as though they had not mastered two verbs: the p-factive verb in the case of presupposition failure and another verb (*tell that* in the non-s-event condition, *tell to,* or *forget to* in the s-event condition). Thirty-one children (77.5%) responded correctly to the p-factive verb *forget that* in the s-event condition and incorrectly in the non-s-event condition, compared to 0% for *forget to*, 2.5% for *tell to*, and 27.5% for *tell that*. A typical incorrect response for *forget that* in the non-s-event condition is given in (22). Similar responses to the test question in (22) are listed in (23) and (24) below.

(22) *Big Bird went to Bert, but he did not invite Bert to dinner.*

Test question:	Did Big Bird forget that he invited Bert?
Child B (4;4):	Yes. He made pizza but he forgot to remember that he was going to invite Bert but he just left.
Story comprehension question:	Did he invite Bert?
Child:	No.

---

[12] Incidentally, all four children had problems with one other verb only, mostly regarding *tell that* in the non-s-event condition in experiment version A. This is further evidence that this test item contained misleading information.

[13] The overt denial responses of the other three children are listed below.

(i) He didn't play. (3;11)
(ii) He did NOT play marbles with Ernie. (5;6)
(iii) He didn't play them with Ernie. (6;0)

(23) Child C (5;9) YES. You're right.

(24) Child C (6;2) YES, silly. [pointing to the crocodile]

In general, children did not express irritation in answering these presupposition failure questions, but responded quickly and often with emphasis and self-confidence. Note that the low number of correct responses to the condition of presupposition failure can neither be attributed to the children's unwillingness to supply negative responses nor to their general inability to react to failed presuppositions. Children quite readily responded with *no* as can be seen in the high number of correct negative responses to *tell that* in the non-s-event condition (72.5 %), to *forget to* in the s-event condition (85 %), and to *tell to* in the s-event condition (85 %). This yields a mean of 80.83 % correct *no* responses in comparison to a mean of 96.87 % correct *yes* responses to the test question.[14]

Moreover, children – and adults – rejected the failed presupposition in the warm up question *Do you sometimes forget your second nose?* (cf. Section 7.3.3). All adults responded either with explicit rejection (*I don't have two noses*) or with irony (*No, I often forget my third one; I wasn't aware I had a second nose*). Thirty-one of the children (77.5 %) rejected the presupposition by laughing, enquiries (*What does that mean? What second nose?*), or by corrections (*I have ONE nose!*). Seven of the children reacted with simply negating the question, and two children responded with *don't know*. Even though nominal and sentential presuppositions differ in a number of respects, this data indicates that children's inability to negate a false sentential presupposition does not arise from a general difficulty to recognize and reject or negate a wrong presupposition. The difference in response patterns found for failed presuppositions in sentential and in nominal contexts then suggests that in the former case an altogether different interpretational path may be at work.

7.3.6 Discussion of Experiment 1

Experiment 1 tested whether preschool children assign truth-values to sentences based on the semantic-syntactic interaction of matrix predicate and complement clause and based on discourse-semantic properties such as the discourse background given. The study controlled for a number of potential nuisance effects including effects of story version, order of experiment, and order of test items. In addition, the subjects were provided with sufficient pre-experimental training to ensure that they were familiar with the critical lexical items and also capable of performing the task. Moreover, inclusion of an adult group allowed comparing children's responses to the response patterns actually representing adult linguistic competence.

Control for story-comprehension showed that both children and adults in general had no difficulty understanding the stories. Story-comprehension questions were answered correctly by all adults and by 88 % of the children. What is more, no correlation was found between the degree of story understanding and the number of correct responses to the test question. Thus, responses to the test question indeed reflect the interpretation of the complement clause.

The DSH is confirmed by the results from the test question for the children group. Poor performance on the factive item *forget that* was limited to the cases of presupposition fail-

[14] Compare that to the means of overall positive and negative responses to the story-comprehension question: 97 % of the children correctly responded *yes*; 87.5 % of the children correctly answered *no*.

ure. If the event presupposed by the complex factive sentence matched the story background, children had no difficulty interpreting the structure as factive. As mentioned before, the low percentage of correct responses in the *forget that* non-s-event condition cannot be attributed to the children's unwillingness to give negative responses, for 85% of their responses in the infinitival s-event condition were negative. Moreover, children's response patterns are incompatible with a misinterpretation of *forget that* as positive-implicative. If the complement of a positive-implicative matrix predicate is false, it can simply be negated, as presupposition failure does not arise. It seems that the contradiction between the linguistic presupposition and the established discourse background increased the complexity of the interpretational task, which was solved only by the adults.[15] Children in the third developmental stage hence have not yet fully mastered the notion of factivity. However, note that while the DSH correctly predicted low performance in cases of presupposition failure, it does not explain why most of the children gave a positive response to the test question. This observation is taken up in Section 7.5.2.

Moreover, the results of the present experiment confirm the FAH_{COMP} along with H1.5 and H3. Children between the ages of 4 and 6 are aware that p-factive and nonfactive verbs in concert with finite and nonfinite complement clauses differ as to their presuppositional character. In calculating the response to the test questions they generally consider the discourse background set up in the story. Put differently, neither the finiteness nor the factivity of the complement clause increased the complexity of the interpretational task, but the presence of presupposition failure in a factive sentence did. Only adults reacted adequately to the cases of presupposition failure.

The complement-only strategy, which predicts equal performance for all finite complement clauses, is not confirmed by the data. Rather than correctly negating the test question in the non-s-event condition, 82.5% of the children incorrectly answered *yes* in this condition. Note that the related assumption that initially nonfactive verbs are interpreted as factives could not be tested in this experimental design. Although all children performed well on the nonfactives, quotative *tell that,* negative-implicative *forget to,* and volitive *tell to* cannot be classed as typical nonfactives such as *think* or *believe*, which were employed in previous experimental studies.

In summary, the data from Experiment 1 indicates that already at age 4 children are able to correctly differentiate p-factive and nonfactive matrix predicates according to the truth-values of their complement clauses. These results confirm previous studies (Macnamara et al., 1978; Abbeduto & Rosenberg, 1985, and Moore & Davidge, 1989) and provide further evidence for the developmental path proposed in Chapter 6 that suggests the emergence of the theory of mind around age 4 as a turning point in children's understanding of factivity. What is more, the inability of children between the ages of 4 and 6 to interpret failed sentential presuppositions supports the assumption that after the age of 4 children are still unaware of a number of subtle differences between p-factive and nonfactive verbs. Between

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[15] One could argue that children might simply be unwilling to reject or contradict a question posed by an authority figure such as the experimenter (cf. Siegal, 1997). Recall, however, how readily all of the children rejected the introductory question *Do you sometimes forget your second nose?* In light of this fact it does not seem very likely that children held back their negative responses out of fear of disobedience. What is more, contrary to Siegal's prediction children responded quickly and often determinedly to the presupposition failure question.

the ages of 4 and 7 then, children do not recognize that p-factive verbs are barriers for negation-raising (cf. Phinney, 1981b) and for adverbial *wh*-movement (cf. Philip & de Villiers, 1992a; Roeper & de Villiers, 1992b; de Villiers et al., 1997) and that factive structures can give rise to presupposition failure.

Taking on a crosslinguistic perspective, the results from similar truth-value judgment studies with German and Spanish children aged 4 to 6 confirm the English findings. Only 25% of the German children and 15.8% of the Spanish children interpreted the complement of a p-factive verb correctly in cases of presupposition failure while performing much better on all other conditions (cf. Pérez-Leroux, de Villiers & Schulz, 1994; Pérez-Leroux & Schulz, 1999). These outcomes are consistent with the results of the present experiment pointing to universal factors in the acquisition of factivity.

Let me conclude the discussion of Experiment 1 by pointing out some drawbacks that possibly limit the generalizability of its findings. First, children's response patterns did not change with age so that a further division by age was futile. Even though this finding agrees with the assumption that the third developmental stage lasts from the age of 4 until the age of around 7, selection of subjects may have confounded the results. Many of the five- and six-year-old children were recruited from a YMCA Summer Camp that was frequented by low-income families, while the three- and four-year-olds were mainly drawn from Day Care Centers serving a middle class clientele.[16] Second, the present experiment cannot conclusively answer the question of at what age children begin to master the interpretation of factive sentences and of presupposition failure as even the youngest children interpreted the factive items correctly and even the oldest children aged 6;11 did not yet exhibit consistent adult-like performance. Further research is also needed to test a wider range of matrix verbs.

7.4 Experiment 2

Experiment 2 focused on the question of whether four- to six-year-old children are sensitive to the factors 'type of matrix predicate' and 'type of complement clause' in achieving a factive or nonfactive interpretation of a complex sentence, if no discourse background is supplied. The participants were the same as in Experiment 1. Section 7.4.1 explains the test design and the materials, and Section 7.4.2 illustrates the testing procedure. Section 7.4.3 contains the predictions, derived from the acquisition hypotheses. Section 7.4.4 presents the results of the experiment, which are then discussed in Section 7.4.5.

7.4.1 Materials for Experiment 2

In this section I explain the design of the test materials for Experiment 2 and discuss whether and how the test design meets the requirements (R1) to (R4) for a TVJ task, listed in Section 7.3.2.

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[16] For the influence of social and cultural factors on language competence, see for example Grimm, Schöler & Wintermantel (1975).

In the first experiment the discourse background – modeled by the variable s-event – was given. The yes/no question required assessing the mental state of the story character as well as analyzing the complement clause and evaluating its truth relative to the given discourse-background. The second experiment tested children's ability to draw inferences about the truth of the complement clause solely on the basis of the type of complement clause and the type of matrix verb. The discourse background remained undetermined. For this experiment again the yes/no version of the TVJ task was employed. Three-sentence stories introduced the characters and set up the situation, without describing any particular event that happened or failed to happen. Developing the design of Abbeduto & Rosenberg (1985), I tested the following verb classes: p-factive (*forget that, find out that*), negative-implicative (*forget to, refuse to*), and indeterminate (*ask to, think that*). Table 7.11 summarizes the test design.

Table 7.11 Independent variables in Experiment 2

Verb class	Type of complement clause	Verb
p-factive	*that*-complement	*forget*
	that-complement	*find out*
indeterminate	*that*-complement	*think*
	to-complement	*ask*
negative-implicative	*to*-complement	*forget*
	to-complement	*refuse*

The matrix verbs listed in Table 7.11 together with the embedded complements constituted the last sentence of the story, the test sentence. The test prompt consisted of a yes/no question assessing the truth-value of the complement clause of the test sentence. The truth-value could neither be inferred from the story context nor from general world knowledge, but only from analyzing the last complex sentence of the story, in agreement with requirement (R3). Examples (25) - (27) illustrate the test sentences; (28) exemplifies the test question.

(25) The girl forgot that she left the teddy at home.

(26) The girl thought that she left the teddy at home.

(27) The girl forgot to leave the teddy at home.

(28) Did she leave the teddy at home?

The correct response to the test question in (28) depends on the proper interpretation of the various matrix verbs in concert with the type of complement clause: *yes* for factive complements (25), *maybe* or *don't know* for indeterminate complements (26), and *no* for negative-implicative complements (27). Note that the requirement (R1) to create a plausible context for all possible responses is fulfilled since the respective event is only mentioned in the complex sentence, allowing for different interpretations. In addition, potential biases of the story context itself were controlled for. The story preceding the sentences above, for example, contained information that made it equally likely for the girl to either take or not take the teddy with her.

Requirement (R2) demands a clear distinction of target and non-target responses. Whereas for p-factive and negative-implicative verbs only one type of response is correct, responses to indeterminate verbs are more complex. Even though propositional verbs do not determine the truth-value of the complement clause, in reality a supposed event can only be true or false. Consider the following sentence:

(29) The boy thought that there was an ant in the bowl.

The utterance of (29) is appropriate both in a situation in which there is an ant in the bowl and in a context where there is no ant in the bowl. Consequently, the yes/no question (30) could theoretically be answered in the negative or in the affirmative.

(30) Is there an ant in the bowl?

A correct indeterminate response such as *don't know* requires an abstraction on a metalinguistic level that children might not master even though they correctly interpret the situation as vague. Put differently, a false response may result from the child's inability to express this indeterminacy rather than from a misinterpretation of indeterminate verbs.[17] The question then arises of whether and how we can distinguish a correct from an incorrect response. Three different answers are possible. First, *yes, no,* and *don't know* responses are equally evaluated as correct, thus impeding a sensible evaluation. Second, only *don't know* responses are judged as correct, leaving open the possibility that target-like responses are not recognized as such (this is the solution endorsed by Abbeduto & Rosenberg, 1985). I opted for a third possibility: Besides optimizing the context for an indeterminate response, I added an additional question in order to gain more information about the child's interpretation of the indeterminate structure. Matrix verbs and contexts were chosen so that an indeterminate response was facilitated. This was tested in an informal study including 10 adults. As a result *tell* was excluded from the list of indeterminate matrix verbs because it suggests the truth of the complement clause both when embedding a finite and when embedding a nonfinite complement. Instead, the matrix verbs *think that* and *ask to* were included. Second, children were instructed during the experimental set up that *don't know* was a viable response option and not an expression of ignorance. Third, a story-comprehension question was added to ensure that children were able to express uncertainty regarding the truth of the complement (see Section 7.4.4 for details of the evaluation).

For each of these matrix verbs two stories were formulated describing adventures of two or three story characters[18] yielding a total of twelve test items. The stories were presented in two different orders to avoid a possible effect of order of item. In addition, complex sentences were counterbalanced for the type of complement where permissible, i.e. for *forget that* and *forget to*, to avoid a possible effect of the story or the accompanying picture (creating experiment versions A and B). The verbs used in the complement clauses (*be, break,*

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[17] In a similar vain, Abbeduto & Rosenberg (1985: 626) remark that it is crucial to ensure that a *don't know* answer is seen by the child as a viable response option rather than as an admission of ignorance. Note, however, that the point I want to stress goes beyond the ambiguity involved in responding *don't know*.

[18] To avoid a bias from the Sesame Street characters featuring in the first experiment, in this experiment I used role-stereotypes such as father, mother, girl, and boy that are easy to distinguish. To minimize children's memory load the characters were referred to by their role.

buy, climb, have, leave, lock, ride, take) are attested in the speech of children by the age of 4 (e. g., Hart et al. 1977). Each story was illustrated by a picture to enhance concentration and to keep the child's attention without providing clues about how to answer the question (for an example, see Appendix).

The test question regarding the truth of the complement clause was followed by a story-comprehension question, framed as a *wh*-question. Even though answers to *wh*-questions are more difficult to classify as correct or incorrect, they can reveal how the child understood the complex sentence. What is more, by incorporating a story-comprehension question into the test design, we can detect more easily which responses given to the test question are due to chance, as required by (R4). Let me elaborate this point by giving examples of the three experimental conditions. (31) illustrates the factive condition, (32) and (33) are examples of the indeterminate condition with a nonfinite and a finite complement clause, and (34) exemplifies a negative-implicative scenario.

(31) Sample story: *forget that*
This girl got a beautiful teddy for her birthday. One day, she went to the playground with her friend. She forgot that she left the teddy at home.
Test question: Did the girl leave the teddy at home?
Story-comprehension question: Why?/What happened with the teddy?

(32) Sample story: *ask to*
This girl went with her friend to a swimming pool. And there was a nice water slide. The girl asked her friend to climb up the slide.
Test question: Did her friend climb up the slide?
Story-comprehension question: Why?/Why not?

(33) Sample story: *think that*
One morning, this boy and his mother made a beautiful cake for dessert. The boy looked in the bowl and saw a dark spot. The boy thought that there was an ant in the bowl.
Test question: Was there an ant in the bowl?
Story-comprehension question: What did the boy see?

(34) Sample story: *forget to*
This girl and her father collected a lot of stones on the beach and played with them. Then, they went back home. The girl forgot to take the stones with her.
Test question: Did the girl take the stones with her?
Story-comprehension question: Why?/What happened with the stones?

If a child responds to the test question correctly, but gives an inconclusive answer to the follow-up question, it is very likely that the first response was due to chance. The reverse situation is especially pertinent to the indeterminate condition: If the child responds to the test questions in (32) and (33) simply with *yes* or *no*, then the answer to the story-comprehension question can reveal whether the child correctly grasps the truth-value of the complement clause as indeterminate, while lacking the ability to express that uncertainty as *don't know*.

Summarizing, this experiment is characterized by the following factors. The proposition is only verbally present, i. e. it is not possible to draw inferences on the basis of the story or

the picture. The response to the test question allows deduction of the inference drawn by the subject, since the test question concerns solely the truth-value of the embedded clause. The case of presupposition failure is not included in the experimental design. The incorporation of indeterminate verbs (with an unspecified discourse background) introduces the response pattern *don't know*, which independently of the analysis of the matrix verb could lead to difficulties.

7.4.2 Procedure for Experiment 2

The children were asked whether they wanted to play a guessing game in which they would hear short stories and guess the right answer to various questions. Parallel to the first experiment, the experimenter posed introductory questions to the child that contained the selected matrix verbs to ensure children's knowledge of the verbs (35).

(35) a. Do you sometimes find out new things?
b. Do you sometimes refuse to go to bed? Why?/Why not?
c. Do you sometimes ask your mother for candy?

The subsequent practice session consisted of two parts. First, the experimenter demonstrated the task with three examples, using the hand puppet to ask the question, while the experimenter played the part of the child. Little stories, illustrated by one picture and followed by a question, were told, and the experimenter answered each one correctly with *yes*, *no*, and *don't know*, respectively, and emphasized that these three responses were available to the child throughout the guessing game. Then, the child received three practice items that required use of the three response options. The matrix verbs used in the practice trial were not part of the test session. A typical practice item is given in (36) below.

(36) Sample story of the practice session
Oscar the Grouch was in front of the bakery asleep. He dreamed about his favorite cake.
Question: Did Oscar dream about strawberry cake?
Second question: What did he dream about?

Corrective feedback was provided after each item and the child was again reminded of the response options. *Can't tell* and *maybe* were accepted as indeterminate responses as well. An overgeneralization of indeterminate responses was not observed.

Both the test session and the practice session were set up as a guessing game in which answers to questions had to be guessed by the child.[19] The children were told the stories while they looked at the picture. After a short pause, the hand puppet asked the yes/no question, e.g. *Guess, did the girl leave the teddy at home?* and added the story-comprehension question, e.g., *Why?* or *What happened with the teddy?*

The adults were tested in groups in a single session. They were told that they would hear stories and be asked questions afterwards. The three response alternatives were explained and the practice items were demonstrated and answered by the experimenter. Adults saw the accompanying pictures as overheads and had to write their answers on a questionnaire.

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[19] This setting provoked more indeterminate responses than the pilot version in which the questions were asked by the puppet without any further explanation.

7.4.3 Predictions for Experiment 2

The second experiment employed the following independent and dependent variables (modified from Table 7.11):

Table 7.12 Independent and dependent variables in Experiment 2

Verb class	Type of complement clause	Verb	Σ Correct responses
p-factive	*that*-complement	*forget*	CR_1
	that-complement	*find out*	CR_2
indeterminate	*that*-complement	*think*	CR_3
	to-complement	*ask*	CR_4
negative-implicative	*to*-complement	*forget*	CR_5
	to-complement	*refuse*	CR_6

Owing to the fact that presupposition failure does not arise in this experimental design the DSH cannot be tested. According to H1.5 children at this stage in development are sensitive to the type of the matrix predicate (p-factive, indeterminate, negative-implicative) and to the type of complement (*that* vs. *to*). This hypothesis in concert with the FAH_{Comp} stating that children differentiate these structures according to the truth-values of their complement clauses predicts that at the developmental stage 3 the responses to conditions 1 to 6 do not differ significantly from each other. This is stated in (37).

(37) Prediction of the FAH_{Comp}
$CR_1 = CR_2 = CR_3 = CR_4 = CR_5 = CR_6$

This prediction coincides with the prediction resulting from the null hypothesis H_0. The Developmental Hypothesis DH, however, predicts that the number of correct responses increases from the third stage of acquisition, time t, to the adult stage, time t'. The response pattern expected by the DH is stated in (38).

(38) Prediction of the DH
$CR_{1\text{-}6}(t) < CR_{1\text{-}6}(t')$ with $t < t'$

According to the COS for finite complements, the complements of nonfactive *think* should be incorrectly interpreted as true, while factive complements should be correctly interpreted as true. This is stated in (39).

(39) Prediction of the COS
$CR_3 < CR_1, CR_2$

The pragmatic inference hypothesis predicts that children perform worse on all indeterminate items, since they assign truth-values to their complements based on probability measures. This prediction is formulated in (40).

(40) Prediction of the pragmatic inference hypothesis
$CR_3, CR_4 < CR_1, CR_2, CR_5, CR_6$

7.4.4 Results of Experiment 2

This section contains child and adult data on the test questions and the story-comprehension questions and the analysis of individual response patterns. Taking up the issue of how to code responses to indeterminate matrix verbs, I will present two different evaluation procedures and demonstrate that a composite score comprising the responses to both questions is superior to a separate evaluation of the test question.

First, let us consider the separate evaluation of the test question. Each correct response was coded as 1 and each incorrect response was coded as 0. *Yes* was coded as the correct response for *forget that* and *find out that*; *no* as the correct response for *forget to* and *refuse to*, and *don't know, maybe* or *can't tell* as correct responses for *think that* and *ask to*. Table 7.13 gives an overview of the distribution of the three response types in children and adults.

Table 7.13 Experiment 2. Proportion of yes, no, and don't know responses by verb and age

	Children			Adults		
Responses	***yes***	***no***	***don't know***	***yes***	***no***	***don't know***
forget to	7.50	91.25	1.25	2.50	97.50	0.00
refuse to	23.75	57.50	18.75	0.00	100	0.00
ask to[a]	38.75	15.00	45.00	5.00	0.00	95.00
think that[b]	18.75	40.00	38.75	5.00	27.50	67.50
find out that	95.00	5.00	0.00	100	0.00	0.00
forget that	86.25	13.75	0.00	97.50	2.50	0.00

[a] One response is excluded ('Just one').
[b] Two responses are excluded ('Mince, a dark spot' and 'Chocolate').

The table reveals that across age groups the number of correct responses for *forget that, find out that,* and *forget to* is higher than for *refuse, ask,* and *think*. These differences are illustrated in the following figures. Figure 7.5 shows the proportion of *yes* responses, Figure 7.6 the proportions of *no* responses, and Figure 7.7 the proportions of *don't know* responses by verb and age group.

The performance of the adult group indicates that the propositional verb *think* was treated differently from all other verbs. While for *ask,* for the p-factive, and the negative-implicative verbs adults performed at ceiling, for *think* they gave the expected indeterminate answer only in 67.5 % of the cases. Thus, if responses to the test question are evaluated separately, adults are found to perform non-target like on the propositional verb *think.* Children are found to perform non-target-like on the items *refuse to, ask to* and *think that.*

Consider now the possibility of calculating a composite score comprising the responses to the test question and the story-comprehension question. As pointed out before, the responses to the story-comprehension question can give us information about the interpretation of the test question and yield a more accurate picture of the overall interpretation of the matrix verb. Note that taking into account responses to the story-comprehension question is assumed to be of relevance mainly for *think* and *ask,* which leave the truth-value of their complement clause open. This assumption is borne out by both the adult and the child data.

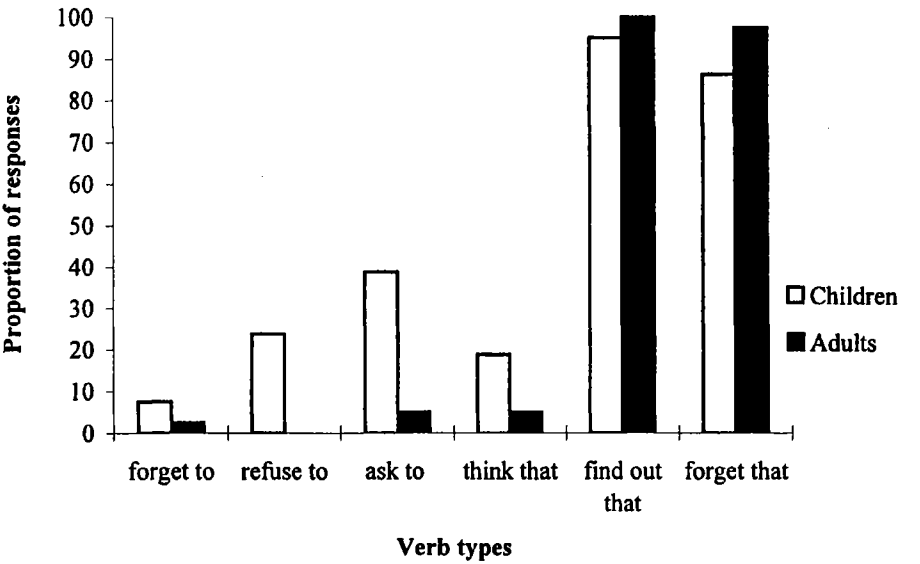

Figure 7.5 Experiment 2. Proportion of 'yes' responses by verb and age group

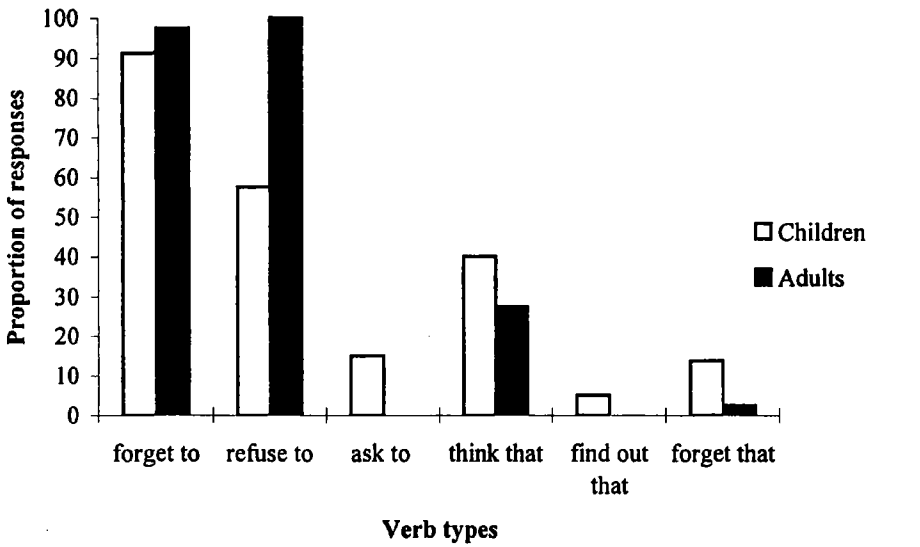

Figure 7.6 Experiment 2. Proportion of 'no' responses by verb and age group

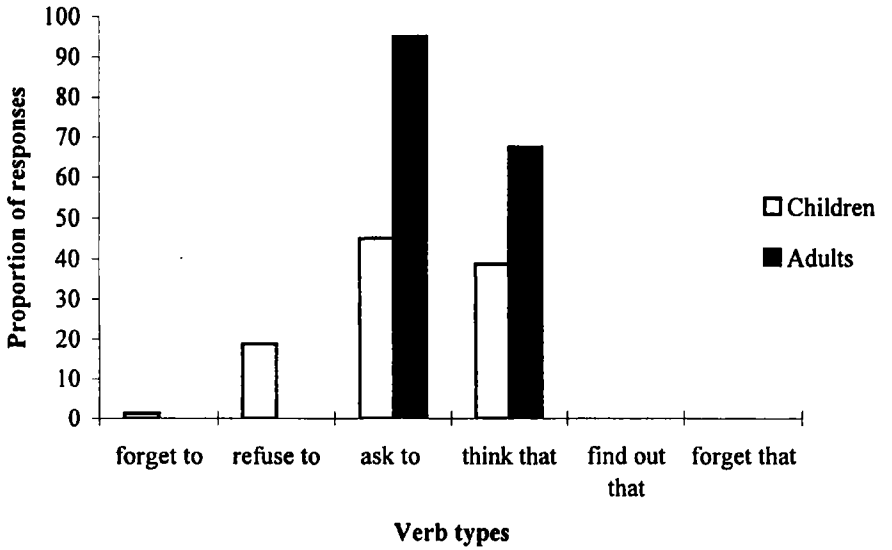

Figure 7.7 Experiment 2. Proportion of 'don't know' responses by verb and age group

Calculating a composite score that included subjects' responses to the story-comprehension question did not yield different results for p-factive and negative-implicative verbs, the only exception being a child who answered the test question concerning *forget that* correctly, but provided an inconclusive response to the second question. In what follows I will therefore focus on responses to the indeterminate verbs.

Let us first look at the adult data. If the answer to the test question was indeterminate, the response to the story-comprehension question often illustrated the train of thought that lead to the first response. Consider examples (41) and (42) for *think,* and examples (43) and (44) for *ask.*

(41) Test question: Did a hippo have a shoe in his mouth?
Adult: Don't know.
Story-comprehension question: What did the girl see?
Adult: She saw what looked like a shoe.

(42) Test question: Was there an ant in the bowl?
Adult: Don't know.
Story-comprehension question: What did the boy see?
Adult: Who knows? A raisin. Doesn't say.

(43) Test question: Did her friend climb up the slide?
Adult: Don't know.
Story-comprehension question: Why?
Adult: Can't answer with the information provided.

(44) Test question: Did the mother buy three balloons?
Adult: Don't know.
Story-comprehension question: Why?
Adult: Story ended before transaction.

Affirmative or negative responses to the test question were most often followed by explanatory responses to the story-comprehension question demonstrating that subjects understood that the truth-value of the complement was indeterminate. This response pattern is exemplified in (45) for *think* and in (46) for *ask*.

(45) Test question: Did a hippo have a shoe in his mouth?
Adult: Yes.
Story-comprehension question: What did the girl see?
Adult: She thought a hippo had a shoe in his mouth.[20]

(46) Test question: Did the mother buy three balloons?
Adult: Yes.
Story-comprehension question: Why?
Adult: The boy asked her to.

Recall that the peculiarity of an indeterminate response is based on the tension between the fact that the story does not provide sufficient information for a clear positive or negative response and the necessity to decide for or against the truth of the complement clause, given that a state of 'maybe' does not exist in reality. To recognize that a response such as *don't know* or *maybe* provides a way out of that dilemma requires a summary of the given facts on an abstract level. Complements of propositional verbs such as *think* seem to be especially prone to be interpreted either as false or as true, depending on the assessment of the probability of the situation. Note that this assumption is not equivalent to the pragmatic inference hypothesis because the latter but not the former implies that the subject is unable to correctly interpret the truth-value as indeterminate.

Having looked at the adult data, let us consider children's responses to the indeterminate items. Indeterminate responses to the test question were often followed by matching explanations, as exemplified in (47) and (48) for *think* and in (49) for *ask*.

(47) Test question: Did a hippo have a shoe in his mouth?
Child D (4;7) I don't know.
Story-comprehension question: What did the girl see?
Child: A chocolate chip. He might have been right or he might have been wrong.

(48) Test question: Did a hippo have a shoe in his mouth?
Child E (3;11): I don't know.
Story-comprehension question: What did the girl see?
Child: Hippos.

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[20] Note, that this is not an exact repetition of the last sentence of the story (*Suddenly, the girl thought that a hippo had a shoe in his mouth*). Drawing upon results from sentence repetition tasks, we can infer that the subject actually constructed his own representation of the sentence when responding to the story-comprehension question. This also holds true for example (46).

(49) Test question: Did the mother buy three balloons?
Child F (5;9): I don't know yet.
Story-comprehension question: Why?
Child: The story didn't tell.

Affirmative or negative responses to the test question were frequently modified by the responses to the story-comprehension question, often containing a mental verb or other expressions of uncertainty. Consider the examples for *think* in (50) and (51), and the examples for *ask* in (52) and (53).

(50) Test question: Was there an ant in the bowl?
Child G (6;2): I think no.
Story-comprehension question: What did the boy see?
Child: He saw - He was just thinking about.

(51) Test question: Did a hippo have a shoe in his mouth?
Child G (6;2): No.
Story-comprehension question: What did the girl see?
Child: I don't know. Maybe she saw a shoe in his mouth or not. I don't know.

(52) Test question: Did her friend climb up the slide?
Child H (5;5): No - yes.
Story-comprehension question: Why?
Child: Cause she wanted him to and he agreed.

(53) Test question: Did the mother buy three balloons?
Child I (5;7) Think yes - I think so.
Story-comprehension question: Why?
Child: Because she wanted to.

In my assessment, the above responses by children and adults express a target-like interpretation of the complement clause of indeterminate verbs, which is obscured by the first coding procedure of evaluating the test question separately. Consequently, I will use the composite coding system by which responses to the first and to the second question are collapsed into one category. For p-factive verbs, a response was coded as correct if the answer to the test question was *yes,* and the answer to the story-comprehension question contained a plausible elaboration. For negative-implicative verbs, a response was coded as correct if the negative answer to the test question was followed by a plausible response to the second question. For indeterminate verbs, a response was coded as correct if the first answer was *don't know* or if the first answer was *yes* or *no* along with a response to the story-comprehension question expressing uncertainty via the strategies exemplified in examples (50) - (53) above. An example of an incorrect response in the indeterminate condition is given below.

(54) Test question: Was there an ant in the bowl?
Child J (5;0): Yes.
Story-comprehension question: What did the boy see?
Child: Just the cake.

This composite score resembles Scoville & Gordon's (1980) scoring procedure. They added the question *Are you sure?* to the yes/no question.

> That is, 'yes-not sure' and 'no-not sure' were collapsed into one category along with 'I don't know'. Since nonfactives have expectation values associated with them, individual differences in sensitivity to these expectations could polarize the responses artificially. [...] Hence the collapsing of uncertain responses [to two questions] was thought to maximize the sensitivity of the analysis to this strategy, and thus to be a conservative measure in the search for child patterns. (Scoville & Gordon, 1980: 387)

A (2) version of experiment × (2) order of stories × (6) verb ANOVA for the child data, with the last factor as repeated measure, yielded no significant effects for the between subjects control factors. Version of experiment was not significant at $p = .448$, $F(1, 36) = 0.59$, $MS = 0.26$; and order of stories was not significant at $p = .631$, $F(1, 36) = 0.23$, $MS = 0.10$. Therefore, the data from the different lists were evaluated together.

The child and adult data were then analyzed by a (2) age × (6) verb ANOVA, with the last factor as a repeated measure. The subjects received two items per condition, thus a mean number correct of 2.0 corresponds to 100% correct. The mean number correct for the six verbs are shown, by age, in Table 7.14.

Table 7.14 Experiment 2. Mean number of correct responses (and standard deviation) by verb type and age group

Verb	Children	Adults
forget to	1.83 (0.50)	1.96 (0.20)
refuse to	1.15 (0.86)	2.00 (0.00)
ask to	1.78 (0.66)	2.00 (0.00)
think that	1.85 (0.36)	2.00 (0.00)
find out that	1.90 (0.44)	2.00 (0.00)
forget that	1.70 (0.52)	1.96 (0.20)

There was a significant main effect of verb, $F(5, 310) = 5.88$, $MS = 1.13$, $p < .001$, that was due to the low mean of *refuse to* (*MEAN* = 1.15) in the children group. A *post hoc* comparison using a Scheffé procedure ($p < .05$) confirmed that the mean of the negative-implicative verb *refuse to* in the children group was significantly lower than the means of all other conditions, with no differences among the other items. To test whether performance with regard to *refuse to* was better than chance, each of the means was compared to the proportion anticipated by chance (0.33) using the binomial test ($\alpha = .05$). All means, including *refuse to*, were significantly higher than expected by chance. There was also a significant main effect of age, $F(1, 62) = 26.81$, $MS = 7.37$, $p < .001$. This main effect as well as the significant age × verb interaction, $F(5, 310) = 6.20$, $MS = 1.2$, $p < .001$, were due to the fact that performance on *refuse to* in the children group was so low.

The answers to the introductory questions revealed that 60% of the children did not know the meaning of the verb *refuse*, as illustrated in the examples below:

(55) Experimenter: Do you sometimes refuse to go to bed?
Child (4;6): Yes.
Experimenter: Why?
Child: I'm tired.

(56) Experimenter: Do you sometimes refuse to go to bed?
Child (5;3): Yes.
Experimenter: Why?
Child: I like to go to bed.

Three of the children (aged 4;9, 5;8, 5;8) inquired explicitly about the meaning of the verb *refuse*. Eighteen children mastered the verb *refuse to* in the introductory questions, with increasing age starting at 4;9. In the discussion of the results I will return to the question of whether children's poor performance on *refuse to* can nevertheless give us information about the interpretation of complement clauses subcategorized by a matrix verb not yet mastered by the child. In the following analyses *refuse to* was excluded in order to not bias the outcome of the statistical tests.

The child and adult data were thus analyzed by a (2) age × (5) verb ANOVA, with the last factor as a repeated measure. There was no significant main effect of verb, $F(4, 248) = 0.93$, $MS = 0.12$, $p = .45$. The mean number correct was higher for the adults than for the children, $F(1, 62) = 9.47$, $MS = 2.25$, $p < .01$. As illustrated in Figure 7.8 below, there was no significant interaction of age and verb, $F(4, 248) = 0.48$, $MS = 0.07$, $p = .747$. These results suggest an overall advance in performance with age independent of the specific verb type. A *post hoc* comparison using a Scheffé procedure ($\alpha = .05$) confirmed that the means of the five verbs for children and adults did not differ significantly from each other.

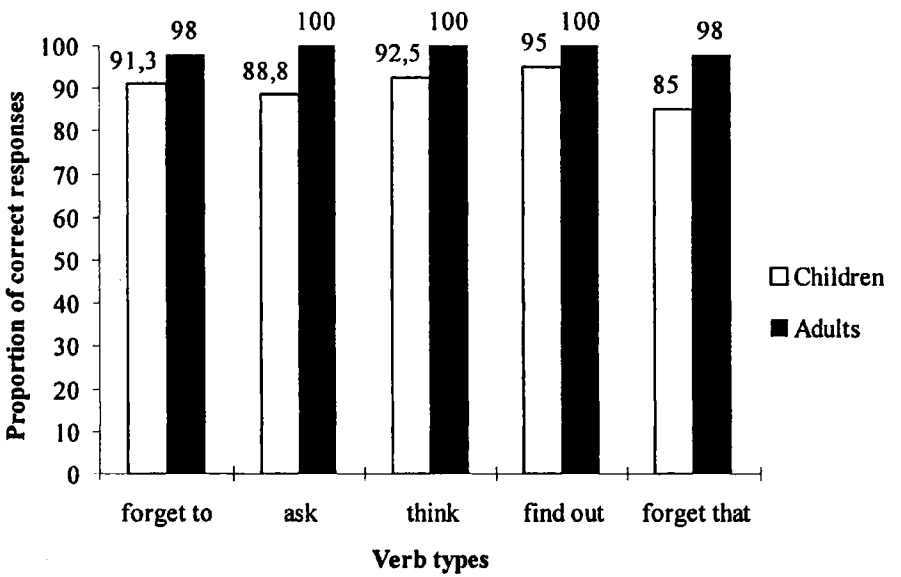

Figure 7.8 Experiment 2. Proportion of correct responses by verb type and age group

Weighted analyses of contrast for the child data were employed to examine possible distinctions between the verb groups tested. There was no significant difference for the type of complement, i.e. for the contrast of *to* and *that*, $t = 0.95$ pooled variance estimate; $t = 0.955$ separate variance estimate. The contrast of verb type, i.e. of p-factive, indeterminate and negative-implicative, was not found to be significant, $t = 0.594$ pooled variance estimate; $t = 0.622$ separate variance estimate. Neither was the contrast of *forget to* and *forget that* significant, $t = 0.149$ pooled variance estimate; $t = 0.195$ separate variance estimate. Finally, the contrast of *forget that* and *find out* moved towards significance, $t = 0.054$ pooled variance estimate; $t = 0.075$ separate variance estimate.

Individual Responses

Examination of the individual response patterns supports the preceding group analyses, again excluding *refuse*. A verb was considered to be mastered by a child if she responded correctly to both items according to the modified scoring procedure. Twenty out of 40 children (aged 3;11 to 6;9) responded as though they had mastered all of the verbs. Thirteen children (32.5 %) had mastered all of the verbs except one; eight of these subjects (aged 4;3 to 6;0) failed to interpret *forget that* correctly in that they negated the truth of the complement clause. Five children (aged 4;0 to 6;11) had not mastered two of the verbs, and two children had not mastered three of the verbs. Only one child (aged 5;3) responded to *think that* as though it was factive; three children (aged 5;7 to 6,11) interpreted *think* as negative-implicative.[21] Eighteen children (aged 3;11 to 6;9) gave an indeterminate response to both *think* items, and nineteen children (aged 3;11 to 6;9) did so with regard to *ask to*. One child (6;11) responded with *no* to *ask*, and two children (4;3 and 4;5) responded with *yes*. In sum, although the matrix verb affected to some degree the estimated probability of the truth of a complement, nonfactive verbs were not interpreted as factives.

7.4.5 Discussion of Experiment 2

Experiment 2 tested whether preschool children assign truth-values to sentences based on the semantic-syntactic interaction of matrix predicate and complement clause if the discourse background is left unspecified. Similar to the design of Experiment 1 this study controlled for a number of potential nuisance effects including effects of story version, order of experiment, and order of test items. Subjects were provided with sufficient pre-experimental training to ensure that they were capable of performing the task and that they knew the crucial matrix verbs. Moreover, inclusion of an adult group allowed comparing children's responses to the response patterns actually representing adult linguistic competence.

The findings from Experiment 2 confirm FAH_{Comp} in relation to H1.5. Leaving the verb *refuse to* aside for the moment, children interpreted p-factive and nonfactive verbs embedding finite and nonfinite clauses equally well. They assigned truth-values solely based on the presuppositional properties arising from the matrix verb in connection with a certain type of complement clause. The adult group performed at ceiling on all conditions confirming H_0. Children gave significantly fewer correct responses across all conditions, as predicted by DH.

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[21] Under the first scoring procedure, seven children treated *think* as negative-implicative.

Use of a general COS was not found in this study. The high number of correct responses for *forget that* (85%) and *find out that* (95%) is compatible with the use of this strategy. However, contrary to prediction, the indeterminate status of *think* was recognized by most of the children (92.5% correct responses). Note that this is not just an artifact of the scoring procedure. Even if use of the COS is tested on the basis of the scores derived from the first scoring procedure, we arrive at only 18.75% *yes* responses compared to 40% *no* responses. Children did not interpret all finite complements as factive, and hence the child interpretation patterns cannot be attributed to use of the COS. These findings are compatible with Abbeduto & Rosenberg's (1985) results. They report that 27% of the four-year-olds interpreted *think* as factive, due to use of the COS. In the present experiment the accompanying pictures and the design of the task as a guessing game might have facilitated *don't know* responses.

The pragmatic inference hypothesis was not supported by the data from the present experiment. If preschool children infer the truth of a complement clause according to probability measures, they should respond to indeterminate items with affirmation or negation of the truth, depending on world knowledge and task specific circumstances. Contrary to this prediction, 38.75% of the responses to *think*, and 45% of the responses to *ask* were indeterminate, arriving in the modified scoring at only 7.5% and 11.25% incorrect responses for *think* and *ask*, respectively. I argued that the abstraction required in giving an indeterminate response presents an obstacle to children's interpretation of nonfactives. This is in contrast to Harris (1974) and Falmagne et al. (1994), who hold that the obstacle lies in the inference of the truth-value of the complement clause based on world knowledge and probability measures.

Moreover, the interpretation patterns revealed in the present experiment differ from the claims made by Scoville & Gordon (1980) that p-factive and nonfactive verbs are discriminated at a much later age (cf. Section 5.6.1). Besides methodological differences, their selection of verbs probably increased the complexity of the task. Scoville & Gordon used the nonfactive matrix predicates *be sure, figure, say, believe*, and *think*. Only for *think*, however, is the truth-value clearly indeterminate, whereas what *somebody is sure of, figures, says,* or *believes* is more often taken to be true than false.

In summary, the data from Experiment 2 indicates that already at age 4 children are able to correctly differentiate p-factive and nonfactive matrix predicates according to the truth-values of their complement clauses. What is more, they indicate that children at the age of 4 are sensitive to the factors 'type of matrix predicate' and 'type of complement clause'. With regard to the interpretation of finite complement clauses, these results confirm previous studies (Macnamara et al., 1978; Abbeduto & Rosenberg, 1985; Moore & Davidge, 1989), which suggested a mastery of the nonfactive verb *think* and the p-factive verbs *forget, know* and *remember* at around the age of 4.

The present experiment thus provides further evidence for the developmental path proposed in Chapter 6, which suggested that age 4 – the age at which theory of mind emerges – is indeed a turning point in children's understanding of factivity. Support for this assumption comes from a study in German with children between the ages of 3 and 6 (Meissner, 2002). In addition to the German adaptation of the present experiment a false belief task was administered. Meissner found that children who passed the false belief tasks – the theory of mind passers (mean age 5;03) – performed adult-like on factive and on negative-implicative complements. In contrast, theory of mind failers (mean age 3;07) correctly

interpreted factive complements, but often incorrectly interpreted nonfactive and negative-implicative complements as true, comparable with use of COS. It remains to be explained, however, why German speaking children who pass the theory of mind tests continue to interpret complements of nonfactive *denken* (think) as true (50% yes answers), while the English speaking children provided much fewer affirmative answers.

Let me conclude by pointing out some of the open questions related to the interpretation of *refuse to*. Recall that I excluded responses to the item *refuse to* from further statistical analyses because children's responses to the introductory question *Do you sometimes refuse to go to bed* revealed that most children did not know the meaning of the verb. It was found that 8% of the four-year-olds, 70% of the five-year-olds, and 80% of the six-year-olds passed the two introductory *refuse* questions, clearly indicating increasing knowledge by age. Owing to the fact that overall response patterns did not allow further separation by age, this developmental aspect was obscured by the data. A related question arises of how children who did not know the meaning of *refuse to* interpreted the truth-value question. Assuming the default strategy suggested for the second stage of mastering factivity (cf. Section 6.3.2), the complement of *refuse to* should be interpreted as nonfactive, i.e. as negative-implicative as in *forget to* and *fail to* or as volitive as in *ask to* and *tell to*. While more than half of the responses were in fact negative or indeterminate, there was still a considerable number of positive responses (23.75%) to the test questions.

This outcome calls for further research as it is not clear whether the special properties of *refuse to* (after initially refusing to do x, one may end up doing x) or the use of a default interpretation strategy of nonfinite complements contrary to the one I suggested caused the positive responses.[22] Having discussed the results from Experiment 1 and 2, I now turn to the general discussion of the experimental findings and their implications.

7.5 General Discussion

Using the TVJ task, Experiment 1 and 2 tested different aspects of children's understanding of factivity. How are the results from Experiment 1 and 2 related? And how can we explain the children's responses to failed sentential presuppositions in Experiment 1? The first question is addressed in Section 7.5.1. Section 7.5.2 offers a speculative outlook on the child's interpretation of presupposition failure in terms of the theoretical model of factivity developed in the previous chapters.

7.5.1 Summary of the Experimental Results

The results of the two experiments confirm the FAH_{Comp} and DSH, along with the specific hypotheses H1.5 and H3. Children between the ages of 4 and 6 are sensitive to the factors 'matrix predicate' and 'complement clause' in interpreting factive and nonfactive sentences

[22] An experiment employing novel verbs that embed either finite or nonfinite complement clauses could help distinguish between these default interpretation strategies and their alternatives.

(cf. H1.5). They are aware that negative-implicative (*forget to*) and indeterminate verbs (*tell to, tell that, think that, ask to)* do not presuppose the truth of their complement clause (cf. FAH_{Comp}). Moreover, children at this age are able to interpret these verbs correctly in different story contexts: s-event, non-s-event in the first experiment, and undetermined discourse background in the second experiment. When the presupposed event happened or was not mentioned, they recognize the presuppositions of the factive verbs *forget that* and *find out that* and assign the proper truth-values to their complements rather than relying on probability measures (cf. H3). A comparison of the results from the two experiments reveals that *forget that* yielded slightly more correct responses in the first experiment (*MEAN* = .93), where a discourse background was provided, than in the second experiment (*MEAN* = .85), which did not specify a discourse background. This finding provides further grounds for the assumption that previous studies that did not consider the discourse background might have underestimated children's competence. At the same time, it indicates that children at this age are able to create an appropriate antecedent for the embedded event variable if they process a factive sentence in isolation, i. e. they can accommodate a file to match the interpretational requirements of the sentence. The above findings are not compatible with use of a complement-only strategy or with the pragmatic inference hypothesis.

The same children fail, however, to react properly to presupposition failure. In contrast to adults, who reject or negate false presuppositions, they do not interpret the complement of a p-factive verb as presupposed to be true if the discourse background contradicts the presupposition in the complement clause. As suggested by the DSH, interpretation of factive sentences with an unfulfilled presupposition still poses a problem for children between the ages of 4 and 6. This finding corroborates the theory put forth in this book that factivity is a multidimensional concept whose acquisition proceeds stepwise and not in an all-or-nothing fashion. Adequate reaction to presupposition failure is a further aspect of factivity, next to prohibition of adverbial *wh*-movement and of negation-raising, which is not mastered at the third developmental stage. Two questions arise. Which interpretation do children assign to the complement of a p-factive matrix predicates if the presupposition is not met by the discourse background? And can the non-target-like interpretation of presupposition failure be attributed to the same underspecification of the child's grammar that was claimed to lead to the absence of the barrierhood properties of p-factive verbs? The first question is addressed in Section 7.5.2. In Section 7.6, I tackle the second question when recasting the developmental path.

7.5.2 A Possible Interpretation of Presupposition Failure

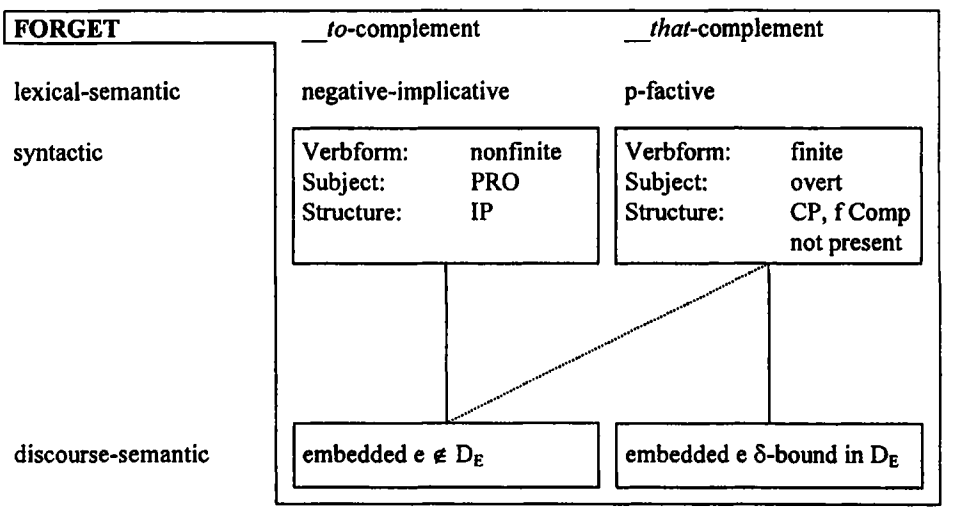
While it is obvious that most of the children gave incorrect answers in the condition of presupposition failure, it is less evident which interpretation formed the basis of that response. In this section I will speculate on the interpretation that children may assign to the complement of a p-factive verb if the presupposition fails and consider psycholinguistic studies on processing sentences with failed presuppositions (cf. also Schulz, 2001). To questions containing a presupposition failure 82% of the children promptly responded with *yes* rather than with *don't know* or with refusal to answer altogether. Note that this response pattern cannot be attributed to the children being unaware of the presuppositional status of the complement clause as in this case they would find a negative answer easy. What is

more, the children do not interpret the verb as positive-implicative, because then they would give a negative response. Instead, they seem to find 'some other way around' the presupposition of the complement clause resulting in a positive response. I suggest as a possible escape hatch that the language learner can reanalyze factive *forget* as negative-implicative. This proposal is based on the following assumptions drawn from language acquisition, psycholinguistics, and discourse-semantics:

- The language learner does not necessarily have correctly specified lexical entries at her disposal. Lexical entries may be underspecified or features may have too many alternative values.[23]
- Restructuring of an analysis is possible if the analysis initially assigned to the expression failed (cf. Section 6.2.1). For the language learner, restructuring is possible not only upon encountering the so-called garden path sentences leading to a syntactic reanalysis. It is also possible to restructure specifications of lexical entries, which can lead to the reanalysis of a lexical entry.
- The presuppositional status of a complement clause is part of the lexical entry of a verb (cf. also Inhoff, 1985).
- The discourse-semantic interpretation of factive complements comprises δ-binding of the embedded event variable (cf. Section 4.3).

For ease of exposition, let us assume that the language learner in stage 3 has at her disposal the following lexical entry for the sentential complements of *forget*:

(57) Lexical entry for forget[24]



[23] For example, a verb might not be specified as belonging to a semantic class such as factive at all, or a verb might be specified as embedding factive as well as nonfactive complements, whereas in fact only one complement-type is grammatical.

[24] Note that syntactic and discourse-semantic features are given as separate entries in this example. I do not take a stand, however, as to how exactly these levels are intertwined. For the present purposes I merely assume that both levels contribute to the interpretation of the sentence.

In order to demonstrate how a child's interpretation of a sentence with a failed presupposition proceeds I will consider one of test items in detail. Assume the discourse background given in (58).

(58) Big Bird made a pizza. Then he went to Bert's house and Bert gave him a cup of tea. Big Bird really wanted to ask Bert to dinner, but he didn't remember. So he didn't invite Bert and just left.

Upon listening to the story in (58) the child creates file cards for the individuals Big Bird and Bert and moreover file cards for the described events such as Big Bird visiting Bert. There is no file card for an event e [invite(Big Bird, Bert, e)]. Instead, there is a file card specified for something like e [¬(invite, Big Bird, Bert, e)]. Next the child is presented with the test question *Did Big Bird forget that he invited Bert.* As soon as she perceives the item *forget* the multiple subcategorization frames of the matrix verb along with the respective θ-grids are activated: the NP, the nonfinite and the finite frame, possibly with different levels of activation according to frequency. Processing the complementizer *that* leads to the deactivation of the NP and the nonfinite subcategorization frame. Activation of the finite subcategorization frame in turn gives way to the verb class entry *p-factive.* According to the specification of the verb class *p-factive,* at the discourse-semantic level the analysis of the subsequent complement clause *he invited Bert* requires binding the event variable within the already established discourse frame, that is to link the event e [invite(Big Bird, Bert, e)] to its antecedent in the discourse by δ-binding e. Since no such e is found, the mechanism of accommodation is activated, but fails as well since this event is listed as not having happened. Similar to garden path sentences, the child reconsiders the discarded alternatives and thus activates the negative-implicative verb class entry. I stipulate that this reanalysis is possible because tensed rf Comp is not required to be present at LF. (cf. Section 7.6.1 for a justification). According to the specification of negative-implicative verbs, the absence of an antecedent to the event [invite(Big Bird, Bert, e)] in the discourse must be examined. This condition is fulfilled and hence the child responds *yes* to the yes/no question.

Note that this model, although incomplete, correctly predicts that the child knows that the event did not take place, responding in the negative to the story-comprehension question *Did Big Bird invite Bert.* Put differently, the child acknowledges that the discourse background cannot be changed to correspond to the meaning of the sentence in question. Instead, she reverts to reanalyzing the discourse-semantic interpretation of the complement clause in order to fit the discourse. Adults, on the other hand, treat the discourse-semantic interpretation of a certain complement type as fixed. Thus, if the discourse background cannot be modified accordingly (i.e. accommodated), the presupposition fails and the sentence is rejected.

Beyond accounting for the interpretation of *forget,* this model makes specific predictions with regard to the interpretation of other p-factive matrix predicates that call for future empirical justification. It is predicted that p-factive verbs that are similar to *forget* regarding the multiple subcategorization frames can be reanalyzed as nonfactive if the presupposition conflicts with the established discourse background.[25] More generally speaking, it is hy-

[25] Note that this assumption is not identical to Perner's (1991) proposition that initially sentential complements are interpreted as NP complements. In such a case both finite and nonfinite complements are predicted to be ambiguous between a factive and a nonfactive reading.

pothesized that initially syntactic specification and discourse-semantic interpretation do not necessarily correspond in the child's lexicon. Verbs such as *find out*, subcategorizing only sentential finite complements, do not lend themselves to a restructuring of the discourse-semantic feature specification. Accordingly, the language learner is predicted to react to presupposition failure with *don't know* or with refusing an answer.

How is this interpretation related to studies on the processing of sentences with failed presuppositions? The escape hatch I proposed for cases of presupposition failure draws on Frazier's model of sentence processing (cf. Section 6.2). Conducting eye movement studies, Frazier and her colleagues (Frazier & Rayner, 1982; Frazier, 1987; Frazier & Clifton, 1996) showed that garden path effects in sentences lead to longer overall reading times and moreover to longer fixation times for those regions of the sentence that caused this garden path effect. If we take this parallel between syntactic and discourse-semantic processing further we would expect that psycholinguistic studies on the interpretation of factive and nonfactive sentences reveal similar effects. Factive complements containing a failed presupposition should cause longer reading times than factive sentences containing a fulfilled presupposition, while factive sentences should not take longer to read than nonfactive sentences. In a reading study by Inhoff (1985) adult subjects were presented with complex sentences containing p-factive and nonfactive matrix verbs that embedded either true or false complement clauses. Typical test items are given in (59) and (60) below.[26]

(59) a. This proves that the world is round. factive
b. This suggests that the world is round. nonfactive

(60) a. He knew that two and two equal three. factive
b. He said that two and two equal three. nonfactive

It was found that p-factive and nonfactive verbs did not receive different amounts of fixation time during reading, and that false complements received longer fixation times when embedded by a p-factive verb than when embedded by a nonfactive verb. According to Inhoff these findings support the assumption of a distinction between lexical access and post-lexical processing. During lexical access – happening fairly automatically – readers identify a particular word and retrieve the semantic information that is associated with the word, e. g., multiple meanings of ambiguous words or presuppositional constraints. During postlexical processing such as sentence integration, on the other hand, the fixated words are interpreted within a prior linguistic context, for example the false complement clause within the context of a p-factive or nonfactive verb. This process requires the use not only of linguistic knowledge but also of factual knowledge, thus arriving at longer fixation times.

To conclude, I speculated that children may reanalyze the complement of a p-factive verb as negative-implicative if the presupposition fails. This way of restructuring failed presuppositions may be reflected in adult's longer fixation times for false complements, as found by Inhoff (1985).

[26] The falsity of the complements is based on a contradiction of empirical knowledge rather than of an established discourse background in form of a narrative as in my first experiment.

7.6 The Developmental Path Recasted

In this section the findings from the experiments will be integrated into the developmental path proposed in Chapter 6, focusing on the third developmental stage. In recasting the course of development, I will address the question of whether the non-target-like interpretation of presupposition failure can be attributed to the same underspecification of the child's grammar that was claimed to lead to the absence of the barrierhood properties of p-factive matrix predicates. I will suggest that children's interpretation of presupposition failure can be reframed in terms of the specifics of the δ-binding mechanism, similar to the missing barrier regarding long *wh*-movement and negation-raising.

Section 7.6.1 reexamines the third developmental stage. In Section 7.6.2 I speculate about acquisitional progress still to be made at stage 4. Section 7.6.3 concludes with the recasted developmental path of the acquisition of factivity.

7.6.1 Stage 3: Emergence of the Theory of Mind

Based on previous research, in Chapter 6 I tentatively stated that children at this stage have established the discourse-semantic mechanism of δ-binding, thus distinguishing (finite) factive from nonfactive complements and assigning the truth-values to the complements accordingly. Furthermore, I argued that the relevant features of factive Comp are not yet present at LF and thus factive Comp does not function as a barrier to long *wh*-movement and to negation-raising. The findings from the two experimental studies clearly support the assumption that children between the ages of 4 and 7 can distinguish factive from nonfactive complements according to their truth-values. More specifically, the results confirm that four- to six-year-olds take into account the type of matrix predicate as well as the type of complement when calculating the truth-value of the complement clause. First, the high number of correct responses for the *forget to* and *forget that* items in both experiments reveals that children are aware that interpretation of the matrix verb does not suffice to determine the verb class. Second, the same argument holds true for the *tell* items in the first experiment. The low number of incorrect responses to both *tell to* and *tell that* indicates that the type of complement clause was taken into consideration. Third, the correct performance on almost all items in the second experiment demonstrates that children do not assign a uniform interpretation to complement clauses solely depending on the type of complement clause, but incorporate the specific type of matrix verb into the interpretation as well. These results are compatible with the hypothesis that at this stage factives are interpreted as positive-implicatives. Recall that in Section 6.3.3 I pointed out that investigating children's reactions to presupposition failure enables us to reexamine this hypothesis. If a complex sentence were interpreted as positive-implicative, a false complement could be simply negated, whereas a false complement embedded by a p-factive verb has to be rejected explicitly. Note that both positive and negative responses to *forget* embedding a *to*-complement are not problematic for children at this age. Thus, children could in principle negate the false complement. However, 82% of the children responded in the affirmative to cases of presupposition failure. In other words, they did not respond as if *forget* embedding

a *that*-complement were positive-implicative but negative-implicative. Consequently, the hypothesis that factives are misrepresented as positive-implicatives can be discarded.

As for the characterization of which knowledge is lacking, I found that children at this stage do not react properly to presupposition failure, i.e. they do not reject a false presupposition. Put differently, they do not interpret the embedded complement clause as presupposed to be true, if the embedded event conflicts with the present discourse frame. In Section 7.5.2, I hypothesized that children find some escape hatch to avoid the failed presupposition by interpreting the structure as negative-implicative. I claim that this reaction to presupposition failure can be attributed to absence of the relevant features of factive Comp features at LF. Recall the interpretation children in this stage assign to factive structures, repeated in (61).

(61) a. John forgot (that) Mary visited Lucy.
b. [δe: visit(M,L,e)] John forgot that e occurred

Now suppose the event [visit(M,L,e)] cannot be linked to an event variable in one of the file cards present. Factive Comp is recognized as a δ-binder. Owing to the ambiguous input regarding the complementizer *that*, however, the features of factive Comp including [$t_{CC}\leq$] are not yet present at the level of LF. As a consequence, the interpretation of the δ-bound event variable as a definite description is not irrevocable. Thus, in order to resolve the contradiction between the file obtaining in the discourse and the embedded event variable in the complement clause the language learner reverts to restructuring the discourse-semantic interpretation, as illustrated in the preceding section. As soon as factive Comp is present at LF, restructuring of the complement clause as negative-implicative is blocked, because the connection between the finite complement clause and that interpretation is not available anymore.

As for nonfinite complement clauses, the findings regarding the interpretation of *refuse to* (Experiment 2) suggest that at this stage nonfinite complements embedded by verbs that are not yet part of the child's lexicon are not interpreted as presupposing. Instead, they are preferably interpreted as negative-implicative or as indeterminate, possibly owing to the fact that at this stage tensed factive infinitives are not yet part of the child's grammar.

How does the child modify this knowledge system and learn that failed presuppositions have to be rejected explicitly in order to deny their truth? Instantiation of the factive Comp features at LF (for example via the analysis of negated factive sentences in unambiguous contexts, cf. Section 6.3.3) is regarded as 'fixing' the discourse-semantic properties across different levels of grammar. In turn, these properties are no longer treated as being open to accommodation if the specific discourse background stands in contradiction to the linguistic structure. Thus, presence of the features of factive Comp at LF inevitably results in recognition of cases of presupposition failure as the child attempts to match the definite description of the embedded event to an already established event variable in one of the file cards. If there is no event variable matching the event variable specified in the complement clause, the child has to deny the presupposition instead of trying to override the verb's subcategorization frame. In consequence, the child arrives at a one-to-one correspondence between LF and discourse-semantics.

7.6.2 Stage 4: Barrierhood of Factive Comp

After the age of 7 or 8, I assume that the interpretation of negation-structures and fronted *wh*-adverbials as well as the reaction to presupposition failure become adult-like owing to the presence of the δ-binding features of factive Comp at LF. Even after having established all the necessary features of factive Comp, however, the child still has to learn that p-factive matrix predicates can differ as to the likelihood of suspending the presupposition. For example, presuppositions of *forget* are almost never suspended outside of the generally presupposition cancelling contexts. Verbs including *find out*, in contrast, induce nonfactive interpretations in certain contexts (cf. Section 2.6). Further research has to show whether these assumptions are correct.

7.6.3 The Recasted Developmental Path in a Nutshell

Incorporating the results from my experimental studies into the course of development detailed in Section 6.3, we arrive at the developmental path depicted in Table 7.15 below. For the sake of perspicuity, the table illustrates the developmental progress without detailing the knowledge that is lacking at a certain stage of development. Thus, each change within the learner's knowledge system is listed at the stage at which it first occurs. Unless stated otherwise it remains present in the child's knowledge system.

This developmental path towards mastery of factivity considers changes in the child's cognitive, lexical-semantic, syntactic, and discourse-semantic representation. In the first developmental stage the language learner starts out with simple sentences at the IP level that are mapped onto simple events. P-factive verbs are not produced, and if mental verbs occur they are used in a non-mental interpretation. Triggered by input data that require an additional structural level above IP, the complementizer system comes into place at stage 2. The child produces various types of complement clauses, embedded by nonfactive verbs. P-factive verbs appear only with nominal and nonfinite complements. Children at stage 2 recognize the difference between true and false statement. However, due to use of a complement-only strategy finite complement clauses are interpreted as independent units and are thus taken to express true propositions. Nonfinite complements are probably interpreted as indeterminate or false. By acquiring the syntax of embedding the child is being equipped with the structural format necessary to represent embedded propositions, thus paving the way for the mastery of theory of mind at stage 3. The resulting distinction between facts and thoughts enables the child to correctly interpret propositional verbs as well as negative-implicative or positive-implicative verbs. In propositional complements the embedded event variable is evaluated relative to the subject's mental model as true or false, while in implicative complements the embedded event variable is evaluated relative to the discourse frame as true or false. Factive (finite) complements are correctly interpreted as presupposed to be true, and if a discourse background is given, factive sentences are evaluated relative to that background. Thus, in factive complements the embedded event variable is correctly δ-bound. Children at this age produce a variety of mental verbs in mental interpretation and also finite complements embedded by p-factive matrix predicates. I speculated that nonfinite complements are still by default interpreted as nonfactive. At stage 3 syntactic restrictions on factive structures including barrierhood regarding *wh*-movement and negation-

Table 7.15 The developmental path of acquiring (semantic-syntactic) factivity

Stage	Cognitive	Lexical-semantic	Syntactic	Discourse-semantic
1. Simple sentences and simple events		Production of mental verbs in non-mental interpretation	Production of simple sentences	
2. Syntax of embedding	Recognition of pretense, difference between true and false statements	Production of p-factive verbs	Production of *to*-, *wh*- and *that*-complements of nonfactive verbs	Complement-only strategy for finite complement clauses
3. Emergence of the theory of mind	Theory of mind	Production of a variety of mental verbs in mental interpretation	Production and comprehension of *that*-complements of p-factive verbs	Calculation of dependent event variables: – $\exists e \varepsilon M_E$ for p-verbs – $\exists e \varepsilon D_E$ for positive- and negative-implicative verbs – δe for p-factive verbs
4. Barrierhood of factive Comp			Factive Comp present at LF: – barrier to adverbial *wh*-movement – barrier to negation-raising	Discourse-semantic properties fixed → adequate reaction to presupposition failure

raising are not recognized and failed presuppositions are not interpreted correctly. I argued that this asynchrony results from a dissociation of discourse-semantic and logical form properties: Factive Comp δ-binds the embedded event variable, but is not present at LF. I claimed that the δ-binding features of factive Comp are not yet part of the child's grammatical representation at LF due to ambiguity of the input data. Triggered by input data that contain disambiguating discourse-semantic information at stage 4 the δ-binding features of factive Comp are established at the level of LF, enabling the language learner to recognize the weak island effects of p-factive matrix predicates and to react adequately to presupposition failure. Due to the ambiguity related to factive nonfinite complements and response stance complements these structures are expected to occur only at stage 4.

In sum, the question of at what age mastery of factivity occurs can be answered in several ways. Mastery of the presuppositional properties of factive sentences is achieved around age 4, at the same age at which theory of mind develops. Mastery of the syntactic restrictions and the discourse-semantic intricacies of factivity comes much later, around age 7 or 8.

However, many gaps in the developmental path still remain to be filled. It has to be left for further research to examine at what age response stance complements occur and when factive infinitival complements are interpreted correctly by the language learner. Moreover, we do not yet know at what age children recognize other syntactic restrictions of factive complements including prohibition of ECM infinitival complements, of subject-to-subject raising, and of postposing. Finally, to date there is to my knowledge no research on when and how children master the principles of presupposition projection and defeasibility.

7.7 Conclusion

In this chapter I discussed in detail two experimental studies examining preschool children's comprehension of factive and nonfactive sentences in different syntactic and discourse contexts. Both experiments were designed in a way that allowed testing acquisition hypotheses that could not be assessed in previous studies. I tested the Factivity Acquisition Hypothesis FAH_{Comp} stating that four- to six-year-old children distinguish p-factive from nonfactive matrix predicates according to the possible truth-values of their complement clauses. Hypothesis H1.5 in addition predicted that the type of complement clause is taken into account in assigning a truth-value to a sentence. Moreover, the Discourse-Semantic Hypothesis (DSH) was tested. This hypothesis states that the analysis of complements of p-factive matrix predicates is more complex than the analysis of complements of nonfactive verbs, if the presupposition of the complement clause conflicts with the discourse background already established.

The data from Experiment 1 and 2 indicates that already at age 4 children are able to correctly differentiate p-factive and nonfactive matrix predicates and assign truth-values to their complement clauses accordingly. What is more, the findings indicate that children at the age of 4 are sensitive to the factors 'type of matrix predicate' and 'type of complement clause'. Experiment 1 reveals that children between the ages of 4 and 6 are able to take into account the discourse background in calculating a sentence's interpretation, but are unable

to interpret failed sentential presuppositions. This supports the assumption that after age 4 children are still unaware of a number of subtle differences between p-factive and nonfactive verbs. I speculated that children might reanalyze the complement of a p-factive verb such as *forget* as negative-implicative if the presupposition fails. This way of restructuring failed presuppositions was argued to be reminiscent of adult's longer fixation times for false complements as examined in eye movement studies.

The recasted developmental path clearly demonstrates that acquisition of factivity proceeds indeed stepwise in a number of respects. As a result, the question of at what age mastery of factivity occurs can be answered in at least two ways. The experimental data presented here suggests that mastery of the presuppositional properties of factive sentences is achieved around age 4, at the same age at which theory of mind develops. However, mastery of the syntactic restrictions and the discourse-semantic intricacies of factivity seems to occur much later, around age 7 or 8.

8. Conclusion

In this book I have developed a compositional approach to the concept of factivity and its acquisition. Previous research on factivity, dating back to Kiparsky & Kiparsky (1971), has not sufficiently taken into consideration the complexity of the phenomenon and as a consequence has underestimated the complexity of the acquisition task. As my point of departure I put forth the hypothesis that the notion of factivity is necessarily compositional in nature, resulting from the complex interaction of lexical-semantic, syntactic, and discourse-semantic factors.

In view of continuity assumptions for language acquisition, this compositional proposal predicts that children acquire the concept of factivity stepwise and not in an all-or-nothing fashion. It implies moreover that children – trying to avoid irreversible wrong decisions for their interim grammars – are aware of the compositional character of factivity from early on. Focusing on English, these predictions were tested with production and comprehension data covering children's acquisitional patterns between the ages of 2 and 8. Besides re-examining previous longitudinal and experimental studies, I analyzed spontaneous speech data from two longitudinal corpora from the CHILDES database and developed two comprehension experiments. The compositional approach was shown to account both for the order in which nonfactive and factive structures emerge in children's speech and for changing interpretation patterns of factive and nonfactive complements.

Analyzing the nature of factivity I addressed the following questions:

(1) What are the factors contributing to a factive interpretation of a sentence?
(2) How can the class of nonfactive matrix predicates be characterized and distinguished from the class of p-factive matrix predicates?
(3) Are p-factive matrix predicates linguistic presupposition triggers?
(4) Does factivity have syntactic repercussions and if so which ones?

In response to question 1, I advanced a semantic-syntactic account of factivity. This can be regarded as a refinement of Kiparsky & Kiparsky's account of factivity, according to which a verb is factive if the complex sentence containing that verb carries the presupposition that the complement clause expresses a true proposition. Contrary to their lexical-semantic approach, I demonstrated that factivity is not a property of the matrix predicate alone but results from the interaction of a specific type of matrix predicate and a specific type of complement clause.

The following complement types were found to trigger a factive reading of the complex sentence if embedded by a Kiparskian factive matrix predicate: overt and non-overt *that*-complements, finite *wh*-complements, and a limited range of nonfinite complement types (perfectives, control infinitives, PRO-ing gerunds). The types of complement clauses admissible in factive sentences were argued to contain a specific form of tense/aspect marking. Hence I defined semantic-syntactic factivity as follows: Only if the complement clause is marked for a certain kind of tense/aspect feature can potentially factive (p-factive) predicates induce the presupposition that the complement clause expresses a true proposition. Extending Klein's analysis of tense to subordinate clauses, the restriction on tense/aspect marking was stated as a restriction on the topic time relation between matrix and embedded

clause. I put forward the hypothesis that all complement clauses admissible in factive sentences contain a topic time (t_{CC}) that precedes or overlaps with the topic time of the matrix clause (t_{MC}). This was formalized as follows: $\exists t_{CC} \in TT_{CC}$ and $\exists t_{MC} \in TT_{MC}$, $t_{CC} \leq t_{MC}$ (or short: $[t_{CC} \leq]$). If this precede/overlap requirement is not met, the complement clause cannot be part of a factive sentence. Put differently, p-factive predicates are generally underspecified with regard to their descriptive meaning and achieve factivity only in interaction with the right kind of complement clause, the possible exception being emotive participial and verbal predicates such as *be surprised* and *regret* that allow a wider range of complement types without losing the factive reading. I argued that this semantic-syntactic account of factivity is different from the notion of pragmatic factivity that comes about by means of contextual or specific structural conditions, which go beyond the interaction of a specific matrix predicate and a specific type of complement clause.

Turning to question 2, I demonstrated how p-factive matrix predicates, which induce a presuppositional reading of a complement clause, can be distinguished from various types of nonfactive matrix predicates, which do not presuppose the truth of their complement clause. Based on the truth-values of their respective complement clauses, several classes of nonfactive predicates were identified: p-factive (e.g., *regret, forget, be tragic*), positive-implicative (e.g., *happen, manage, be true*), propositional (e.g., *assume, believe, be possible, tell, think*), volitive (e.g., *ask to, tell to, want*), and negative-implicative (e.g., *forget to, refuse, be false*). I emphasized that positive-implicative and p-factive verbs only differ with respect to the truth-value of their complement clause when the matrix verb is negated or if the complement clause is false.

The third question asked whether p-factive matrix predicates are linguistic presupposition triggers. The compositional view of factivity advanced here rests on the assumption that the interaction of a p-factive matrix predicate and a specific type of complement clause *invariably* results in a sentence that carries the presupposition that the complement expresses a true proposition. More precisely, it is assumed that the factive presupposition arises as a result of the specific linguistic structure of the sentence – referred to as the inner-grammatical notion of presupposition – and not as a result of uttering this sentence in certain contexts. Thus, p-factive predicates are expected to be presupposition triggers. This prediction was shown to be borne out within a discourse-semantic framework that likens presuppositions such as definite NPs and factive complements to anaphors. I argued that factive complements, by virtue of being anaphoric expressions, require a link to a specific event file card that is already established in the discourse. More specifically, I proposed that Comp, specified as $[t_{CC} \leq]$, δ–binds the event variable in complement clauses of p-factive matrix predicates, thus yielding a definite description of an event, and that these matrix predicates select only complement clauses with the event variable already bound.

In view of this definition, a factive complement always refers back to a specific event file card. Depending on intrasentential and context factors, the event variable is bound either at an intermediate or at the top-most level of representation thus yielding an actual presuppositional reading. As a further result, I showed that the standard intrasentential presupposition tests merely serve to illustrate the behavior of presuppositions if nothing else intervenes, i.e. if the event variable can be bound at the top-most level of representation. Within a discourse-semantic framework, semantic-syntactic factivity has therefore inner-grammatical status. Consequently, p-factive matrix predicates are presupposition triggers, owing to the characterization of their (factive) complements as anaphoric expres-

sions that have to be bound at some level of representation, causing presupposition failure otherwise.

With regard to the class of response stance predicates (r-predicates), I provided a detailed account of their characteristics by contrasting them with p-factive predicates. I showed that while both p-factive and response stance predicates involve δ-binding, only the former induce a presupposition. This was attributed to a difference of p-factive and response stance predicates regarding the level of representation at which the embedded event variable can be δ-bound. The event variable in factive complements can be bound at any level of representation; the event variable in complements of response stance predicates can be bound at all but the top-most level of representation. In this respect, r-complements were said to resemble conditionals.

Consequently, the phenomena of presupposition projection and cancellation were reinterpreted as anaphoric linking. Presupposition projection, i.e. δ-binding at the top level of representation, is only available to presupposition triggers such as p-factive matrix predicates. δ-binding at some intermediate level of representation results in presupposition cancellation in the case of f-complements, and is the only option available to r-complements. Anaphoric failure arises if it is impossible to anaphorically link the event argument at any level of representation and if – due to conditions of felicity – accommodation cannot take place. Presupposition failure is hence a special case of anaphoric failure arising when the event variable is bound by a p-factive matrix predicate.

Question 4 asked whether factivity has syntactic repercussions. Since factive presuppositions are analyzed as anaphors with a specific event structure, the semantic-syntactic model of factivity predicts repercussions of factivity at the level of syntax. I showed that among the wide range of syntactic phenomena that have been proposed to result from the complement-taking predicate being p-factive, only five syntactic patterns stand up to this claim. Unlike nonfactive predicates, p-factive (and response stance) predicates in principle prohibit subject-to-subject raising, ECM infinitival complements, negation-raising, long adverbial *wh*-movement, and postposing. These restrictions are weak rather than defining properties of p-factive matrix predicates, since the same restrictions are also found in various types of nonfactive predicates. I argued that the different syntactic restrictions found in factive and nonfactive sentences can be accounted for by differences between the event structures and binding mechanisms of factive and nonfactive complements. As a consequence, the syntactic restrictions that hold for f- and r-complements seem to depend on conditions of anaphoricity rather than on conditions of presupposition.

Rendering the above characteristics of factivity in terms of language acquisition, it is generally expected that children acquire the concept of factivity stepwise and not in an all-or-nothing fashion. Moreover, the following more specific hypotheses were derived from the semantic-syntactic model of factivity:

(H1) A target-like understanding of factivity requires recognition of the compositional character of factivity, i.e. the interrelation of a potentially factive matrix predicate with a tensed/aspect marked complement clause.

H.1.1 Since the complementizer *that* is not obligatory in factive complements, *that* does not play a leading role in acquiring the target-like interpretation of factive and nonfactive sentences.

H.1.2 Production of finite complement clauses does not coincide with mastery of factive structures.

H.1.3 Acquisition of factive nonfinite complements is delayed, as it is more difficult to infer their non-overt tense/aspect marking from the surface structure than for factive finite complement clauses.

H.1.4 Response stance complements occur rather late in children's speech, resulting from the specific property of r-predicates to δ-bind the embedded event variable without inducing a presupposition.

H.1.5 Children are sensitive to the contributing factors 'type of matrix predicate' and 'type of complement clause' from early on.

(H2) Since p-factive and nonfactive matrix predicates differ in the possible truth-values that their complement clauses can receive, the language learner masters (some of) these nonfactive predicates at the same time at which she correctly interprets complement clauses of p-factive matrix predicates as presupposed to be true.

(H3) Given that within a discourse-semantic framework p-factive predicates are linguistic presupposition triggers, children assign truth-values to complement clauses based on this linguistic property rather than according to pragmatic measures such as probability. In calculating a sentence's interpretation, language learners take into account the previously established discourse background.

(H4) Children recognize the syntactic restrictions of factive complements (prohibition of long adverbial *wh*-movement, negation-raising, ECM structures, subject-to-subject raising, and of postposing) only after they have established rf Comp as a δ-binder of the embedded event variable at the level of LF.

Comparing these acquisition hypotheses with both the results from previous language acquisition studies and my own results from an analysis of two longitudinal corpora and two comprehension experiments, I found most predictions to be borne out. What is more, the discourse-semantic representation used to characterize children's grammatical systems at specific stages in development proved suitable for accounting for how children understand factive and nonfactive sentences at different times in development.

As predicted by H1.1, the complementizer *that* does not play a central role in the acquisition of factivity. Previous longitudinal studies as well as my analysis of the Abe- and the Adam-corpus indicate that the complementizer is almost never present in *that*-complements. In addition, results from sentence repetition tasks reveal that children up to the age of 5 are not sensitive to presence of the complementizer.

H1.2, more specifically formulated as the Factivity Acquisition Hypothesis on production (FAH_{Prod}), was supported by the analysis of the two corpora as well. Adam and Abe produced finite nonfactive complement clauses long before they started producing finite factive complement clauses, even though potentially factive matrix verbs such as *forget* were already used by the children in combination with nominal or nonfinite complements. Factive sentences occurred first around age 4. Particularly, these findings support the postulated stepwise acquisition of factivity.

According to H1.3 and H1.4, factive nonfinite complements and complements of response stance verbs occur rather late in children's speech. This hypothesis is corroborated by the data from Adam and Abe. Except for one factive infinitival complement uttered by

Adam at 4;10, they did not produce either form until the age of 5. Further research is called for to investigate in detail how and when factive nonfinite complements and complements of response stance verbs are acquired.

Hypothesis H1.5 is substantiated by results from my two comprehension studies with 55 English speaking children between the ages of 4 and 6. The children were able to pay attention to both factors contributing to a factive interpretation: the specific type of matrix predicate and the type of complement clause. They differentiated between matrix verbs such as *forget* and *think*. A finite complement embedded by the former verb received a factive interpretation and a finite complement embedded by the latter verb received a propositional interpretation. Moreover, the children distinguished finite from nonfinite complements. *Forget* with a *to*-complement was interpreted as negative-implicative, while *forget* with a *that*-complement was interpreted as factive. Likewise, the *to*-complement of *tell* received a different truth-value than the *that*-complement of *tell*.

Hypothesis H2 predicts that nonfactive predicates can be distinguished according to the truth-value of their complements at the same age at which factive complements are correctly interpreted as presupposed to be true. While this prediction has been confirmed by a number of previous comprehension studies, research so far has remained inconclusive regarding the age at which this developmental shift takes place. Age of mastery varied between 4 and 14. Extending the model of linguistic determinism by de Villiers & de Villiers, I postulated the Factivity Acquisition Hypothesis on comprehension (FAH_{Comp}) according to which p-factive matrix predicates are distinguished from the various types of nonfactive matrix predicates according to the possible truth-value of their complement clauses after emergence of a theory of mind at about age 4. In contrast, before development of a theory of mind children are expected to interpret complements of nonfactive and p-factive matrix predicates as true. Results from comprehension studies with children younger than 4 as predicted indicate that at that stage of development children employ a complement-only strategy, i.e. they interpret the complement clause to be true independently of the matrix predicate, arriving at incorrect interpretations for nonfactive, but at apparently target-like interpretations for factive complements. In other words, even though children younger than age 4 produce various complement types, they assign a non-target-like interpretation to them. The emergence of the theory of mind around the age of 3;6 then paves the way for mastering the interpretation of embedded sentences, among them factive complements, by enabling the child to distinguish between facts and thoughts. The data from my own comprehension experiments substantiated the first part of the FAH_{Comp}. Already at age 4 children were able to correctly differentiate p-factive and nonfactive matrix predicates and assign truth-values to their complement clauses accordingly.

As for hypothesis H3, my experimental studies corroborated the assumption that four- to six-year-old children interpret predicates based on discourse-semantic properties such as factivity rather than on the perceived level of probability or invited inferences. The results from Experiment 1, which included in its design a discourse background against which subjects had to evaluate the truth of factive and nonfactive sentences, particularly strengthen the hypothesis that in calculating a sentence's interpretation children are able to take into account the given discourse background. As predicted by the Discourse-Semantic Hypothesis (DSH), however, children aged 4 to 6 failed to correctly interpret factive complements, if the presupposition conflicted with the discourse background established so far, i.e. in cases of presupposition failure. I argued that this reaction proves that they do not

misinterpret factive complements as positive-implicative, since in that case a false complement could simply be negated. Instead, in cases of presupposition failure the children interpreted the factive complement of *forget* as negative-implicative. I speculated that this interpretation results from reanalyzing the discourse-semantic interpretation of the complement clause in order to fit the discourse. Adequate reaction to presupposition failure was conjectured to occur at around the age of 7. Below I return to the question of how this knowledge change can be characterized in terms of a discourse-semantic framework.

As for hypothesis H4, various comprehension studies revealed that children between the ages of 4 and 7 are presumably aware of the presuppositional status of factive complements, but fail to recognize the barrierhood of factives regarding long adverbial *wh*-movement and regarding negation-raising. Emergence of the theory of mind, which takes place around age 4, was therefore analyzed as a necessary but not sufficient requisite for mastering factivity. As one of the central issues in the acquisition of factivity I identified the question of how we can explain that children at the age of about 4 seem to produce and correctly interpret factive complement clauses, while failing to recognize that factive complements are islands to extraction. Discarding two alternative hypotheses, I argued that this asynchrony results from a dissociation of discourse-semantic and logical form properties. Factive Comp δ-binds the embedded event variable, but is not present at the level of LF. I claimed that the δ-binding features of factive Comp are not yet part of the child's grammatical representation at LF due to multiple ambiguities of the input data. First, response stance complements are δ-bound while not being interpreted as presuppositional. Second, complements of response stance and p-factive predicates do not generally require the presence of the complementizer *that*. Third, syntactic restrictions of factive (and response stance) complements are weak rather than defining properties of p-factive matrix predicates, as none of the syntactic restriction is exclusive to p-factive matrix predicates. The absence of factive Comp features at LF makes it possible to circumvent the factive barrier for adverbial *wh*-movement and negation-raising. I speculated that the representation of factive Comp at LF may be triggered upon correct analysis of factive negation-structures referring to unambiguous contexts or upon analyzing adverbial *wh*-questions with adjectival matrix predicates.

With respect to presupposition failure, I argued that the absence of the relevant factive Comp features [$t_{CC}\leq$] at LF has as one of its consequences that the interpretation of the embedded clause as a definite description is not irrevocable. Thus, while in cases of presupposition failure an adult listener may try to accommodate the discourse background only, the child can accommodate the discourse-semantic interpretation of the embedded event argument. As soon as the factive Comp features are present at LF, the interpretation as a definite description is 'fixed' and consequently restructuring is no longer available, nor is movement out of complements of p-factive and response stance matrix predicates.

In a further step, I integrated these acquisitional findings into a developmental path towards mastery of factivity that encompasses changes in the child's cognitive, lexical-semantic, syntactic, and discourse-semantic representation. In the first developmental stage the language learner starts out with simple sentences that are mapped onto simple events. Triggered by input data that require an additional structural level, the complementizer system comes into place at stage 2. Due to use of the complement-only strategy, complement clauses are interpreted as independent units and are thus taken to express true propositions. By acquiring the syntax of embedding the child is being equipped with the structural format

necessary to represent embedded propositions, thus paving the way for the mastery of theory of mind at stage 3. The resulting distinction between facts and thoughts enables the child to correctly interpret nonfactive and factive complement clauses with regard to their different truth-values. At stage 3 syntactic restrictions of factive structures including barrierhood regarding *wh*-movement and negation-raising are not recognized and failed presuppositions are not interpreted correctly. Triggered by input data that contain disambiguating discourse-semantic information, at stage 4 the δ-binding features of factive Comp are established at the level of LF, enabling the language learner to recognize the weak island effects of p-factive matrix predicates and to react adequately to presupposition failure.

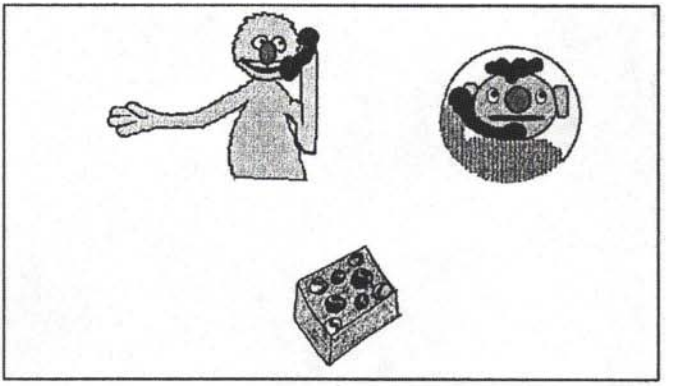
In sum, the acquisitional findings reported here generally confirm the hypotheses derived from a compositional approach to the notion of factivity. Besides the conceptual advance of discussing acquisitional issues in light of a well-founded theoretical framework, the findings from acquisition can also be used to assess the theoretical hypotheses. The acquisition data were for the most part shown to be consistent with the theory, thus substantiating the composite character of factivity and the discourse-semantic nature of presupposition. What is more, the findings regarding barrier violations and presupposition failure, if correct, point to the need for a more refined notion of the relation between discourse-semantic properties and the level of Logical Form. I contend that in the language learner's grammatical system the instantiation of some discourse-semantic feature such as δ-binding does not coincide with representing the relevant features at LF. The one-to-one-correspondence between these two aspects, as implied for example by Lasnik & Saito's (1984) principle of deletion at LF, should thus be reconsidered. It should also be spelled out how a discourse-semantic feature is rendered into a rather syntactic property present at LF. What is more, a developmental perspective is needed on the relationship between discourse-semantic properties and the level of LF.

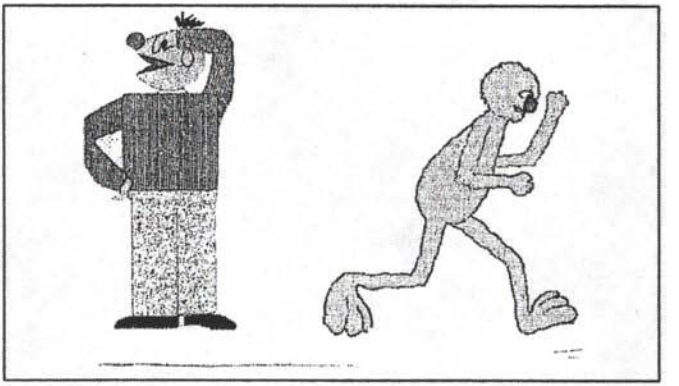
Many gaps remain in the developmental path towards mastery of factivity. The acquisition of response stance complements and factive infinitival complements merit more detailed examination. Moreover, acquisition of other syntactic restrictions of factive complements besides *wh*-movement and negation-raising (i.e. prohibition of ECM infinitival complements, of subject-to-subject raising, and of postposing) warrant further investigation. Furthermore, the question of when and how children master the intricate principles of presupposition projection and defeasibility has to be left to future research. Finally and most importantly, the acquisitional implications of the proposed discourse-semantic parallel between definite NPs and factive complements remain to be explored.

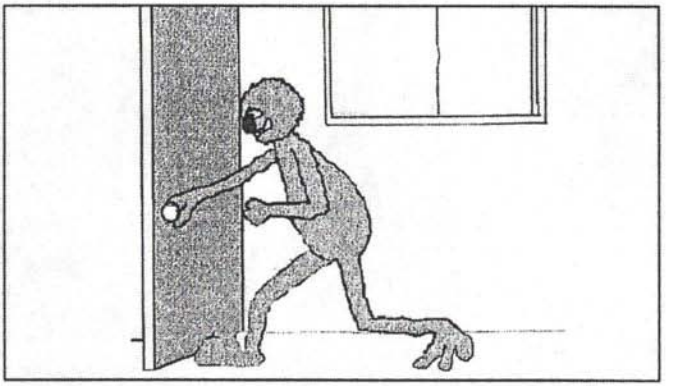
Concluding, it seems that children are about 7 when they achieve a full understanding of the concept of factivity including its intricate syntactic and discourse-semantic properties, an age at which according to Doris Lessing they "suddenly become stupid like adults".

Appendix

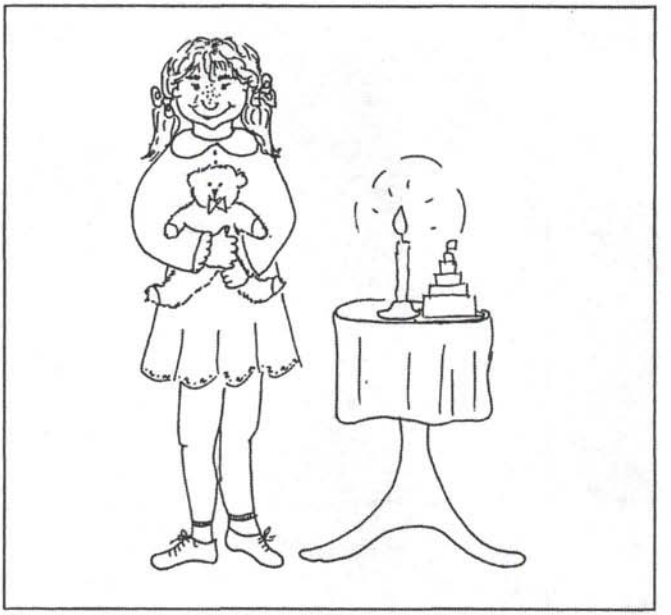
Experiment 1: Pictures for the sample story *forget/non-s-event*



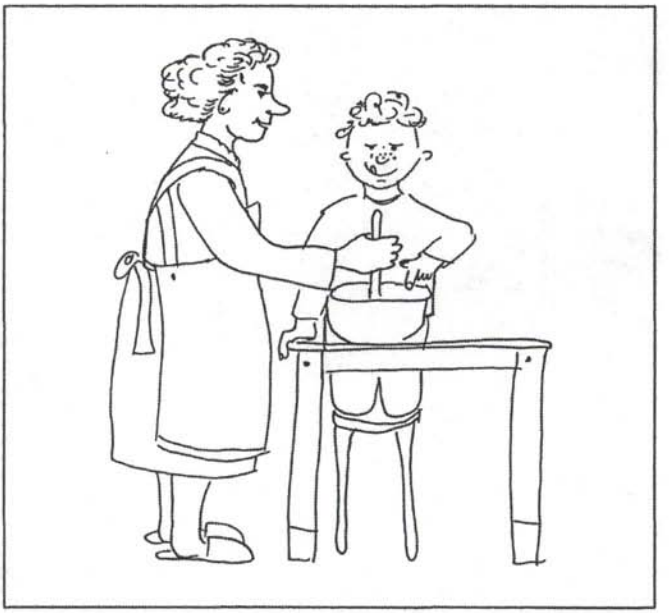




Experiment 2: Picture for the sample story *forget that*



Experiment 2: Picture for the sample story *think that*



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