Presuppositions in Context

by

Athulya Aravind

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Signature redacted

Author .....
Department of Linguistics and Philosophy
August 30, 2018

Signature redacted

Certified by .....
Martin Hackl
Associate Professor of Linguistics
Thesis Supervisor

Certified by ..... Signature redacted .....
Daniel Fox
Anshen-Chomsky Professor of Language and Thought
Thesis Supervisor

Signature redacted

Accepted by .....
Adam Albright
Linguistics Section Head, Department of Linguistics and Philosophy

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Abstract

This dissertation is about the acquisition of presupposition. The specific focus is on the interplay between presuppositional content as hardwired in the semantics of particular expressions and the conversational contexts in which utterances containing those expressions may be used. A series of behavioral experiments examine what children in the preschool age range know about the pragmatic principles governing presupposition, and how they come to acquire this knowledge.

The dissertation is organized into two thematic halves. The first half investigates the conditions that govern when presupposing something is appropriate, hence allow for the use of a presupposition triggering expression. Specifically, I ask: do young children know the *common ground requirement* — the formal requirement that presuppositions be previously established common knowledge — and do they know when and how this requirement can be violated? Two sets of experiments, using two presupposition-carrying expressions with importantly divergent properties (*too* and *the*), reveal that children, like adults, generate a default expectation that a presuppositional sentence be uttered to a listener who already takes for granted the presupposition. However, they hold onto this expectation even in circumstances where adult speakers do not. Unlike adults, children do not expect that an otherwise 'neutral' listener might accommodate a speaker's informative presupposition. Together, these findings point to a developmental path where the formal requirement — that presuppositions be *pre*suppositions — is acquired before an understanding *that* the rule can be bent and *how*.

The second half examines the conditions that make marking of presuppositions obligatory, hence require the use of a presupposition triggering expression. Are children sensitive to *Maximize Presupposition!* (Heim 1991) as a principle governing competition and utterance choice? The ability to deploy *Maximize Presupposition!* in an adult-like way shows a more protracted developmental trajectory. Moreover, children's ability to rule out presuppositionally weaker sentences seems to vary across competition environments. Taking the non-uniformity in development as signaling non-uniformity in the underlying phenomena, I develop an alternative account for a pair of expressions commonly thought to compete

for *Maximize Presupposition!*: *another* vs. *a*. Ultimately, I suggest that *Maximize Presupposition!* is one of several pragmatic principles that lead to competition and selection of structures imposing the strongest contextual requirement. Children have command of some of these conditions, but not others. The acquisition trajectories are modulated by various factors, including the type of requirement imposed on the context (e.g. that some proposition is salient vs. accepted common belief) and the types of knowledge that are pre-requisites (e.g. knowledge of idiosyncratic properties of the lexicon).

Thesis Supervisor: Martin Hackl
Title: Associate Professor of Linguistics

Thesis Supervisor: Daniel Fox
Title: Anshen-Chomsky Professor of Language and Thought

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Chapter 1

Introduction

1.1 Overview and goals

Natural language affords us with means of distinguishing the main point of an utterance, its *asserted* content, from background information taken for granted by the conversation participants, its *presuppositions*. A speaker uttering the sentences in (1) and (2), for example, would be asserting (1-a) and (2-a) respectively. In both cases, the speaker presupposes that they spoke to a unique woman.

(1) The woman that I talked to is an MIT graduate.

   a. The unique woman that I talked to is an MIT graduate
   b. There is a unique woman that I talked to

(2) It's not the case that the woman that I talked to is an MIT graduate.

   a. The unique woman that I talked to is not an MIT graduate
   b. There is a unique woman that I talked to.

The implications in (a) and (b) have in common that a sincere speaker of the utterance is committed to them. However, asserted and presupposed content differ with respect to both usage and compositionality. Unlike asserted content, the implication in (b) is not offered up as new information that is up for debate. Moreover, unlike asserted content, the presupposed content seems to interact differently with embedding operators (e.g. negation): presuppositions "project".

A core issue in the study of natural language meaning concerns the organization of and division of labor between these components of meaning. What are the semantic and pragmatic assumptions we need to capture these empirical properties? When and how does a child acquire the ability to differentiate these aspects of meaning and identify how they factor into the ways sentences can be used? In this dissertation, I home in on the second set of questions and in attempting to answer them, aim to contribute answers to the first. In a series of behavioral experiments, I investigate what children, roughly in the preschool age range, know about the principles of language use governing presupposition, and how they come to acquire this knowledge.

My broader aims in carrying out these studies are two-fold. The first is descriptive. Developmental research on presuppositions as a class of phenomena is limited. Consequently, we know very little at present about what children know of the system underlying presuppositional phenomena. This gap is unfortunate, as presuppositions, located squarely at the intersection of lexical-semantics, syntax and pragmatics, provide a unique window into understanding children's developing grammatical and communicative competence. Presuppositions are generally thought to be conventionally associated with, i.e. written into the meanings of, specific lexical items.[1] Beyond this, they are associated with a set of rules of presupposition projection — how a presupposition triggered in a sub-constituent is inherited by the more complex structures it is part of — and usability — what the discourse context must look like so that the use of a presupposition is deemed appropriate in that context. Despite the manifest intricacy of the system underlying presuppositions, there is suggestive evidence to the fact that children learn its ropes early on. First uses of presuppositional expressions can be seen as early as 1;6 years of age. The CDI's Vocabulary Checklist for 8-to-18-month olds (Fenson, Marchman, Thal, Dale & Reznick 2007) includes 23 words typically thought to trigger a presupposition (2 Action Words, 11 Pronouns, 6 Question Qords, 4 Quantifers), a further indication that presuppositional expressions are among the first words that a child produces.[2] This raises important questions of interest to both developmentalists and semanticists: What do they know about these words? If they only have partial knowledge, what parts do they know, and how do they learn the rest? If they have

[1]There are also constructions, e.g. clefts, which have been said to be conventionally associated with presuppositions. Even in these cases, it is not clear whether the presuppositionality is contributed by a specific morpheme present in the structure, e.g. a silent definite determiner (Akmajian 1970; Hedberg 2000; Percus 1997).

[2]The CDI lists a total of 396 typical words in young children's vocabularies.

master their meanings and use early on, what grammatical knowledge must children come in with order to allow for such swift mastery? What social and cognitive abilities must already be in place so that they can deploy this grammatical knowledge, and what does it tell us about the relationship between grammar and those other components of the mind?

My second goal is theoretical. The domain of presupposition is a complex and noisy empirical terrain. As will be explicated shortly, we find considerable variability in the usability of presuppositional sentences across contexts and heterogeneity within the class of presupposition-triggering expressions. Moreover, much of what is involved in the interpretation of presuppositional sentences might not be accessible to stable, direct intuition or inspection. As a result of all of this, there is substantial disagreement among theories about virtually every aspect of presupposition. The time-course of acquisition of this component of grammar may help constrain the space of possible theories by providing a set of facts that must be captured by any adequate theory. With this in mind, findings from the studies conducted here will be discussed in relation to linguistic theories of the particular phenomena of interest, with the intent to inform these theories.

1.2 Presuppositions and anti-presuppositions

The specific focus of this dissertation will be on young children's understanding of the interplay between presuppositions and the context. I will examine two separate, but interconnected aspects of presupposition use: (*i*) the conditions that govern when presupposing something is appropriate, hence allow for the use of a presupposition triggering expression, and (*ii*) the conditions that make marking of presuppositions obligatory, hence require the use of a presupposition triggering expression. This section spells out these conditions in more detail.

1.2.1 The conversational common ground

Following Stalnaker (1974, 1978), I assume that sentences used in communication contribute to an existing conversational record among the discourse participants. Part of this record is the set of assumptions taken for granted by the discourse participants, the conversational *common ground*. The common ground describes a set of worlds, the *context set*, which are those worlds in which all of the propositions in the common ground are true, and

which constitute the range of worlds that conversational participants take to be candidates for being the actual world.

The common ground guides the course of a conversation, but it evolves as conversation unfolds. Exchange of information is taken to be a cooperative endeavor, where agents aim to increase the body of mutually accepted assumptions, in turn narrowing down the set of candidate worlds that could be the actual world. The main way of doing this is by making an assertion. The goal of an assertive speech act is to update the common ground with the proposition it describes. To update the common ground with an assertively used sentence is to eliminate those worlds in the context set at which the proposition expressed is false, while retaining those at which the proposition is true. If successful, the end result of an assertion is a new set of worlds that is a proper subset of the context set at the previous stage in discourse.

1.2.2 Presuppositions

Presuppositions of a sentence impose constraints on the types of contexts against which that sentence can be uttered. The sentences in (3) - (5) all require that the presupposed proposition already be part of the common ground of conversation at the point of utterance.

(3) The woman that I talked to is an MIT graduate.
Presupposes that there is exactly one (relevant[3]) woman that I talked to

(4) Both of her children are MIT graduates.
Presupposes that she has exactly two children

(5) Dana knows that MIT has a swimming requirement.
Presupposes that MIT has a swimming requirement

Where does this requirement come from? On one view, originally suggested by Stalnaker himself (Stalnaker 1978) and elaborated upon in von Fintel (2008), it derives in a principled manner from the semantics of presuppositional sentences and general conversational rules governing cooperative discourse. Following the Fregean tradition, a sentence S semantically presupposes another sentence S' if S' must be true in order for S to have a denotation.

[3]The condition is not that the speaker has talked to exactly one woman among all the women in the world. The domain of the definite description is restricted to a contextually relevant subset.

On this view, then, the semantic values assigned to sentences must encode a formal distinction between presupposition failure. One way of doing this (described in e.g. Heim & Kratzer 1998) is to treat presuppositional sentences as expressing partial functions, which have an interpretation (or receive a classical truth value (1 or 0)), only in circumstances where the presuppositions are true. Thus:

(6) Given the interpretation function $[\![\ ]\!]$ and any world *w*:

a. *The woman that I talked to is an MIT graduate* $\in$ dom($[\![\ ]\!]^w$) iff I talked to a unique woman in *w*

b. When defined, $[\![$*The woman that I talked to is an MIT graduate.*$]\!]^w = 1$ if the unique woman I talked to is an MIT graduate in w;
otherwise $[\![$*The woman that I talked to is an MIT graduate*$]\!]^w = 0$

As mentioned earlier, assertively used sentences are proposals to update the common ground against which they are uttered. To carry out this update, the listener must be able to deterministically evaluate the relevant proposition as true or false in each world in the context set. If the context set contains a world in which the proposition cannot be evaluated as true or false, then it would be unclear whether or not this world should be kept or eliminated during the update procedure, and the proposal to update will not go through. This is at the heart of the requirement that presuppositions of a sentence not only be known to the speaker, but be shared common knowledge. If sentences with semantic presuppositions fail to receive a classical truth-value at worlds where its presuppositions are false, and moreover, assertively used sentences must receive a classical truth-value in every world in the context set, a cooperative speaker should only use presuppositional sentences if its presuppositions are met in every world in the context set against which it is uttered. Throughout, I refer to this requirement as the "common ground requirement" of presuppositions.

The common ground requirement, on this view, is a formal requirement that results from the partial semantics of presuppositional sentences[4] and the fact that assertions are

[4]Stalnaker is silent on why some sentences are associated with semantic presuppositions in the first place. Soames (1989) provides a "functional" answer: semantic presuppositions provide speakers with conventional means of indicating what assumptions they are making about the conversational backgrounds to which their utterances contribute. But why do certain expressions, but not others, enable such redundancy? This is the triggering problem of presuppositions. Abrusán (2011) provides a way of answering this question for verbal triggers. Consider aspectual verbs like *stop*, which describe a transition from one state to another. The tendency is for the preceding state to be presupposed. Abrusán 2011 suggests that this is systematic and relates to the

meant to update the common ground. The "bridge" between the semantics and pragmatics is the condition that a proposition can update a context set only if it has a *determinate truth-value* in every world in the context set. This empirical picture, however, is complicated by the fact that the formal requirement is not always met in ordinary conversation. Speakers often use presuppositional sentences, seemingly felicitously, in contexts that do not entail their presuppositions. Consider (7), from (von Fintel 2008). I might utter this, having just walked into a meeting full of people I barely know. Here, I seem to be presuppose that I have a daughter, even though I do not assume that my audience knows this. In this context, then, the presupposition — that I have exactly one daughter — is "informative".

(7) I am sorry that I am late. I had to take my daughter to the doctor.

To account for the fact that update of the context with (7) can be successful in spite of the fact that it has a semantic presupposition not entailed by it, we have to enrich the previously articulated picture somewhat. Specifically, a procedure of "presupposition accommodation" is assumed, whereby listeners, knowing that certain contextual constraints are in force, will adjust their beliefs to bring the common ground in line with the requirements of an uttered sentence. The basic idea is this. Strictly speaking, a speaker should not assert a sentence whose presupposition is not entailed by the common ground. However, the common ground is never explicitly settled and is constantly in flux. When a sentence with a missing presupposition is used, listeners can use the semantic presupposition of that sentence as a clue as to the type of context the speaker wants to take for granted. If they don't have qualms about shifting to such a context, they play along, either for the purpose of the conversation or for real. Thus, on the view articulated here, two systems must be distinguished: (*i*) the formal requirement that presuppositions be presupposed in the common ground prior to assertion and (*ii*) a cooperative strategy for when the formal requirement is violated by an otherwise cooperative speaker.

1.2.3 Anti-presuppositions

The existence of presuppositions shows us that sentences can be conventionally linked to use conditions of the form: "Assert me only to propose an update of a context with property

fact that we are more interested in what is at stake at the evaluation time than at a time prior. This results in a systematic demoting, or backgrounding, of the information about the past event.

X". This raises the question: what kinds of properties can such conventionally derived use conditions make reference to? At least first blush, sentences like (8)-(10) seem to impose contextual demands of a similar nature. For instance, the requirement associated with (8) makes it look like the sentence presuppose the opposite of what (1) does: *non*-uniqueness. Similarly, (9) seems to presuppose the opposite of what (4) does: anti-duality.

(8) A woman that I talked to is an MIT graduate.
It's not the case that there is exactly one woman that I talked to

(9) All of her children are MIT graduates.
It's not the case that she has exactly two children

(10) Dana thinks that MIT has a swimming requirement.
It's not the case that MIT has a swimming requirement

However, a closer look at the data shows otherwise. If, for instance, (4) presupposed a dual domain and (9) a non-dual one, neither would be appropriate in circumstances where the number of children has not yet been established. However, the fact of the matter is that *all* is fine here (and the listener is not compelled to accommodate the existence of more than two children, either).

(11) I don't know exactly how many children she has, but I do know that...
✓all/#both of her children are MIT graduates.

So what is the nature of the requirement associated with (8)-(10)? These sentences require a certain proposition *not* to be entailed by the common ground; they *anti-presuppose* that proposition. And while they share a family resemblance with presuppositional requirement, the general consensus is that anti-presuppositions of this sort do not have the same cognitive status as presuppositions. Unlike presuppositional requirements, anti- presuppositional requirements do not arise as a direct consequence of the formal properties of the sentences in question. Rather, they arise indirectly, due to competition. Specifically, in cases where (8)-(10) is unuseable, this is because they are blocked by the possibility of using the sentences in (3)-(5) above.

The competition view of anti-presuppositional effects originates with Heim (1991), who proposed a principle *Maximize Presupposition!*, which requires speakers to mark the

strongest presupposition compatible with the context. So, in situations where e.g. (3) and (8) would communicate the same information, we would need to use the sentence with *the* rather than *a* because *the* contributes a stronger presupposition than *a*. If this view is right, this suggests that the part of the grammar that determines anti-presuppositions does not merely look at a single syntactic structure, the one that gets associated with an anti-presupposition. Rather, it compares this syntactic structure with a competing structure, and determines whether it can be used by considering whether its competitor could be used instead.

1.3 Outline of the dissertation

In this dissertation, I focus on those aspects of grammar and language use that lead to presuppositions and anti-presuppositions, as described above. Specifically, I ask two questions:

(*i*) What are the developmental trajectories of presuppositional and anti-presuppositional constraints?

(*ii*) What does the particular acquisition path chosen by the child tell us about the nature of these constraints?

Investigation into these questions proceeds in two parts. In the first thematic half of the dissertation (Chapters 2-3), I examine children's understanding of when speakers have grounds to use a presuppositional sentence. In Chapter 2, I examine the common ground requirement. To preview the results, we find that by 4-years of age, children are sensitive to this requirement and have a default expectation that the presuppositions of an asserted sentence is shared knowledge among the speaker and addressee. This result, in turn, informs us that young children have underlying knowledge of the distinction between presuppositions and asserted content in the semantics and the principles of language use that modulate the appropriateness of these different aspects of meaning.

The topic of Chapter 3 is accommodation. Do children expect, like adults, that presuppositions can be informative in the right circumstances? Do they know how accommodation works? The results reveal that children, unlike adults, do not expect that an otherwise ignorant listener should be able to accommodate a novel presupposition. This suggests that

children not only have the common ground requirement in place, but they start out with the assumption that the requirement is inviolable.

In the second half of the dissertation (Chapters 4-5), I turn to anti-presuppositions. Specifically, I ask whether children are sensitive to *Maximize Presupposition!* as a principle governing utterance choice. In Chapter 4, I show that unlike the common ground requirement, the principles that lead to anti-presuppositional effects develop in a more protracted manner. Moreover, children's ability to rule out presuppositionally weaker sentences seems to vary across environments. I take the non-uniformity in development as evidence for non-uniformity in the underlying phenomena. Chapter 5 examines this non-uniformity in-depth and develops an alternative account for one of the test environments that was previously thought to fall under the purview of *Maximize Presupposition!*.

Ultimately, *Maximize Presupposition!* is shown to be one of several conditions that lead to competition and selection of the structure imposing the strongest contextual requirement. Children have command of some of these conditions, but not others. I suggest that the ease and speed of acquisition are modulated by various factors, including the type of requirement imposed on the context (e.g. that some proposition is salient vs. accepted common belief) and the type of knowledge that are pre-requisites (e.g. knowledge of specific lexical items).

Chapter 2

Knowing when to presuppose

2.1 Introduction

2.1.1 The common ground requirement

On a common approach to presuppositions, the propositions that a sentence presupposes are those that must be entailed by the common ground against which that sentence is uttered (Stalnaker 1974, 1978; Karttunen 1974). The common ground, roughly, is the set of all those propositions that the conversation participants take for granted, either because they constitute permanent shared knowledge within the speaker community, or because they have been established over the course of the preceding discourse. In this respect, the pragmatics of presupposition differs fundamentally from that of asserted content, which need not — and should not — be previously established common knowledge. The pragmatic requirement associated with presuppositional sentences is stated in (1).

(1) **Felicity condition on presupposition use:** A sentence S with presupposition p may be used in a conversational context c only if c entails p at the time that S is uttered.

I will label theories committed to this condition the 'common ground theories of presupposition.'

As explicated in the Introduction, I take this requirement to fall out as a consequence of the partial semantics of presuppositional sentences and general rules governing cooperative

discourse (von Fintel 2008).[1] The crucial ingredients are listed in (2).

(2) a. **Semantics:** A presuppositional sentence is undefined (or receives a third truth-value, '#') in worlds where its presuppositions are not true.

b. **Pragmatics:** The goal of an assertion is to update the common ground by eliminating a set of worlds from the context set (i.e. by adding new information).

c. **The Bridge:** A proposition is assertable in a conversational context only if every world in that context set is such that the proposition is either true or false in it.

To summarize: Presuppositions are conventionally encoded components of sentence meaning. Sentences are asserted as proposals to eliminate from the context set those worlds in which the proposition is false. This can happen only if the listener can identify in a deterministic way those worlds in which the relevant proposition is false. The listener can deterministically evaluate the truth of a sentence only if they know that its presuppositions are satisfied. Consequently, cooperative speakers should only use a presuppositional sentence in circumstances where the listener already knows that the sentence presuppositions are met.

The main goal of this chapter is to investigate children's acquisition of the use condition on presuppositions given in (1). Given the theoretical assumptions outlined above, an investigation into the acquisition of the felicity condition on presupposition use is indirectly also an investigation of children's knowledge of the semantic distinction between assertive and presuppositional components of meaning, as well as general principles governing natural language use. In a series of experiments, I examine participants' biases about the information state of the addressee generated by a speaker's utterance of a presuppositional sentence. That is, given the utterance of a sentence S with the presupposition p, how likely is it that the addressee is presumed to already know that p holds? Such biases, in turn, serve as a proxy for expectations about the state of the conversational context, i.e. about what properties the context must have in order for S to have been appropriate.

[1] My theoretical views thus diverge somewhat from the original proposals in e.g. Stalnaker (1974), who remained agnostic about whether or not pragmatic presuppositions are fundamentally associated with semantic presuppositions.

2.1.2 Informative presuppositions

If the characterization of presupposition use described above is correct and the child learner must converge on a rule such as in (1), her acquisition task is bound to be non-trivial. This is because evidence for this rule in actual conversation — which makes up the child's input — is noisy. In actual conversation, speakers routinely violate the common ground requirement and use presuppositions to introduce new information.

Let us consider again the predictions of the framework sketched above. A straightforward prediction on this approach is a clean division between assertions and presuppositions in language use. Assertions must contribute new information and presuppositions must express old information that is already part of the conversation participants' background assumptions. If a presuppositional sentence is used against a context that is neutral with respect to the sentence presupposition (i.e. it neither entails the truth or falsity of the presupposition), the expectation on the common ground theory — in its simplest form — is that the conversation comes to a snag. The context does not entail the presupposition, and update of the context with the content expressed by the sentence cannot happen. The listener might then challenge the presupposition or request clarification, allowing the speaker a chance to back up and fill in the missing presupposition so that the conversation can move forward.

This may indeed happen, but it has been observed that there are cases where such missing presuppositions do not lead to a conversation breakdown. For example, (3), which presupposes that the speaker has a daughter, can very well be felicitously and successfully uttered even when it is not common knowledge that the speaker has a daughter. Moreover, the utterance of such a sentence is successful even without any explicit signaling that a conversational rule is being violated.

(3) I am sorry that I am late. I had to take my daughter to the doctor this morning.

On the common ground approach to presuppositions, the felicity of this sentence results from the availability of *presupposition accommodation*, whereby listeners can adjust the contextual assumptions so as to satisfy the presuppositional requirements of the sentence. The basic idea is as follows. Suppose a speaker utters a sentence S which requires that the common ground satisfy certain requirements, e.g. that it entails a certain proposition p. But suppose that although p is not part of the common ground, it is not controversial and the speaker believes that the listeners will be ready to update the common ground with p

in any case. A cooperative and efficient listener, knowing that a requirement like (1) is in force, and assuming that the speaker intends her utterance to effect an update to the common ground, will simply adjust her beliefs in the necessary way and bring the common ground in line with the requirements imposed by the utterance. That is, even if p is not entailed by the context, the listener might nevertheless agree to accept the presupposition and interpret the sentence as if p is established common knowledge. The speaker, anticipating the listener's cooperative stance, might then rely on their ability to accommodate and use sentences with unsatisfied presuppositions to meet some strategic end (e.g. efficiency).

The availability accommodation is governed by various, often ill-understood factors like plausibility or uncontroversiality of the proposition needing to be accommodated (to be discussed further in Chapter 3). Perhaps what is most crucial for present purposes is the fact that the availability of accommodation seems to differ on the basis of the trigger involved. Whereas presuppositions associated with possessive pronouns, certain definite descriptions, certain factive verbs, etc. can be accommodated in the right circumstances, other triggers like regular personal pronouns or discourse particles such as *too* seem to resist accommodation (Kripke 2009; Beaver, Clark, Flemming, Jaeger & Wolters 2007; von Fintel 2008; Roberts 2015). There may be two factors that lead to the resistance of some triggers to accommodation. The first is identifiability: with certain triggers, the particular proposition the speaker intends to be accommodated may not be readily figured out. For instance, the sentence in (4) has a semantic presupposition that some other salient entity had dinner in New York besides Sue. However, in the absence of sufficient contextual cues, it is not easy for the listener to identify which other entity the speaker has in mind, and therefore, which specific proposition should be added to the common ground.

(4) Sue had dinner in New York, too.

The second issue is anaphoricity. Certain presuppositions target not just what is in the common ground, but the history of the conversation itself. In such cases, accommodation cannot help, because the type of contextual adjustment required effectively involves a rewriting of the facts about the conversational record.

The existence of accommodation and the variability across triggers pose a potentially vexing problem for the child learner. The child's input will be riddled with cases where the condition in (1) is seemingly violated, and moreover, the rate of such violations will

be non-uniform across environments. How, then, does the learner converge on the right pragmatic properties of presupposition as a uniform class? Does she initially ascribe to presuppositional sentences a different use condition from (1), one which is more straightforwardly in line with her input? Is sensitivity to the contextual requirements imposed by presuppositions acquired piecemeal, in a way that corresponds to their experience with specific presupposition triggers? In what follows, I report on findings from a set of experiments designed to address these and related questions. The experiments probe children's implicit understanding of the principle in (1) using two different presuppositional expressions, *too* and definite descriptions, which vary with respect to the ease with which their presuppositions can be accommodated, and in turn, their profile in the child's input.[2]

2.1.3 Roadmap of the chapter

The rest of the chapter is organized as follows. I begin in the next section with a discussion of some of the previous developmental work on presuppositions. Previous developmental

[2]There is a second type of situation — presupposition *cancellation* — which leads to apparent violations the felicity condition in (1). The examples in (i-a) and (i-b) both involve presupposition triggers: the factive verb *aware* in (i-a), which presupposes the truth of its complement; the change-of-state verb *stop* in (i-b), which presupposes the existence of a prior time at which some state held. In both cases, the triggers are embedded under operators (negation, *possible*) from which the presuppositions usually project. But if these presuppositions projected, the speaker of these sentences might be judged as having an inconsistent epistemic state: after all, they had just before stated explicitly their agnosticism about the presupposed proposition. In actually, however, we do not infer such inconsistency. We feel that the sentences don't presuppose anything.

(i) a. I'm not sure where Sue is. Her personal assistant isn't aware that she is on vacation.
b. I am not sure if Billy has ever played videogames. But it is possible that he stopped playing at some point.

Following Heim (1983), cases like (i) have been treated as involving what is called a *local accommodation* mechanism. Local accommodation involves a process of effectively "canceling" the presupposition by treating it as as an ordinary entailment of the sentence. Thus, the presuppositional sentences in (i) would be treated as expressing the (ii).

(ii) a. It is not the case both that Sue is on vacation and her personal assistant is aware of it.
b. It is possible that Billy played videogames in the past but does not play them now.

Such collapsing of presupposition and assertion is thought to be possible only when adding the presupposition to the global context would lead to a contextual clash, like needing to ascribe to the speaker a contradictory belief state. Unlike "global" accommodation described above, which involves the conversational context being enriched so that it will entail the sentence presupposition, local accommodation involves an adjustment of the sentence to fit the background assumptions up to the point of utterance. I will not be discussing cancellation in much depth here, but it is worth keeping in mind as still more "noise" present in the child's input.

work on presuppositions has been item-driven, and almost incidentally about presuppostion. In this sense, the goals of these studies contrast with mine in this chapter, which is to systematically investigate presupposition as a class of phenomena. §3 lays out an overview of the present experiments and predictions about children's behavior. Experimental results from adult participants are presented in §4. My goal in testing adults is, on the one hand, to set a baseline against which to compare the child data, and on the other, to adduce empirical support for some of the theoretical assumptions made. §5 presents findings from 4-to-6-year-old children. Anticipating the results, we find that children show parallel behavior as adults across the two presupposition triggers tested, indicating that important aspects of the architecture of natural language meaning and of language use are in place, at least by the age of 4. Developmental and theoretical implications of these findings are discussed in §6.

2.2 Pragmatics of presuppositions and child language

Most studies of presuppositions to date have focused on questions relating to lexical acquisition, probing children's understanding of specific presuppositional expressions.[3] However, the results and proposals from some of this work have direct bearing on issues of interest here. Of particular relevance is the long line of developmental research on children's acquisition of the article system. On standard analyses following the Fregean tradition, the definite and indefinite articles differ in that the definite article introduces presuppositions of existence and uniqueness. Thus, *the NP* should be used only if it is known to all parties in the discourse that there is a unique referent that satisfies the property described by the NP. It has been repeatedly observed that children, at least up until the age of 6, fail to adhere to this requirement, over-using the definite article in situations where adults prefer to use the indefinite (Brown 1973; Maratsos 1976; Karmiloff-Smith 1979; Wexler 2003; Schaeffer & Matthewson 2005). For example, Maratsos (1976) attempted to elicit articles from preschool-aged children by providing them with scenarios and follow-up questions like in (5).

(5) Once there was a lady. She had lots of girls and boys, about four girls and three

[3]Some relevant works include: Karmiloff-Smith (1979); Wexler (2003); Schaeffer & Matthewson (2005); Munn, Miller & Schmitt (2006) for the definite article; Bergsma (2006); Berger & Hohle (2012) for additive and iterative particles like *too* and *again*; Hopmann & Maratsos (1978); Abbeduto & Rosenberg (1985); Dudley, Orita, Hacquard & Lidz (2015); Dudley (2017) for factive predicates.

boys. One of them started laughing and giggling. Let's see. Who was laughing and giggling like that?

Before the age of 6, children responded to the question in (5) with *the boy/girl* at a rate of around 40%, although the target (adult) response would have been *a boy/girl.* The definite article is infelicitous, as there is no unique girl or boy under discussion. Put differently, the uniqueness presupposition of the definite description is not met in the common ground between the speaker (the child) and the addressee (the experimenter). Karmiloff-Smith (1979) replicates these results in French. In an extensive study of children's production and comprehension of articles, she found that children as old as 8 years of age produced definite articles in similar indefinite contexts at non-trivial rates (39-63%). A number of studies since, sometimes with slightly different methodologies, have reproduced these results (Schafer & de Villiers 2000; Schaeffer & Matthewson 2005; Munn et al. 2006; Modyanova & Wexler 2007; van Hout, Harrigan & de Villiers 2010).

One common line of explanation for this behavior is that children's over-use of the definite article is a result of their communicative "egocentricism", a concept that goes back at least to Piaget (1955). Egocentrism rests on the idea that young children are fundamentally incapable of taking the perspective of others and tailoring their communication to their listener's information state. In proposals about children's non-adult article use, egocentrism is presented as a pragmatic deficit: children use *the* when they have a unique, salient referent in mind, ignoring the state of their addressee's information state (e.g., Maratsos 1976; Karmiloff-Smith 1979; Schaeffer & Matthewson 2005).

Consider again the story in (5). The fact that needs to be described in the answer is "one of the four boys/three girls was laughing and giggling". As mentioned above, the singular definite article comes with the presupposition that the NP restrictor is a singleton set. This presupposition, moreover, can be assumed to be computed relative to a contextually given domain, which typically is a proper subset of the universe. An adult speaker will reject the definite article in this situation because uniqueness is not met in the established context — the cardinality of the set of boys in the contextually relevant domain is four and it is three for the set of girls. A child, might, however use privileged information to restrict the domain further to a subset that would meet the uniqueness requirement. For instance, the child might imagine a particular boy, a particularly naughty one perhaps, and decides that this boy is relevant for the story. She then assumes, due to her egocentricity, that her

hearer shares knowledge of this naughty boy, and uses *the*.

In its most extreme form, the egocentrism hypothesis is difficult to reconcile with a Stalnakarian view of discourse. If the child is egocentric, her epistemic state will be identical to that of others. There cannot be a coherent notion of the common ground for the child that is not entirely trivial (the common ground *is* the body of information known to the child). On this view, the goal of a conversation for the child cannot be to update the common ground, as no new information can ever be exchanged. Thus, the egocentrism hypothesis predicts not only that young children lack general conversational principles governing presupposition use, but also that they lack basic communicative competence. There is independent evidence that this cannot be the case. Children as young as 2 have been shown to be able to assess the knowledge of others and adapt their communication accordingly (Akhtar, Carpenter & Tomasello 1996; O'Neill 1996; Moll & Tomasello 2006). It has also been suggested that expectations about communicative intent and conversation participants' information states are central to language acquisition, in particular early word learning (e.g. Bloom 2002).

Weaker variants of egocentrism have also been put forth. Schaeffer & Matthewson (2005), for example, propose that children lack what they call the "Concept of Non-Shared Assumptions", the idea that the information states of the speaker and the hearer are *always* presumed to be independent. The independence of speaker and hearer assumptions, in turn, imposes an obligation for the speaker to consider the hearer's knowledge state every time they make an utterance. A child who lacks this concept will fail to distinguish between the information states of the interlocutors at least some of the time. When they are themselves the speaker, this pragmatic deficit will sometimes result in egocentric behavior.

A full assessment of this account is difficult, as it makes very weak predictions. A child who lacks the Concept of Non-Shared Assumptions need not behave egocentrically all of the time, as it does not follow from the account that children always assume that speaker and hearer assumptions are identical. The only clear empirical prediction is that whereas adults' language use will be constrained in systematic ways due to a bias to consider the knowledge state of the addressee, children's language use should be haphazard.

Though these accounts were originally put forth to explain a specific deficit, namely the misuse of articles, they suggest — even entail — a proposal about presupposition acquisition. If children have a pragmatic deficit rooted in their egocentricity, it would mean that they do not have an adult-like conception of the common ground and in turn, that they do

not have an adult-like knowledge of the common ground requirement on presuppositions. Findings from the studies here, in that case, can contribute to debates in the developmental literature concerning the source of children's non-adultlike use of definites.[4]

2.3 Experimental design and predictions

2.3.1 Sketch of the paradigm

All of the experiments reported here use a novel paradigm, described schematically below, in which participants rely on properties of an asserted sentence to identify the intended addressee of that sentence. In a forced-choice inference task, participants are presented with brief conversational situations involving a speaker and two possible addressees. The potential addressees differ with respect to their knowledge of some proposition p, such that the common ground between the speaker and the more knowledgeable addressee entails p, but the common ground between the speaker and the more ignorant addressee does not.

In the critical condition, the speaker utters a sentence that presupposes p, and the participant is tasked with identifying who was being spoken to based on this information. If participants are sensitive to the condition that p must be common ground prior to a felicitous assertion of a sentence presupposing p, they should reason that the more likely addressee is the character who already knew that p. Although the more ignorant addressee can in principle meet the condition via accommodation, there is some uncertainty as to whether accommodation is possible or whether the listener will choose to carry it out. On the other hand, if p has already been accepted into the common ground, the sentence is in fact unproblematic.

The critical condition is paired with a control condition that exploits participants' knowledge of the principles governing felicitous assertion, in particular, their knowledge that a successful assertion adds new information to the common ground (thereby reducing the context set). In this condition, the speaker asserts, rather than presuppose, p. The expectations about addressee preferences shift accordingly. To felicitously assert p (and only p), the common ground must be one that does not already entail p. A participant sensitive

[4] In fact, egocentricity is not the only account for the definite over-use. For instance, Wexler (2003) proposes that the root of the problem is a non-adult semantics for the definite article, which does not encode a uniqueness/maximality presupposition. For Munn et al. (2006), the problem lies in children's inability to restrict the domain of reference in an adult-like manner.

to this conversational principle should reason that the more likely addressee, i.e. one for whom the utterance is more likely to lead to successful context update, is the one who did not already know that p. Child and adult friendly variants of this paradigm were given to the respective population.

2.3.2 Selection of presupposition triggers

Both groups were tested on two types of presuppositional expressions, which fall on two ends of the spectrum with respect to the degree to which their uses seemingly bypass the felicity condition in (1). Experiments 1A and 2A uses the presupposition trigger *too* to probe adults' and children's knowledge of the requirements imposed on the context by presuppositional sentences. *Too* triggers an additive presupposition. (6) presupposes, roughly, that a salient person in addition to Sam plays videogames.

(6) Sam plays videogames, too.

Crucially, *too* makes a specific demands on its environment beyond the additive presupposition: it requires an antecedent in the discourse, and in this regard, it is *anaphoric* (Kripke 2009; Heim 1992; van der Sandt & Huitink 2003).

As briefly mentioned in §2.1.2, the presupposition of *too* is difficult to accommodate. This could be due to its anaphoricity — the presupposition is in part about the nature of the conversational record. Alternatively, or additionally, difficulties with identifiability might play a role: when no antecedent is available the descriptive content of the trigger may not be rich enough to signal exactly what is presupposed. Whatever the reason, a consequence of the difficulties in accommodating the presupposition of *too* is that a learner's encounters with the particle will typically be in discourse situations where the condition in (1) is met. Evidence from child and child-ambient speech confirms this. For instance, Dudley (2017) finds that the presupposition of *too* rarely goes unsupported in child-directed speech, and the cues often come from highly salient aspects of a discourse, e.g. previously uttered sentences or visual stimuli that is in the scene. Moreover, experimental and corpus findings suggest that children's earliest presupposition uses involve such triggers. Toddlers show an understanding of the meaning of anaphoric additive triggers like *too* and *again* (Berger & Pouscoulous 2013); a preliminary examination of child-speech in the corpus (the Brown Corpus in CHILDES, Brown (1973)) reveals that children use these triggers earlier and

more frequently than those like *stop* or *know*. If the relative lack of noise in the child's experience plays a critical role in this apparent early acquisition, we might indeed find that children treat these types of triggers as imposing a common ground requirement before they do so with triggers that do not resist accommodation

Experiments 2A and 2B investigate the same set of questions as 1A and 1B, with the crucial difference that the critical condition involved presuppositional sentences with *the*. Unlike *too*, the existence and uniqueness presuppositions triggered by definite descriptions can easily be accommodated. In fact, accommodation is so easy with this trigger that some researchers have proposed that it is not *pre*suppositional — in the sense of imposing constraints on the input context — to begin with (e.g. Tonhauser, Beaver, Roberts & Simons 2013; Tonhauser 2015). The accommodability of the presuppositions of definite descriptions means that they are likely to show a different profile also in the child's input, as well. The child is much more likely, in the case of sentences with *the*, to encounter them in discourse situations where their presuppositions are not already taken for granted at the time of utterance. A preliminary examination of Brown's (1973) corpus for Eve shows that informative uses of this trigger are indeed found in child-directed speech.

(7) *Context: Child is asking after her father*
Eve: `David!` [name of father]
Mother: `He'll be right here.`
Mother: `He's just helping` `the men from Morgan Memorial.`

(8) *Context: Family is preparing for moving day.*
Mother: `Eve come here. I'll tell you what's going to happen.`
Mother: `Papa's going to go to the basement with` `the movers.`
Mother: `I'm going to go in here and talk to` `the insurance man.`

A direct comparison of children's behavior with the two triggers therefore serves two purposes. First, it helps us detect variability, if it exists, in rates of adherence to the usage conditions on presuppositions in development. Second, it can contribute to our theorizing about the observed non-homogeneity across presupposition triggers with respect to their "informative" uses.

2.3.3 Predictions

The critical and control conditions in our task are intended to test participants' sensitivity to principles of language use governing presupposition and assertion, respectively. On the common ground approach to discourse, the predicted "target" behavior is as follows. In the critical condition, in which the target sentences are associated with a presupposition, participants should show a strong preference for the addressee who already takes the presupposition for granted. If the addressee knows the presupposition already, the condition in (1) will certainly be met and the utterance will be accepted. The ignorant addressee can in principle accommodate the unmet presupposition. However, accommodation is not guaranteed, so there is the possibility that the utterance goes challenged. Thus the more successful discourse situation will be one in which the speaker is addressing someone who does not have to accommodate their presuppositions.

The null hypothesis is that the preference for the "knowledgeable" addressee does not vary on the basis of the presupposition trigger used. Although accommodation is more readily available for *the* compared to *too*, if the analysis laid out above is right, the better addressee in either case will be the one who has to accommodate the least. Thus, insofar as *too* and *the* are both associated with presuppositions, the condition governing their use are identical for the purposes of this task and we expect participants' behavior to be uniform.

The target response on the control conditions is choice of the more ignorant addressee. Recall that the control condition relies on a very basic conversational principle about informativity of assertions: update of the common ground with an asserted proposition must be non-vacuous, i.e. it must contribute some new information. In the control conditions, a proposition q is asserted, and only the more ignorant agent fails to already know that q. Thus, the common ground between the speaker and the ignorant addressee is one where an update with the proposition q would be non-vacuous and thus unproblematic.

Children may diverge from the target response patterns in various ways. Children may indeed go through an egocentric stage in development, where they lack the basic principles guiding cooperative discourse. In this case, we expect them to show no biases on either the critical or control conditions. That is, we expect their intended listener choices to be arbitrary. Alternatively, children may only lack an adult-like understanding of one of the two principles tested. For instance, they may only lack the principles of language use that govern presuppositions, in which case they might display target behavior on the control

condition but simply guess on the critical condition. On the view of presuppositions articulated in §1.1, knowledge of the general principle about informativity of assertions may be seen as a *prerequisite* for knowledge of the felicity conditions governing presupposition use. The requirement that assertions effect a non-trivial update to the context forces speakers to use partial propositions only when its truth can be deterministically evaluated by the listener. In addition, sensitivity to the latter presupposes an understanding of the fact that the presuppositional sentences express partial propositions and an appropriate bridge between this partial semantics and the pragmatics. In this regard, the child has more opportunities to go awry in the realm of presuppositions. An asymmetry in the other direction, where children follow presuppositional biases but not assertive biases for the intended addressee, is a logical possibility, though inconsistent with the Stalnakerian picture assumed here.

A final possibility is that children show selective sensitivity to the common ground requirements tied to presuppositions depending on the presupposition trigger. A natural expectation is that children's response patterns should correspond to the variable rates at which this usage condition is not met in everyday use of the triggers. If so, children who show a bias towards the knowledgeable agent when the presuppositional sentences involve *too* may show weaker or no such preferences when the sentences involve definite descriptions. Results from the children, which tease apart these possibilities, are presented in §5.

2.4 Adults

My goals in testing adults are two-fold. The first and obvious one is that adult data provide a baseline against which to compare children's response patterns. The second goal is to motivate some of my theoretical assumptions and hypotheses about target behavior. On the common ground theory of presuppositions, presuppositional sentences are formally associated with a condition that their presuppositions be taken for granted in the conversational common ground prior to utterance. Competent speakers, in turn, are expected to have implicit knowledge of this requirement. We have already seen, however, that the connection between theory and empirical evidence most readily available to us — our native speaker intuitions — is not always reliable. There are many situations in which presuppositional sentences whose presuppositions are not already entailed by the common ground are deemed acceptable. Consequently, we need a different means of evaluating the validity of the theory. One feature of the experiments reported here may help us accomplish this. The

task involves evaluating not whether some sentence *is* acceptable relative to some context, but rather, which type of context it is more likely to be acceptable in. This could allow us to tease apart the underlying requirement on the conversational context — that presuppositions be shared knowledge prior to assertion — from repair mechanisms that allow us to render an utterance felicitous when it fails to meet some requirement.

2.4.1 Experiment 1A: *Too*

Participants, Materials and Procedure

Thirty-seven native speakers of English, recruited via Amazon Mechanical Turk, participated in Experiment 1A. Experiment 1A and all subsequent experiments used the forced-choice inference task described in 2.3.1. All materials were presented in written form on a computer screen using the IbexFarm experiment presentation tool (Drummond 2013). Participants read, line by line, brief scenarios all involving three characters. In each scenario, an event takes place that only a proper subset of the characters bears witness to. For example, characters A and B may go together to a pet shelter to get a pet for character A, while character C stays home. Later, A comes back to get a second pet, unbeknownst to both B and C. After the event transpires, one of the characters tells another character about it over the phone. Thus, A is described as reporting to someone — either B or C, we don't know which — about her pet shelter adventures. Participants are tasked with guessing the addressee based on what the speaker said.

As mentioned above, there were two critical conditions: In the "Presupposition" condition, the speaker uses a presuppositional sentence whose presupposition is known to only one of the two potential addressees. Thus, the presupposition is only common ground between the speaker and the "knowledgeable" listener. For example, character A might say, "I got a cat, too". Only character B knows that A had previously adopted another pet. In the "No-Presupposition" condition, a non-presuppositional sentence is asserted, where only one of the two potential listeners is ignorant about the content of the assertion. Thus, the asserted proposition could only effect an update to the common ground between the speaker and the "ignorant" listener. In this case, A might say, "I got a bird today," in a situation where character B already knows this information and character C does not. The two conditions and sample scenarios are given in Table 2.1. Each participant saw 8 items per condition and 16 filler items. All critical items involved common and uncontroversial

sets of events, like adopting a pet or procuring household objects. Filler items involved similar stories, but the questions were about other aspects of the story and did not require participants to make inferences about speech act participants. An example is given in (9).

(9) **Amanda**, **Erik** and **Katie** were at the beach together. **Katie** had to go home early, so then it was just **Amanda** and **Erik**. Then **Erik** told **Amanda**, "You know, I love parasailing. But I don't like surfing much." **Amanda** responded that she didn't like either. Later on at home, **Erik** was on the phone with **Katie** and she told him "Guess what, I really love surfing".
Question: Which one liked parasailing? Erik Amanda
Expected Choice: Erik

Results

Three participants were excluded due to low performance (<60%) on filler items, as these participants can be treated as not paying attention to the experiment. Results from thirty-four participants are described below. All analyses of results from this and subsequent experiments were conducted in R, using mixed-effects logistic regressions. The model is maximally specified wherever possible (Barr, Levy, Scheepers & Tily 2013).

Figure 2-1 plots the rates at which the more knowledgeable character was chosen in each condition. Recall that we expect participants to choose the more knowledgeable character in the critical condition, but reject this character on the control condition. The unbiased response pattern, i.e. the pattern we expect if participants saw no reliable way of choosing between the two characters, is choice of the knowledgeable character at a rate of around 50% on both conditions. On the contrary, participants' responses are near-categorical: they overwhelmingly choose the knowledgeable listener in the critical condition and reject the knowledgeable listener in the control condition.

To analyze these trends statistically, we fit a mixed-effects logistic regression on the rates of knowledgeable listener choice, with condition as a fixed effect and random effects of subject and item. We find a significant effect of condition, with the odds of choosing the knowledgeable listener being greater in the critical condition compared to the control. Table 2.2 summarizes results from the regression.

This analysis confirms that participants' behaviors on the two conditions differed, but

Table 2.1: Conditions, Experiment 1A

Condition	Scenario	Question	Expected Choice
Presupposition	**Susie**, **Jane** and **Mike** were hanging out together. But **Jane** had to go and run some errands so she left. Then it was just **Susie** and **Mike**. The two of them decided to go to an animal shelter. At the shelter, **Mike** got himself a pet bird. Then, **Susie** decided to go home. **Mike** decided to go back to the shelter and get himself a cat! Later, **Mike** was on the phone with one of the girls and he said, "Guess what, I got a cat, too!"	Who was Mike talking to when he said, "Guess what, I got a cat, too!"?	Susie
No-Presupposition	**Katie**, **John** and **Molly** were hanging out. But then, **Katie** decided to go to the library to study. Then, it was just **Molly** and **John** and the two of them decided to go to the beach instead. At the beach, they found a seashell and **John** decided to keep it. Then, **Molly** had to leave too. **John** stayed at the beach awhile, and he found a fossil. Later **John** was on the phone with one of the girls and he said, "Hey, guess what, I found a seashell today!"	Who was John talking to when he said, "Guess what, I found a seashell today!"?	Katie

we also wanted to see whether the choice of knowledgeable listener in each condition was different from chance. To examine this, we fit an intercept-only logistic mixed-effect regression. The models, run separately for each condition, included the intercept as a fixed effect, along with random intercepts for participant and item. We then compared whether the estimated intercept, after by-subject and by-item random variation was accounted for, was different from chance, i.e. 50%. The results of the analysis of the control condition showed intercept to be estimated at -3.3887 (SE=0.60), corresponding to a raw value of 3% rate of choosing the knowledgeable listener, with 95% CIs of [-4.57, -2.21], corresponding to raw values of [1.02%, 9.8%]. Chance level, 50%, falls well above this range. For the critical condition, the intercept was estimated to be at 3.37 (SE=0.65), corresponding to a raw value of 96.7%. Confidence intervals are [2.10, 4.64], corresponding to raw values of [89.1%, 99.0%], suggesting that the observed bias towards the knowledgeable listener was not random. Overall, these results are in line with our expectations and indicate that when a sentence with *too* is uttered, adults generate a bias that the addressee is one who already knew that the additive presupposition holds.

Figure 2-1: Rate of choice of knowledgeable listener, Experiment 1A

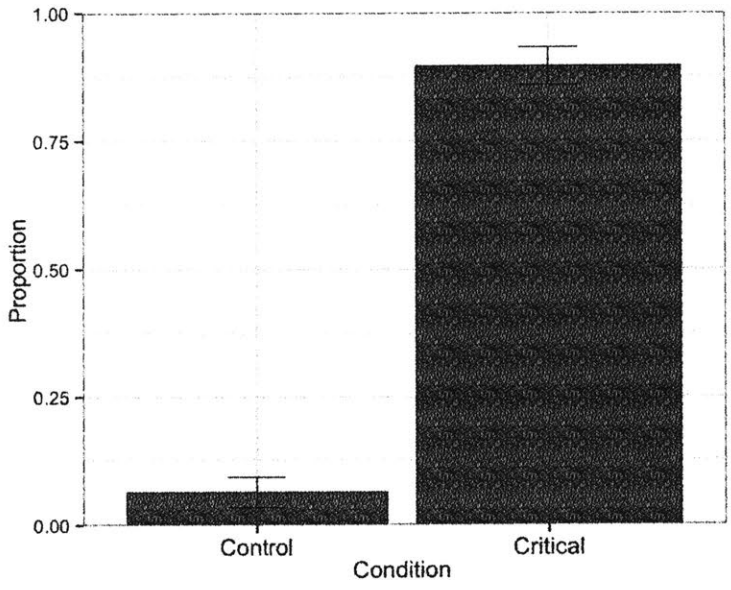


Table 2.2: Summary of statistical analysis, Experiment 1A

	β	SE	z	p
Intercept	-3.45	0.64	-5.37	<.001
Condition (Critical)	6.78	0.93	7.22	<.001

2.4.2 Experiment 1B: *The*

Participants, Materials and Procedure

A separate group of thirty adult native speakers, recruited via Amazon Mechanical Turk, participated in Experiment 1B. The procedure was identical to Experiment 1A, and the scenarios differed only minimally to better support the different target sentences, which now involved definite descriptions. Sample scenarios for each condition is given in Table 2.3. As before, participants saw 8 items per condition and 16 filler items, which were identical to those used in Experiment 1A.

Results

Results from twenty-eight participants are included in the analyses, after the exclusion of two participants whose filler accuracy rates averaged below 60%. Figure 2-2 plots the rates at which participants chose the knowledgeable addressee by condition. As in Experiment 1A, participants showed a strong bias for the knowledgeable listener in the critical condition and a strong bias against the same in the control condition. A mixed-effects logistic regression, results from which are given in Table 2.4, reveals a significant effect of condition on the rates of choosing the knowledgeable listener.

We again ran intercept-only mixed effects logistic regressions to explore whether the observed rates are different from chance. The results of the analysis of the control items showed intercept to be estimated at -2.67 (SE=0.44), corresponding to a raw value of 6.4% rate of choosing the knowledgeable listener, with 95% CIs of [-3.54, -1.81] (values of [2.8%, 14.1%]. For the critical condition, the intercept was estimated at 4.08 (SE=1.27) or 98.3%, with confidence intervals of [1.58, 6.52], corresponding to raw values of [82.9%, 99.8%].

Table 2.3: Conditions, Experiment 1B

Condition	Scenario	Question	Expected Choice
Presupposition	**Susie**, **Jane** and **Mike** were hanging out together. But **Jane** had to go and run some errands so she left. Then it was just **Susie** and **Mike**. The two of them decided to go to an animal shelter. At the shelter, **Mike** got himself a pet bird. Then, **Susie** decided to go home. After she left, the bird flew right out of its cage! Later, **Mike** was on the phone with one of the girls and he said, "Guess what, the bird that I got flew away!"	Who was Mike talking to when he said, "Guess what, the bird that I got flew away!"?	Susie
No-Presupposition	**Katie**, **John** and **Molly** were hanging out. But then **Katie** decided to go to the library to study. Then, it was just **Molly** and **John** and the two of them decided to go to the beach instead. At the beach, they found a seashell and **John** decided to keep it. Then, **Molly** had to leave too. **John** stayed at the beach awhile, but the seashell got buried in the sand somewhere and he couldn't find it again. Later **John** was on the phone with one of the girls and he said, "Hey, guess what, I found a seashell today!"	Who was John talking to when he said, "Guess what, I found a seashell today!"?	Katie

As a final step, we asked if the response patterns observed across the two experiments differed statistically. To do so, we conducted a between-subjects analysis with Experiment (1A vs. 1B) as an additional fixed effect. If the rates of choosing the knowledgeable listener in the critical condition varied as a function of the presupposition trigger involved, we should find an interaction of Experiment and Condition. That is, patterns should be constant in the control conditions, but different in the critical conditions. Results from the model are

summarized in Table 2.5. We find a significant effect of condition, but crucially, there is no interaction between condition and experiment. This suggests that Experiment 1B truly replicates the response patterns observed in Experiment 1A. Thus, the change in trigger did not seem to affect participants' biases to expect the listener to have already known the presuppositions of the uttered sentence to be true.

Table 2.4: Summary of statistical analysis, Experiment 1B

	β	SE	z	p
Intercept	-2.64	0.45	-5.89	<.001
Condition (Critical)	6.49	1.10	5.85	<.001

Figure 2-2: Rate of choice of knowledgeable listener, Experiment 1B

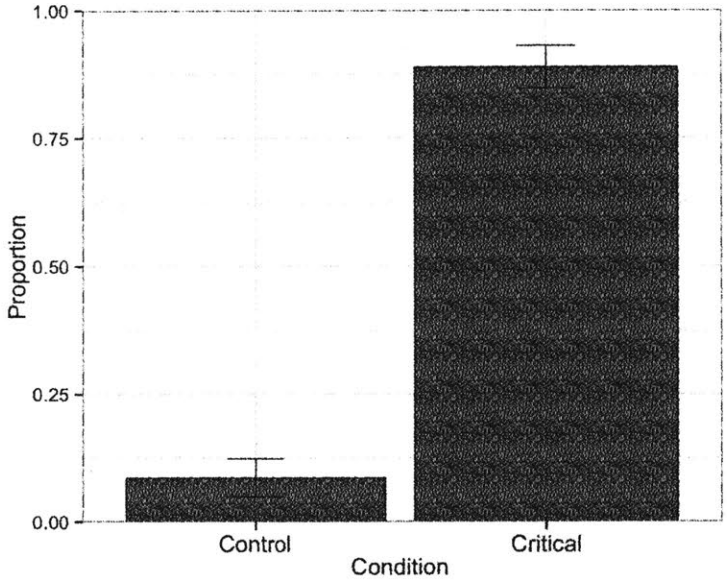


Table 2.5: Comparison of Experiments 1A and 1B

	β	SE	z	p
Intercept	-2.49	0.34	-7.28	<.001
Condition (Critical)	5.75	0.68	8.39	<.001
Experiment (Exp1A)	-0.69	0.52	-1.30	0.20
Condition * Experiment	0.28	0.64	0.44	0.66

2.4.3 Discussion

In this section, I sought to empirically evaluate the predictions of the common ground theory of presuppositions and gather a set of baseline results by probing adults' sensitivity to the constraints presuppositions impose on the conversational context. Experiment 1A, which used presuppositional sentences involving *too*, served as the simplest test case. *Too* requires that the utterance context makes salient an antecedent that satisfies its additive presupposition. As pointed out earlier, in most cases, it would be inappropriate to use *too* out-of-the-blue, in spite of the availability of presupposition accommodation as a general repair strategy. Our results revealed that when a sentence with *too* was uttered, adults overwhelmingly chose as the addressee the agent who already shared with the speaker the knowledge that the additive presupposition of the sentence holds.

In Experiment 1B, the critical items involved a type of presuppositional item, definite descriptions, that shows greater flexibility with respect to whether its presuppositions can be accommodated. Results reveal a strikingly similar response pattern as Experiment 1A, with participants showing a strong bias towards the knowledgeable agent when a sentence with *the* was uttered. Thus, adult participants, despite being able to produce and evaluate sentences where *the* conveys informative presuppositions, nevertheless show a preference for such sentences to be used against a conversational common ground in which the presupposition is already taken for granted.

In sum, irrespective of the availability of accommodation or the ease with which it can be called upon, participants in this task assume that a speaker is more likely to presuppose a proposition when it was already common knowledge between them and the addressee. This is predicted on a theory that distinguishes between redundant and informative presuppositions, even when the two are identical with respect to felicity. The underlying requirement

on presupposition will be met with certainty in cases where the presupposition is common ground prior to utterance. In cases where a sentence with a "missing" presupposition is uttered, the listener may add that presupposition to the common ground prior to evaluating the assertion and remedy the situation, but this is not a guaranteed outcome. Thus, given the choice between two utterance situations — one where the presuppositions of the uttered sentence is certainly met and one where it is not yet met, but could be accommodated — participants prefer the former.

2.5 Children

We now turn to the experiments with children roughly in the preschool age. In §2.5.1, I present results from Experiment 2A, which parallels 1A and tests children's evaluation of presuppositional sentences involving *too*. Experiment 2B, discussed in §2.5.2, is a child-friendly variant of Experiment 1B above and uses sentences involving *the*.

2.5.1 Experiment 2A: *Too*

Like with adults, we begin with *too*. As explained earlier, presuppositional sentences involving *too* provide an ideal window to assess whether children know what the conversational context must look like in order for a speaker to presuppose something. Because of independent difficulties accommodating the presupposition introduced by *too*, the common ground requirement will be met in almost all of the circumstances in which the child hears the trigger used. If children must rely on properties of the input to identify the use conditions on various types of expressions, the learning task will be the easiest for presupposition triggers like *too*. Thus, if a child has converged on something like (1) as the principle governing the use of sentences involving *too*, we expect this knowledge to reveal itself in that child's biases about the addressee of such sentences.

Participants

Thirty-four children between the ages of 4 and 6 (ranging from 4;0 to 6;9; Mean Age=5;1) were recruited from preschools and museums in the Boston area. Pilot testing showed that children younger than 4 were unable to handle the demands of the task, which resulted in 4;0 being the lower bound of our age range. However, a considerable number of previous

studies on children's pragmatic development, including the work on definite descriptions discussed in §2, have included 4-to-6-year-olds and report non-adult behavior and developmental shifts over the course of this age range (among others, Karmiloff-Smith 1979; Modyanova & Wexler 2007 for definite descriptions; Noveck 2001; Katsos & Bishop 2011 for scalar implicatures; Nadig & Sedivy 2002 for referential communication). This makes it a suitable age range to begin investigations into the development of the pragmatics of presuppositions. The dominant language of all participating children was English.

Materials and Procedure

Experiments with children preserve the underlying logic of Experiments 1A and 1B in that the task involves reasoning about the addressee of a sentence given what is common knowledge among the speaker and two other agents. However, the task in the child studies was modified to make it less demanding and more child-friendly. The experiment was presented as a game, in which the child helped the experimenter figure out the identity of an occluded character. Children heard a series of stories about an animal character, a Hippo, and his two friends, Cat and Fox. They were told that Hippo lived in the woods, where the friends visit him. The friends sometimes like to hide behind bushes and trees, making it difficult for the experimenter to see who is visiting him in the various stories. However, Hippo himself can always see the friends and it is possible to figure out who is there based on what Hippo says to them. The child is asked to help the experimenter figure out which of the two friends is visiting Hippo in each story. In all of the stories, the Hippo was shown to eat a number of familiar food stuffs. The Hippo ate at least one of the food items in front of a friend. After that friend leaves, the Hippo eats something else. The Hippo later on reports to the occluded visitor either that he ate food item #2, *too* (critical condition) or that he ate food item #1 (control condition).

Children first saw 2 training items designed to familiarize them with the idea that what Hippo says serves as the sole clue to the visitor's identity. They then saw 12 experimental items in a pseudo-randomized order. As in the adult variant, Experiment 2A included both critical and control conditions, exemplified in Table 2.6 (visual support omitted). There were 4 items per condition. In addition, they saw 4 filler items, which involved situations as in (10) and relied on their knowledge of constraints on the use of the second person indexical pronoun and proper names. The purpose of these filler items was to ensure that

children understood the goals of the game and took into consideration the linguistic cues in making their judgments.

Table 2.6: Conditions, Experiment 2A

Condition	Scenario	Expected Choice
Presupposition	In this story, Hippo and Cat were playing together, when Hippo got very hungry. He said to Cat, "Cat, let's take a break from our games because I am hungry and I'm going to eat an apple." And he ate an apple. But then, Cat heard his mom calling him so he went home. After Cat left, Hippo realized he was still hungry, so he ate an orange. Then, one of his friends came to see him. But, we can't tell who's there — they're hidden behind that big rock! I don't know if it is Cat or Fox behind the rock, but Hippo said to them, "Guess what, I ate an orange, too, today!" Does that give us a clue about who is with Hippo?	Cat
No-Presupposition	In this story, Hippo and Cat were playing together, when Hippo got very hungry. He said to Cat, "Cat, let's take a break from our games because I am hungry and I'm going to eat a watermelon." And he ate a watermelon. Then, Cat was feeling sleepy so he went home to take a nap. After Cat left, Hippo realized he was still hungry, so he ate a pineapple. Then, one of his friends came to see him. But, we can't tell who's there — they're hidden behind the blueberry bush! I don't know if it is Cat or Fox behind the blueberry bush, but Hippo said to them, "Guess what, I ate a watermelon today!" Does that give us a clue about who is with Hippo?	Fox

(10) In this story, Cat visited Hippo and told him, "Look! I brought you this ice cream!" But then, Cat had to go home and do some chores, so he left. After Cat left, Hippo said to himself, "I am very hungry, I'm going to eat this ice cream right away." And he ate it up. Later on, one of his friends came to see him. But, we can't tell who's there — they're hidden behind that tree! I don't know if it's Cat or Fox, but Hippo

said to them, "Guess what, I ate the ice cream that you/Cat gave me."

Figure 2-3: Choice of knowledgeable listener, Experiment 2A

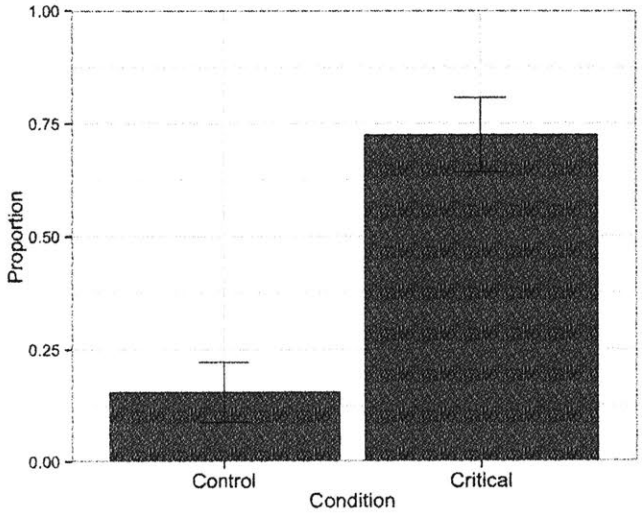


Figure 2-4: Results from 4-year-olds (n=11), Experiment 2A

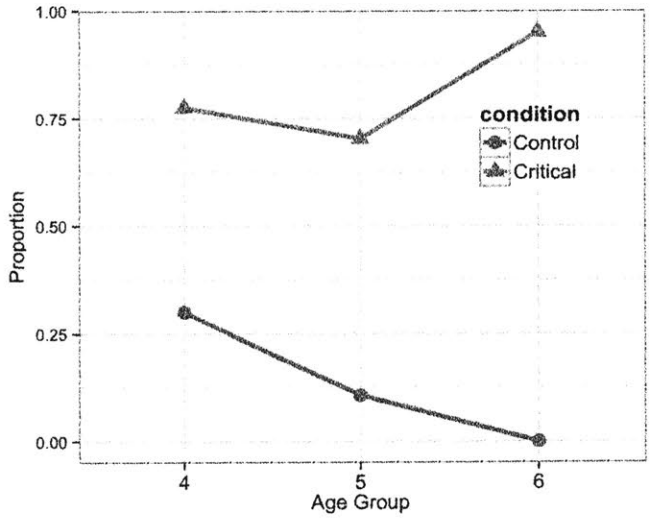


Table 2.7: Summary of statistical analysis, Experiment 2A

	β	SE	z	p
Intercept	9.66	5.20	1.86	0.06
Condition (Critical)	-9.892	5.40	-1.83	0.07
Age	-2.51	1.09	-2.31	0.02
Condition * Age	2.84	1.27	-2.53	0.11

As with adults, we fit an intercept-only mixed effects regression to ensure reliability of the observed biases towards the knowledgeable listener in the critical condition and against this agent in the control condition. The results of the analysis of the control items showed intercept to be estimated at -7.150 (SE=2.44), corresponding to a raw value of 0.07% rate of choosing the knowledgeable listener, with 95% CIs of [-11.95, -2.35] (values of [0.006%, 8.67%]. For the critical condition, the intercept was estimated at 1.54 (SE=1.27) or 82.3%, with confidence intervals of [0.48, 2.59], corresponding to raw values of [61.7%, 93.5%].

Overall, our results indicate that children prefer an addressee who knows the presuppositions of an uttered sentence and one who does not already know the asserted information. In this respect, their biases were the same as those of adults. Although children at the youngest age groups tested showed these biases, the younger children's response patterns were less categorical than those of adults with a steady climb across the tested age range towards adult-likeness.

2.5.2 Experiment 2B: *The*

With adults, we observed identical preferences for the knowledgeable addressee irrespective of whether the presuppositional sentence uttered involved *too* or a definite description. Thus, the variability in ease of accommodation across the two triggers did not seem to affect adults' biases. However, it is an open question whether this variability has an impact on acquisition. The noise in the input contributed by informative presuppositions with *the* could lead to various forms of erroneous behavior. For example, if children assume — as they appear to do with *too* — that presuppositions are always entailed by the context, they may treat informative uses of *the* as indicating that the presuppositions associated with the article are in fact run of the mill entailments. Alternatively, they may treat *the* as presuppositional, but subject to a different felicity condition from presuppositional expressions like

too. For instance, they would be well within reason, given their experience with the trigger, to assume that sentences with *the* are assertable in a conversational context so long as the presupposition is *compatible* with that context (i.e. not false in all worlds in the context set). With these possibilities in mind, we now turn to children's response patterns on sentences involving *the*.

Participants, Materials and Procedure

Thirty-six children in the same age range (4;0-6;7, Mean Age=5;2) as Experiment 2A were recruited to participate in Experiment 2B. The "game" was very similar to that in Experiment 1B. Children heard a series of stories about an animal character, this time a Panda, and his two friends, Cat and Fox. In each story, Panda has an "adventure" with one of the two friends, over the course of which he comes into possession of something. After the friend leaves, however, something happens to that entity. Later on, one of the two friends visits Panda, but is hidden behind some object in the scene, and the child's task is to figure out which of the two friends it is based on what Panda says to them. As before, children saw 4 critical items, 4 control items and 4 fillers. Sample scenarios from critical and control conditions are given in Table 2.8 (visual support omitted); the filler items were the same as in Experiment 2A.

Results

Results from 30 children, after excluding those who incorrectly answered two or more filler items out of four (n = 6), are described here. Figure 2-5 represents the rates at which the knowledgeable listener was chosen. A mixed-effects logistic regression, summarized in Table 2.9, reveals a significant interaction of age and condition, as in Experiment 2A. Once again, while there is improvement with age in both conditions, the observed biases to be stable even in the youngest age group (Figure 2-6).

The preferences we observe in Figure 5 were found to be reliable. The estimated intercept from a mixed-effects regression after taking into account item and subject variance was -1.92 (SE=0.47) or 12% (CIs [-2.85, -0.99] corresponding to raw values of [5.4%, 27.1%]) for the control items and 2.4 (SE=0.55) or 91.7% for the critical items (CIs [1.32, 3.50] corresponding to raw values of [78.9%, 97.1%]). Thus, the results from Experiment 2B replicates the patterns observed with children in Experiment 2A.

Table 2.8: Conditions, Experiment 2B

Condition	Scenario	Expected Choice
Presupposition	In this story, Panda and Cat were playing together, and Panda said to Cat, "Cat, let's go to the animal shelter." The two of them went to the animal shelter, and Panda found a bird he really liked, so he decided to adopt it. Afterwards, Cat had to go home so he left. Right after Cat left, the bird flew right out of his cage — oh no! And Panda was very sad. Later on he was at home, and one of his friends came to see him. But, we can't tell who's there — they're hidden behind that big rock! I don't know if it is Cat or Fox behind the rock, but Panda said to them, "Guess what, the bird that I got flew away!" Does that give us a clue about who is with Panda?	Cat
No-Presupposition	In this story, Panda and Cat were playing together, and Hippo said to Cat, "Cat, I wanna go to the beach today." So they went to the beach. At the beach, the two of them found a very pretty seashell and Panda decided that he would keep it. After a while, Cat was feeling tired so he went home early. Panda stayed at the beach. But it was really windy, and the seashell got buried in the sand and Panda couldn't find it anymore — oh no! Later on, he was at home and one of his friends came to see him. But, we can't tell who's there — they're hidden behind the blueberry bush! I don't know if it is Cat or Fox behind the blueberry bush, but Panda said to them, "Guess what, I found a seashell earlier today!" Does that give us a clue about who is with Panda?	Fox

Figure 2-5: Choice of knowledgeable listener, Experiment 2B

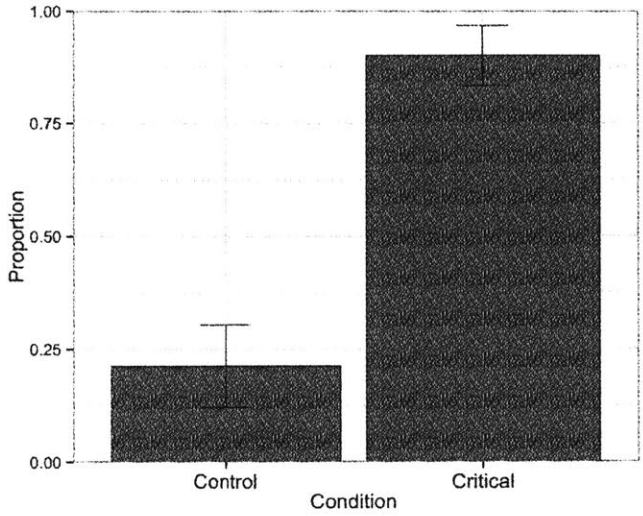


Figure 2-6: Results from 4-year-olds (n=13), Experiment 2B

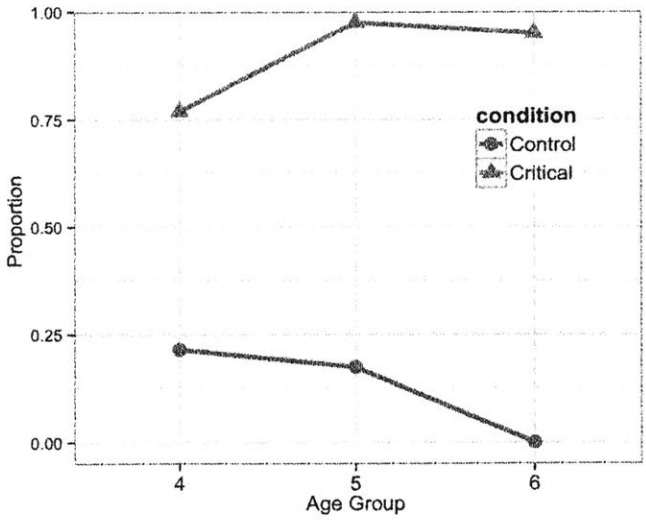


Table 2.9: Summary of statistical analysis, Experiment 2B

	β	SE	z	p
Intercept	1.98	2.01	0.99	0.32
Condition (Critical)	-6.6	2.79	-2.37	0.01
Age	-0.76	0.42	-1.82	0.07
Condition * Age	2.15	0.6	3.57	<0.001

2.5.3 Discussion

My goal in Experiments 2A and 2B was to probe children's implicit understanding of when presuppositions can be used by examining their expectations about the listener, given the use of a presuppositional sentence. The results show children's response patterns to be essentially identical to those of adults. Children, like adults, showed a preference for conversational situations where the presuppositions of an uttered sentence were mutually known by the speaker and the addressee. Moreover, children, like adults, showed the same preferences irrespective of the presupposition trigger involved. Overall, these results show that by the age of 4, children have acquired the use condition in (1) that presuppositions must be taken for granted in the common ground prior to utterance.

In Experiment 2A, we looked at children's reasoning about uses of sentences with *too*. Children consistently chose the knowledgeable character as the listener of such sentences. This behavior parallels that of adults in 1A. Moreover, even the youngest age groups seemed to show these preferences, suggesting that the relevant pragmatic principles are in place at the earliest ages tested. Their performance on the control conditions are also significant and informative. In the control condition, they were adult-like in choosing the listener for whom the proposition expressed by the asserted sentence would be new information; in the scenarios, this would always be the more ignorant character. This shows that children understand a fundamental property of cooperative discourse — that assertions should aim to update the extant body of shared knowledge. On a more methodological front, children's choice of the ignorant character in the control condition makes it clear that their choice of the knowledgeable character in the critical condition was due to their sensitivity to the presuppositionality of the sentences, and not due to an across-the-board preference for this character.

In Experiment 2B, I asked what happens when children are presented with sentences with lexical items like *the* in this task. Convergence on the right usage conditions on such triggers is *prima facie* more complicated, as their presuppositions can be easily accommodated. However, children showed the same biases as in Experiment 2A, a uniformity that parallels adult behaviors in Experiments 1A vs. 1B. Thus, the felicity condition governing presupposition use is in place, not only with those triggers whose uses almost always meet the condition, like *too*, but even with those triggers for which failing to meet the felicity condition is, at least on the surface, a logical possibility in adult language use.

2.6 General Discussion

2.6.1 Summary

This chapter set out to explore children's understanding of the use conditions on presuppositions. To this end, I carried out a series of experiments in which children (and adults) reasoned about the more plausible addressee given the utterance of a presuppositional sentence. Biases about the more likely addressee served as a proxy for expectations about the state of the common ground given an utterance. Using two presupposition triggers with importantly divergent properties, *too* and *the*, these studies demonstrated that 4-to-6-year-olds, just like adults, generated a default expectation that the addressee of presuppositional sentence is someone who already knows that the presupposed proposition holds. Put differently, they treated a presuppositional utterance as more acceptable against a common ground that entails its presupposition compared to one that is neutral with respect to it. I suggested that this bias — in both adults and children — is a behavioral signature of a fundamental conceptual distinction between redundant and informative presuppositions. Only the former are guaranteed to meet the contextual requirements presuppositions impose on the common ground.

On this view, then, a broad conclusion that follows from our experimental results is that preschool-aged children are sensitive to the felicity condition governing presuppositions. A second important finding is that children generate the same expectations about uses of sentences involving *too* and *the* despite their diverging experiences with the two triggers. This acquisition trajectory suggests that the same underlying pragmatic condition governs the use of all presupposition triggers, and that this condition is not acquired piecemeal,

either by lexical item or by class. In turn, the result points to presuppositions being a uniform phenomenon. The acquisition task can instead be characterized as identifying the various independent factors that lead to the observed differences in accommodability across triggers.

Children's sensitivity to the felicity condition on presupposition use informs us also of their semantic and pragmatic competence, more generally. Recall that on the theoretical view adopted here, the common ground requirement imposed by presuppositions falls out as a consequence of the partial semantics of presuppositional sentences in conjunction with general principles governing when a sentence is assertable. The goal of assertions is to update the common ground with the meaning of the sentence asserted. Because presuppositional sentences are neither true nor false at worlds where the presupposition is not true, such sentences can deterministically effect an update only if every world in the context is one where the presupposition is true. If this is the case, then children's apparent sensitivity to the common ground requirement reveals sophistication in at least two other respects. First, it tells us that they have a distinction between presupposition and assertion in their grammar and treat presuppositional sentences as expressing partial functions. Second, it demonstrates knowledge of a fundamental tenet of information-gathering discourse, namely that the goal of an assertive discourse move is to update, in a deterministic way, the extant body of shared information. Independent evidence for competence in this regard comes from the control condition in our experiments, which directly tested sensitivity to the conversational principle that asserted propositions must be informative. Our results reveal early sensitivity to this principle, as well.

The overall picture that emerges is one where important aspects of natural language meaning and the dynamics of discourse are in place in development at least as early as age 4. These findings have several implications, both developmental and theoretical, which I discuss below.

2.6.2 Communicative (non-)egocentrism

As discussed in §2.2, a well-known phenomenon in early child language use is children's overuse of the definite article in situations where its presuppositions are not shared knowledge (Maratsos 1976; Karmiloff-Smith 1979 and many others). This behavior suggests, *prima facie*, that children are not sensitive to the felicity condition on presupposition use.

In fact, this behavior has been taken to be emblematic of a broader form of cognitive deficit, "egocentricity" or an inability or unwillingness to take the information states of others into account.

These ideas are incompatible with the findings in this chapter. At a very basic level, the task was designed in such a way that even rudimentary success at it involved taking others' perspectives into account. The information state of the participant was always different from the information states of the characters in the stories, and to successfully make a decision in the task, one needed to reason about these other agents' knowledge states. Success on any condition, even fillers, would constitute evidence against a simple-minded egocentrism hypothesis, on which children are presumed to be unable to consider other perspectives in their language use. Given children's success across-the-board, we can conclude that this variant of the egocentrism hypothesis is untenable.

Schaeffer and Matthewson's (2005) variant of egocentrism posits that children sometimes fail to distinguish between speaker and hearer perspectives. But this is also inconsistent with the present results. Let us consider first what the account predicts for children's assessment of presuppositional sentences. If the speaker and hearer perspectives are not reliably distinguished, then in any given situation, information that is known to the speaker may very well be available to the hearer as well. If so, the two potential addressees in our task cannot be distinguished on the basis of their prior knowledge of the presupposition of the uttered sentence. What is predicted then is random choice between the two possible listeners, a prediction that is inconsistent with our findings. More problematic is what the account predicts for assertion. The proposal makes the prediction that the child will sometimes assert p or take someone else as asserting p all the while assuming that the listener of p knows that already. Assume that a speaker who asserts q believes q.[5] Again, suppose that the child makes the erroneous assumption that the listener shares the presumptions of the speaker and thus that the listener believes q. If they make this assumption, and we follow a Stalnakerian model of discourse, the speaker should not be able to felicitously assert q — it would violate the essential requirement that assertive content contribute new information. Thus, proponents of this theory, minimally, need a model of discourse that explains the motivations of a child who chooses to say anything in circumstances where their assumption is that the addressee shares their belief state. Now, the control condition in the present studies

[5]This is Hintikka's (1962) Epistemic Implication. It also follows from the Gricean Maxim of Quality (Grice 1975).

demonstrates that children, like adults, are sensitive to the crucial distinction between the information states of the two possible listeners regarding the asserted proposition. Thus, the proposal is not only conceptually problematic, but empirically unsupported.

Having thus argued that egocentrism, on any conception, is untenable, I want to now turn to the more concrete results from these previous studies. Specifically, findings from previous studies suggest that children do not know the use conditions on *the*, i.e. that the existence and uniqueness presupposition be satisfied in the common ground. However, findings from Experiment 2B in this chapter points to a fairly sophisticated understanding of when sentences with *the* are appropriate. Like adults, preschoolers expected sentences with *the* to be addressed to someone who already knows the sentence presuppositions. How might these two findings be reconciled?

One possibility is that the observed over-use of the definite does not arise from a lack of understanding of the use conditions on presuppositions, but rather, miscoordination about what is common ground. The conversational context on the Stalnakerian picture is an information state determined by the interlocutors in a conversation, but the content of that information state is rarely made explicit. Sometimes, what is a shared assumption is manifestly clear, e.g. when it has been established over the course of the preceding conversation, but more often than not, it must be inferred. In this sense, we have here a coordination problem: all parties must make a reasonable guess about what is known and accepted by all others, with the goal of converging on the right set of relevant information that is common knowledge. On this picture, it is inevitable that two people's beliefs about what is shared knowledge differ from time to time. Such cases may be more frequent with children, who may be less adept at reasoning about their interlocutors epistemic states and converging on the optimal solution to this coordination problem. They may over- or under-estimate knowledge, and when they are mistaken in this way, they may over- or under-use presuppositional expressions.[6]

This type of coordination issue is less of a problem in the experimental task here. Beyond the fact that the common grounds among the various characters are delimited and made fairly explicit in the stories, the task involves making decisions about who is a *better*

[6] An important observation by Wexler (2003) is that children do not seem *under-use* the definite article. Put differently, there is no "overuse of the indefinite" counterpart. This does not follow straightforwardly if at the core of children's problems with presupposition use is a difficulty finding optimal solutions to a coordination problem. This issue is taken up and discussed at length in Chapters 4 and 5.

addressee. Even if the child is uncertain about what is shared knowledge between different pairs of characters, they can be certain that the *more likely* person to know the presupposition of a sentence like *The bird that I got flew away* is the one who was co-present during the bird-getting event.

2.6.3 Uniformity across triggers

A notable result from our studies is the uniformity of participants' response patterns across the two presupposition triggers used, *too* vs. *the*. *Too* and *the* differ in the ease with which their presuppositions can be accommodated and fall into distinct classes with respect to presupposition suspension. Our rationale for comparing the two triggers was to ascertain to what extent these differences affect adults' expectations about the addressee of sentences containing these triggers, as well as children's assumptions about how their use is constrained. However, neither group's preferences varied based on presupposition trigger: for both *too*- and *the*-sentences, adults and children preferred an addressee who was knowledgeable about their presuppositions prior to utterance.

With respect to development, this uniformity suggests that rate at which some presupposition can be accommodated probably does not play a critical role in the acquisition trajectory of the trigger in question. That is, to the extent that *too* is acquired by children earlier than *the*, the resistance of *too* to informative uses cannot be at the heart of it.

This result also has significance for our theorizing about presuppositions and in particular for differentiating between classes of presupposition triggers, as has become a recent focus of theoretic interest. The felicity of e.g. sentences with definite descriptions in contexts where a unique referent has not been established — in violation, thereby, of the common ground requirement on presupposition use — has been met with two types of critical responses. One type of response has been to take the common ground view of presuppositions to be on the wrong track (Gazdar 1979; Soames 1982; Burton-Roberts 1989; Gauker 1998; Simons 2001; Abbott 2006). For instance, Gazdar (1979) weakens the common ground requirement by arguing that presuppositions need only be consistent with the common ground, not entailed by it. What is shared among these various proposals, which distinguishes them from the common ground theory, is that the beliefs of the addressee no longer play a critical role. On these accounts, presuppositional sentences may be uttered so long as its presuppositions are background beliefs of the *speaker*; they do not need to be

background beliefs that the speaker is presumed to share with the addressee. Our experimental results, however, show that adults and children have strong biases about the information state of the addressee given presupposition use and are therefore more in line with the common ground view. These biases persisted even for the presuppositions of definite descriptions, whose everyday uses are better described using a weaker felicity condition on presuppositions as in Gazdar (1979). But if presuppositional sentences were in fact subject to this weaker set of use conditions, the speaker of a presuppositional sentence in our experiments would have had equal grounds to address either listener. We therefore do not expect to find a reliable preference for the knowledgeable listener over the ignorant one. These findings point to an underlying conversational principle that speakers rely on, even if they are sometimes able to bypass it: as a rule of thumb, presuppositions must be presupposed in the common ground prior to utterance.

A second type of response to informative uses of triggers like *the* has been to say that they do not impose a felicity condition on the common ground to begin with, perhaps because they are not presuppositional in the traditional sense (e.g. Abusch 2002; Simons, Tonhauser, Beaver & Roberts 2010; Tonhauser et al. 2013; Romoli 2015; Tonhauser 2015). On this line of thinking, whereas triggers like *too* lexically encode a presupposition and are thus associated with the relevant usage conditions, triggers like *the* may give rise to presupposition-like inferences via pragmatic processes (Abusch 2002; Simons et al. 2010; Romoli 2015) or be associated with a different set of contextual expectations (Tonhauser et al. 2013; Tonhauser 2015). The striking uniformity we find across triggers in our experiments argues against this view. These results are unexpected on a view where the presuppositions associated with *the* and *too* derive from fundamentally different mechanisms or are tied to fundamentally different felicity conditions.

Overall, our results lend support to the view that presuppositions of a sentence are required to be common knowledge prior to its utterance. Moreover, these findings suggest that this requirement governs the use of all presupposition triggers irrespective of availability of informative uses, and call into question attempts at classifying triggers into distinct classes based on rates of such uses.

2.6.4 Learning the felicity condition?

Given the use of a presuppositional sentence, children in our studies, like adults, assume that the addressee already takes the presuppositions for granted. This is so even for sentences involving definite descriptions, which are often used in situations where the presuppositions are not previously known by the addressee. The implication here is that children in the tested age range have the same underlying semantic and pragmatic knowledge as adults. They know the meaning of the presupposition triggers tested and understand how their presuppositional meanings constrain the context of utterance.

However, the felicity condition on presupposition use, repeated here from (1), is more restrictive than what is warranted given children's likely experience with triggers like *the*.

(2) **Felicity condition on presupposition use:** A sentence S with presupposition p may be used in a conversational context c if c entails p at the time that S is uttered.

This raises the question of how they nevertheless converge on this principle. In fact, our experimental results suggest that this variability in experience does not have a significant impact: children's treatment of *the* and *too* were the same, despite their experience with two triggers being quite different.

My view is that this felicity condition is not learned. Rather, it emerges from components of grammar and cognition that children come in already equipped with. understanding of the semantics of presuppositions and of the rules of cooperative communication. On the theory of presuppositions adopted here, the sub-components that give rise to the felicity condition above are the following:

i. that the truth of certain propositions are indeterminate at certain worlds

ii. that a valid assertive move should allow for a narrowing of the context to only those worlds compatible with the information conveyed, and

iii. that the use of a proposition whose truth is indeterminate at a world in the context is an invalid move, as it will fail to accomplish the goal in (ii).

The components in (i) and (ii) above may be primitives, respectively, of natural language and social cognition. The child, on this picture, may never need to figure out that presuppositions exist as a component of natural language meaning, or what the general goals of

communication are. The last of the three pieces above, of course, is the bridging principle. In principle, a child who knows (iii) and has the adult-like semantic representation of a presuppositional sentence S presupposing *p* should be able to deduce that a context cannot be updated with its meaning unless *p* holds in every world in that context.

The argument I am making here is a familiar one, the Poverty of the Stimulus: the child develops a piece of grammar for presuppositions that strongly disagrees with the input. Therefore it must be that these properties of the grammar are built-in, innate. In this case, the semantic and pragmatic distinctions between presupposed and asserted content make up part of their cognitive set-up that they never need to learn from experience. The bulk of the child's learning task consists, instead, of a mapping problem: figuring out which forms in her lexicon are conventionally associated with a presupposition.

Chapter 3

Knowing when to accommodate

3.1 Introduction

In the previous chapter, we showed that children, like adults, have strong expectations that the presuppositions of an asserted sentence be previously known to all parties in the conversation. We took this as evidence of early sensitivity to the felicity condition on presuppositions in (1), which mandates that presuppositions be common knowledge to the speaker and addressee(s) prior to assertion.

(1) **Felicity condition on presupposition use:** A sentence S with presupposition p may be used in a conversational context c if c entails p at the time that S is uttered.

Children's early command of this use condition is perhaps surprising. Their experience with presuppositions overall fails to be in line with this principle. Adult speakers use presuppositions to introduce new information to the common ground, complicating significantly the acquisition task: how would the learner ever converge on (1) if there is so much noise — informative presuppositions — in the input? In answering this question, I conjectured that (1) is not in fact learned. Rather, it falls out from innate components of the grammar of presuppositions and language use, i.e. primitives that the child never has to rely on experience to master.

The fact remains, however, that competent speakers felicitously use presuppositions informatively and know what to do when a required sentence presupposition is "missing" from the context. Full command of presupposition use then includes not just the mastery

of redundant presuppositions, which meet the condition in (1), but also informative presuppositions, which over-ride the condition. The main goal of this chapter is to investigate the developmental trajectory of informative presuppositions. To carry out this objective, I once again use as a probe children's expectations about the possible addressee of a presuppositional sentence. In the studies presented here, unlike those in the preceding chapter, the adult-like choice of listener would be the one who did not have prior knowledge about the sentence presupposition. That is, adults were expected to a show a bias towards a conversational situation where the utterance introduced new information via its presuppositions.

A secondary goal is to use the child data to inform our theories of presupposition. The developmental findings from the previous chapter was taken to be evidence in favor of the Stalnakerian picture, where presuppositional sentences are conventionally tied to the use condition in (1). However, those findings, while arguably best explained on the common ground theory, are not necessarily inconsistent with alternative approaches that eschew with the aforementioned felicity condition. The developmental path of informative presuppositions, on the other hand, has the potential to bring in more decisive evidence regarding the status of the felicity condition in (1). The status of informative presuppositions is a critical point of disagreement among theories of presupposition. The common ground theories distinguish two different systems: (*i*) the formal demands that presuppositions impose on the context, i.e. the requirement in (1), and (*ii*) a system of *accommodation* that allows for the recognition and tacit fixing of an otherwise "defective" context. When it becomes clear over the course of a conversation that the context needs to be a certain way, e.g. because the speaker has presupposed something that wasn't mutually presupposed, cooperative listeners can change their beliefs so that what the speaker takes to be common ground is in fact common ground. On the other hand, critics of the common ground theory take the very existence of informative presuppositions to be evidence against the requirement that presuppositions must be entailed by the common ground. The approach, instead, is to adopt different constraints that impose weaker requirements on the context compared to (1).

Child data can be helpful in arbitrating between these two perspectives. The common ground theory allows for the possibility that the two systems — the formal condition and the system for accommodation — develop independently. More specifically, a plausible trajectory on this view is one in which children acquire the rule in (1) — something that falls out from primitives, as argued earlier — before they come to understand *that* the rule can be broken, *when* the rule can be broken and *how* the resulting circumstances can be

fixed in a manner that avoids a conversation breakdown. In other words, the common ground theory is consistent with — arguably *predicts* — a developmental asymmetry. On the alternative accounts, on the other hand, the pragmatic rule governing presuppositions is taken to be flexible enough to cover both redundant and informative presuppositions. Consequently, adult-like competence with presuppositions entails knowing that they can be used informatively. Thus, a developmental asymmetry is not expected on these theories.

I begin in the next section by spelling out the crux of the theoretical debate. In §3, I introduce the experimental paradigm and the predictions for adults and children. Experimental findings, from adult controls and children, are presented in §4 and §5 respectively. Unlike in the studies reported in the previous chapter, we find a clear disconnect between adult and child behavior in the present study: children do not share with adults the expectation that presuppositions can be used to introduce new information. We have, therefore, a developmental asymmetry: there is a stage in development where children show stricter adherence to the felicity condition in (1) than adults, suggesting that they do not yet know that presuppositions can be used informatively. I take these results as strong evidence in favor of the common ground theory. I conclude with a discussion of what it takes to eventually master the skills required to deal with informative presuppositions.

3.2 The theoretical debate

Sentences like (2) are, at least on the surface, problematic on views of presuppositions as conveying old information already known to speaker and addressee prior to utterance.

(2) Sorry I am late! The car that I rented broke down.

The second sentence in (2) contains the definite determiner *the* which presupposes existence and uniqueness of an entity matching the descriptive content of the NP it combines with. Given the requirement in (1), for (2) to be acceptable, the context must entail the existence of a unique car that the speaker rented. However, the intuition is that the sentence would be acceptable even when the context did not already entail that presupposition. That is, the sentence could be felicitously uttered in a situation where the audience does not know that the speaker has rented exactly one car.

These kinds of examples have engendered two main camps of responses. One is to

say that the requirement in (1), while an idealization, is basically right. It is a requirement that falls out from the formal properties of the structure in question. However, there is in addition a process — prompted by the very utterance that would otherwise not be acceptable — whereby the addressee simply adds to the common ground the presupposed proposition and thus make it common ground.

An alternative response is to take these sorts of cases to constitute empirical evidence that we need a weaker — or perhaps different altogether — rule from (1). In what follows, I outline in some detail both of these types of approaches, and point out how data from child language can serve as an arbitrator in this debate.

3.2.1 Accommodation

The felicity of sentences like (2) is *prima facie* a problem for theories that rest on a condition requiring presuppositions to be already entailed by the common ground of conversation. Such apparent counter-examples to the use condition in (1) have been noticed and acknowledged from the earliest days of the common ground theories. In fact, Stalnaker (1974) himself discusses the following scenario:

> I am asked by someone who I have just met, 'Are you going to lunch?' I reply, 'No, I've got to pick up my sister.' Here I seem to presuppose that I have a sister even though I do not assume that the speaker knows this. Yet the statement is clearly acceptable, and it does not seem right to explain this in terms of pretense, or exploitation.

The solution to this problem has been to appeal to a process of *presupposition accommodation*, whereby listeners adjust their contextual assumptions so as to satisfy the presuppositional requirements of a sentence uttered by an otherwise cooperative speaker. Karttunen (1974) describes the process as follows:

> If the current conversational context does not suffice [in satisfying the presupposition of an uttered sentence], the listener is entitled and expected to extend it as required. He must determine for himself what context he is supposed to be in on the basis of what is said and, if he is willing to go along with it, make the same tacit extension that his interlocutor appears to have made.

On this view, not only is accommodation an available repair strategy for violations of the use condition on presupposition, it is part and parcel of the dynamics of cooperative discourse. So long as the speaker is deemed cooperative, listeners are expected to accommodate them by tacitly adjusting their beliefs in a matter that meets the requirements imposed of the uttered sentence. Accommodation, in other words, an adaptation on the part of a cooperative hearer in the face of an intention that the speaker has communicated. Assuming that such adaptations happen, a number of further questions arise. For starters, when does accommodation happen, and what is accommodated? The answers to these questions are far from obvious, but I will briefly discuss some possible ways of thinking about them. For a more in-depth discussion, the reader is referred to Beaver (2004) and von Fintel (2008).

Is accommodation is unconstrained? That is, is it the case that, as David Lewis put it, you presuppose something that is not already presupposed and "that presupposition springs into existence, making what you have said acceptable after all" (Lewis 1979)? This does not seem to be the case. Accommodation seems to be subject to various constraints. In the previous chapter, we discussed trigger-specific constraints on accommodation. Specifically, triggers that are anaphoric, or whose descriptive content is insufficient to signal what must be accommodated, resist informative uses. There are also other, more general conditions that modulate the availability of accommodation. For instance, presupposing something that contradicts what is already common ground won't help change the state of the common ground; the relevant proposition will simply never be accommodated (Beaver 2004). Consequently, the same sentence in (2) will be judged as quite odd in the situation in (3), as the presupposition we would need to accommodate — that there is a unique car that the speaker rented — contradicts what is part of our world knowledge, namely that 7-year-olds cannot rent cars.

(3) [Spoken by a 7-year-old who is late to class]
I'm sorry I'm late! The car that I rented broke down!

Yet another generalization, due to Heim (2014), is that questions cannot be answered by an accommodated presupposition, as evidenced by the oddness of (4-a).

(4) A: Do you drive a rental car?
a. B: #The car that I rented broke down.

b. B': ✓I do drive a rental car. But, it broke down this morning.

Heim's analysis of this constraint is as follows. Every assertion is made against a context c (a set of worlds), *relative to a question or issue* Q (a partition of the set of worlds[1]). The goal of assertion is not just to update the common ground with the asserted proposition, but to update it so as to eliminate at least one cell in the partition set by Q. A proposition is informative relative to c and Q iff p eliminates at least one cell in the partition of c given Q. In the example above, the original context contains worlds in which B drives a rental car and those in which she does not. A's question can partition that context into two cells. but as it is, c does not admit B's utterance in (4-a) because it doesn't already entail that the speaker has a rental car. Now, suppose A were to accommodate that presupposition, shifting c to c' which contains only worlds in which B has rented a car. Doing so would mean that the partition of c' relative to A's question would result in a singleton set, which entails the positive answer to that question. A further update is now trivial: the requirement that at least one cell in the partition be eliminated cannot be met because there is only one cell.

Things that are "controversial" or high on the scale of "noteworthiness", nebulous as those terms are, also seem to be impossible, or at least very difficult, to accommodate. By way of illustration, consider (5). Irrespective of whether the situation described is in fact true, we find the sentence odd. This is likely because the presupposition we are expected to accommodate — that there is a unique zeppelin that the speaker rented — is an unusual enough occurrence that we are not prepared to add it to the common ground without fuss or further inquiry.

(5) I'm sorry I'm late! The zeppelin that I rented broke down!

Given such constraints on when accommodation will take place, a speaker, in deciding whether or not to introduce new information via presupposition, must carry out a cost-benefit analysis. In circumstances where they can be fairly confident that the listener will accommodate the relevant presupposition, using a sentence S with presupposition p (notated S_p henceforth) might be the rational movie — e.g., it would incur less cost and pro-

[1]Given a context set c and question Q, we can say that Q induces a partition of c as follows:

(i) $\text{Partition}(Q, c) = \{\text{PART} \subseteq c: \text{PART} \neq \emptyset \ \& \ \forall p \in Q \ . \ \forall w,w' \in \text{PART} \ . \ p(w) = p(w')\}$

duce the same intended outcome as asserting p and S. In other cases, however, using S_p in a context that does not entail p could simply lead to a conversation breakdown because the listener is unwilling to accommodate.

The second question is this: what does a listener who has made a decision to accommodate the speaker actually accommodate? The simplest answer is the following (formulated from the perspective of the hearer):

(6) **Minimal Accommodation:**
If you want to compute $c + S_p$, but c does not admit S because c does not entail its presupposition p, then change c minimally to a context c' such that c does admit S_p and update c' with S.

Minimal accommodation amounts to an accommodation of the semantic presupposition of the sentence in question and nothing more. But this does not always yield the right results. Compare the following examples:

(7) If Mary is a scuba diver, she will bring her wet suit on vacation.

(8) If Mary is a scuba diver, she will bring her husband on vacation.

Both sentences semantically presuppose a conditional statement, namely if Mary is a scuba diver, she has a {wet suit/husband}. If minimal accommodation is what speakers actually do, the prediction for such sentences, when presented out-of-the-blue as we do here, is that we take the speaker to be taking such a conditional statement for granted. This is indeed the case in (7), but this is not so in (8), where we take the speaker to be assuming that Mary has a husband, *simpliciter*. Contrasts such as these, often referred to as the "proviso problem", has received much attention in the literature (see e.g. Geurts 1996; Beaver & Krahmer 2001; Beaver & Zeevat 2007; Heim 2006; Singh 2008; Pérez-Carballo 2009; Fox 2012), but what these examples may be telling is this: The listener's task is more complicated than the accommodation of the minimal proposition semantically presupposed by an uttered sentence; rather, the listener instead accommodates what they believe the speaker might be plausibly taking for granted. On this view, the accommodation of a stronger proposition — that Mary has a husband — in (8) is necessitated by the fact that it would be implausible, given what we know about scuba divers and spouses, that the speaker believes that Mary's having a husband depends in some way on her being a scuba diver.

If this is right, then an important take-away is that accommodation (and interpretation more generally, as suggested in the previous chapter) involves a complicated coordination problem. The speaker and listener must make rational inferences about the information state and expectations of their interlocutor. A speaker using informative presuppositions must decide whether or not they are likely to be accommodated by their addressee. A listener accommodating informative presuppositions must decide on the accommodation target that most plausibly reflects the information state of the speaker.

3.2.2 Criticism and alternatives

The introduction of accommodation into the system fixes a problem for the common ground theorist: the problem of informative presuppositions. However, a different approach to the problem has been to take it seriously as an argument against the use condition in (1). On the view described above, accommodation is treated as a complex form of inference that implicate semantics, general principles of pragmatics, and specific calculations of the joint goals of discourse participants. Not only that, once you consider what coordinating about the common ground involves, contextual adjustments like accommodation seems like a general and necessary feature of any communicative activity. However, the introduction of such a "rule" as a remedy for missing presuppositions has been seen by many critics as merely an add-on pragmatic fix designed to deal with a single problematic case. This is made plain in Gazdar's (1979) criticisms of the enriched picture, which he claims treats "the bulk of the data [i.e. ordinary conversation] as something special... [and] circumvent any possibility of counterexamples." Gazdar's own solution to the problem was to weaken the common ground requirement on presuppositions. Presuppositions do not need to be entailed by the context, simply consistent with it (9).

(9) **Felicity condition on presupposition use, Gazdar's version:** A sentence S with presupposition p may be used in a conversational context c if c does not entail $\neg p$ at the time that S is uttered.

The condition in (9) accounts for the fact that informatively used presuppositions are unacceptable when it conflicts with what we already know, as we saw in (3). However, it is arguably too weak. As we saw earlier, not everything that is potentially consistent with the common ground can be presupposed, e.g. (5).

A more nuanced condition, which is nevertheless weaker than the felicity condition in (1), is proposed in Soames (1982). Soames defines the felicity condition on presupposition as involving the concept of a proposition being "uncontroversial", as in (10).

(10) **Felicity condition on presupposition use, Soames's version:** A sentence S with presupposition p may be used in a conversational context c if the speaker may take p to be uncontroversial at the time that S is uttered.

Concerning the circumstances that render a proposition uncontroversial, Soames has the following to say:

(11) A speaker S takes a proposition P to be uncontroversial at t (or, equivalently, takes P for granted at t) iff at t, S accepts P and thinks:

a. that P is already part of the conversational context at t; or

b. that the other members of the conversation are prepared to add P to the context without objection.

This conception of the use condition on presupposition makes it possible for there to be mismatches between the set of assumptions that the speaker and hearer are taking for granted, thus leaving room for informative presuppositions. However, the "uncontroversiality" proviso — i.e the requirement that the information be added to the common ground "without objection" — is intended to ensure that cases like (5) are still ruled out.

More recently, there have been approaches that aim at developing a unified account of a range of phenomena, including presuppositions, conventional implicatures (Potts 2005), and other linguistic environments that display 'projective behavior' (Simons 2001, 2006; Simons et al. 2010; Simons, Beaver, Roberts & Tonhauser 2016; Beaver, Roberts, Simons & Tonhauser 2017). "Projective content", on their definition, is any implication that remains unchanged in the scope of entailment-canceling operators. As discussed in Chapter 1, projection is generally taken to be a definitional feature of presuppositions, but the crucial observation these authors make is that the class of phenomena that exhibit such projective behavior is heterogeneous. Moreover, even within the class of presuppositional items, projection behavior is non-uniform.

This observation is taken as motivation for developing theory that does not rely on conventionalized distinctions between presupposed and asserted content. More concretely,

rather than thinking of presuppositional sentences as being undefined or having a stigmatized third truth-value, a classical bivalent logic is assumed (i.e. sentences are either true or false). Whether or not an implication is construed as 'taken for granted' or 'to be taken for granted' depends on the discourse structure. The main hypothesis on these accounts is that projective behavior derives from the property of *at-issueness* relative to the Question Under Discussion (QUD), where at-issueness is defined as in (12). Intuitively, at-issue content is everything entailed by the main proposition the speaker wants to communicate, given the topic of inquiry. *Not-at-issue* content is simply the complement set of those entailments that satisfies (12).

(12) **At-issueness:** A proposition conveyed by a constituent is at-issue if it contributes to the ordinary semantics of the clause in which it is located and entails that some possible answer to the QUD is false; otherwise the proposition is not-at-issue. (Beaver et al. 2017)

An implication conveyed by an utterance projects if and only if it is *not-at-issue*:

(13) **Projection Principle:** If content C is expressed by a constituent embedded under an entailment-canceling operator, then C projects if and only if C is not-at-issue.

In this regard, presuppositions — and any projective content, for that matter — can be thought of as a subsidiary commitment on the part of the speaker, that isn't relevant for resolving the question of interest at that point in conversation. The fact that projective content is often common knowledge is explained in the following way. The interlocutors agree jointly on a QUD, an answer to which must refine the common ground by narrowing the context set (so far, the account is much the same as the Stalnakerian picture). For this to happen, the set of alternative propositions represented by the QUD must contain at least one proposition that is compatible with, but not entailed, by the common ground. If some content is entailed by the context, it is either (*i*) independent of the QUD or (*ii*) then every alternative in the QUD entails it. It follows from the definition of at-issueness in (12) that such content will not be at-issue, and by the Projection Principle that it projects.

Though the theories described above represent three alternative approaches to presuppositions which potentially make different importantly predictions about presupposition use, my goal here is not to evaluate all of them. Rather, I will gloss over these differences

in the rest of the chapter, instead treating these various accounts as a single class based on their uniform rejection of the principle in (1) as the formal condition governing presupposition use. The main advantage in doing so is greater empirical coverage: there is no need, on any of these accounts, to appeal to a process of accommodation to deal with informative presuppositions.

3.2.3 The role of child language

We can thus draw a broad split among the various theories discussed above on the basis of their treatment of informative presuppositions. On the common ground approaches, informative and redundant presuppositions follow from two separate systems. The formal requirement presuppositions impose on the context is that they be entailed prior to assertion. But speakers may violate this formal requirement and use presuppositions informatively precisely because cooperative listeners have the ability to accommodate them. On this view, the redundant uses of presuppositions can be thought of as the more "basic" case, where the formal requirements are satisfied. In contrast, all of the other approaches discussed take informative presuppositions as falling within the purview of any good theory of presuppositions. The critical point of divergence, therefore, concerns the cognitive status and in turn, the theoretical relevance of informative presuppositions.

We can translate this point of debate into predictions about child language development. On the common ground approach, speakers who have underlying knowledge of a formal rule like (1) may nevertheless choose to bend that rule to meet some strategic end. Knowledge of the rule is a prerequisite for knowledge of how to break it, and a developmental trajectory where the learner initially knows only the rule is consistent with such theories. On the alternative approaches, knowing the pragmatics of presupposition entails knowing that they can be used informatively (at least for some triggers). Thus, an asymmetry is not obviously consistent with these approaches. This chapter sets out to test these predictions. To do so, I conduct a variant of the listener identification task introduced in the previous chapter. As explicated in more detail in the following section, the preferred listener of a presuppositional sentence in this variant, for adults, will be the more ignorant listener, to whom the presupposed content introduces new information.

3.3 Logic of the paradigm

The studies reported in Chapter 2 aimed at examining participants' sensitivity to the felicity condition in (1). In contrast, the studies presented in this chapter is interested in participants' willingness to violate it. To do so, we once again examined biases about the common ground given the use of a presuppositional sentence. The presuppositional expression employed was a definite description, which readily permit informative uses. Participants were presented with conversational situations with a speaker and two possible addresses in a variant of the listener-identification task. However, in this task, choosing a more knowledgeable listener for a presuppositional sentence — i.e. the choice that would indicate adherence to the common ground requirement — would be in violation of some other conversational principle. The rationale was that this conflict situation should lead to an increase in rates of choosing the more ignorant listener.

More concretely, in the critical condition, the speaker utters a sentence, $S_{\underline{pq}}$, presupposing p and asserting q. The more knowledgeable listener, L1 for short, already knows that both p and q hold. The less knowledgeable listener, L2, is ignorant about the truth of both propositions. In other words, both the asserted and presupposed content is common ground between L1 and the speaker, whereas neither is common ground between L2 and the speaker. The critical condition in this experiment, therefore, pits the felicity condition on presupposition use against the fundamental pragmatic principle governing assertion, namely that successful assertion must add new information to the common ground.

As before, the task comes down to identifying the more successful conversational situation. We expected that adult participants in this study will choose the more ignorant listener, L2, in the critical condition. This is the rational move on both types of approaches discussed in §2. On the common ground theory, the speaker in the above conversational situation is always in violation of one pragmatic principle or other. In asserting $S_{\underline{pq}}$ to L1, they would be violating the felicity condition on assertion. Asserting the same sentence to L2 would violate the felicity condition on presupposition use in (1). However, violation of the latter is resolvable — it can be repaired via accommodation. Consequently, the ignorant addressee L2 would be more likely to accept the utterance compared to the knowledgeable one in this situation. On the alternative approaches, by default, presupposition uses may introduce new information to the common ground. Thus, asserting $S_{\underline{pq}}$ violates no rule. On the other hand, these theories also take as a fundamental principle the informativity requirement on

asserted content. Because the speaker would be violating a cooperative rule of discourse only when addressing L1, L2 should be judged the one more likely to accept the utterance.

Findings from children, on the other hand, can be more revealing. We already showed in Chapter 2 that children prefer the presuppositions of an asserted sentence to be common knowledge and the asserted content *not* to be common knowledge. What will they do when the two preferences conflict? One possibility, of course, is that they behave just like adults, choosing L2 and allowing for the possibility that presuppositions may be informative. This result cannot help us adjudicate between the two classes of theories under consideration. Their adult-like behavior may be because, in a manner consistent with the common ground approach, children at this stage have not only mastered the rule-of-thumb that presuppositions be common knowledge, but also how speakers may strategically violate that rule. Alternatively, the adult-like behavior could be because knowing the pragmatics of presupposition entails knowing that they can be used informatively, as is the expectation on the alternative approaches. Thus, while such a result would provide a description of the developmental stage, it does not tease apart the two theories of interest.

Another possibility is that children are not adult-like. They may choose the knowledgeable listener more often than adults. Given that the previous chapter had already demonstrated children's (*i*) ability to keep track of the common ground, and (*ii*) sensitivity to conditions governing assertion, if they are non-adultlike in this way, that points to specific difficulties with informative presuppositions. The resulting asymmetry between redundant and informative presuppositions is only consistent with common ground theories, which allow for the possibility of a stage where children know the rule but not the repair.

Keep in mind, however, that the novel data introduced in the previous chapter are more amenable to the common ground theory and already pose a challenge for the alternative accounts. In all of the alternative approaches, the speaker of a presuppositional sentence in our experimental paradigm is perfectly licensed to utter that sentence to either the knowledgeable or the ignorant listener. The fact that we find a strong bias towards the knowledgeable listener in both adult and child population is mysterious on these accounts. In the last chapter, I took these findings to be evidence in favor of the common ground theory. This interpretation of these earlier findings align my expectations about the present study with that of the common ground theory.

In what follows, I will first present results from adult participants, which conforms to our expectation. I will then turn to the child data in §5.

3.4 Adults

Experiment 1A probes adult participants' understanding of the fact that presuppositions may add new information to the common ground. As before, my goal in testing adults is to establish a baseline against which children's response patterns can be evaluated. Again, the expectation for adults on either class of theories is that they take the presupposed content of the uttered sentence to be new information to the listener.

3.4.1 Participants, Materials and Procedure

Thirty-five native speakers of English, recruited via Amazon Mechanical Turk, participated in Experiment 1A. All materials were presented in written form on a computer screen using the IbexFarm experiment presentation tool (Drummond 2013). As in the studies reported in Chapter 2, participants in this experiment read about conversational scenarios involving three characters, and had to make a guess about who was the intended listener for a speech act based on the knowledge states of the various characters.

There were two experimental conditions, where the items were either identical to or minimal modifications of the items from Experiment 1B in Chapter 2. Items in the "No-Presupposition" condition was identical to those used in Experiment 1B. A non- presuppositional sentence is asserted, where only one of the two potential listeners is ignorant about the content of the assertion. Thus, the asserted proposition could only effect an update to the common ground between the speaker and the "ignorant" listener. In this case, A might say, "I got a bird today," in a situation where character B already knows this information and character C does not. We expected to replicate the results from Chapter 2, Experiment 1B, where character C was reliably chosen by participants.

In the "Presupposition" condition, the speaker uses a presuppositional sentence involving definite description. Its presuppositions were known to only one of the two potential addressees, making the relevant information common ground only between the speaker and the "knowledgeable" listener. For example, character A might say, "The bird that I got flew away", when only some character B knows that A had procured exactly one bird to begin with. Unlike in its counterpart in Chapter 2, in this experimental condition, character B would also know that A's bird had flown away. In other words, the asserted content of the utterance would also be part of the common ground between the speaker and the knowledgeable listener. In contrast, neither the presupposed nor asserted contents would

be shared knowledge between character C, the more "ignorant" listener, and the speaker. As mentioned earlier, the expectation here — unlike in Chapter 2, Experiment 1B — is that character C should once again be chosen. The two conditions and sample scenarios are given in Table 3.1. Each participant saw 8 items per condition and 16 filler items.

Table 3.1: Conditions, Experiment 1A

Condition	Scenario	Question	Expected Choice
Presupposition	**Susie**, **Jane** and **Mike** were hanging out together. But **Jane** had to go and run some errands so she left. Then it was just **Susie** and **Mike**. The two of them decided to go to an animal shelter. At the shelter, **Mike** got himself a pet bird. Right afterwards, the bird flew right out of its cage! Then she had to go home, too. Later, **Mike** was on the phone with one of the girls and he said, "Guess what, the bird that I got flew away!"	Who was Mike talking to when he said, "Guess what, the bird that I got flew away!"?	Jane
No-Presupposition	**Katie**, **John** and **Molly** were hanging out. But then **Katie** decided to go to the library to study. Then, it was just **Molly** and **John** and the two of them decided to go to the beach instead. At the beach, they found a seashell and **John** decided to keep it. Then, **Molly** had to leave too. **John** stayed at the beach awhile, but the seashell got buried in the sand somewhere and he couldn't find it again. Later **John** was on the phone with one of the girls and he said, "Hey, guess what, I found a seashell today!"	Who was John talking to when he said, "Guess what, I found a seashell today!"?	Katie

3.4.2 Results and discussion

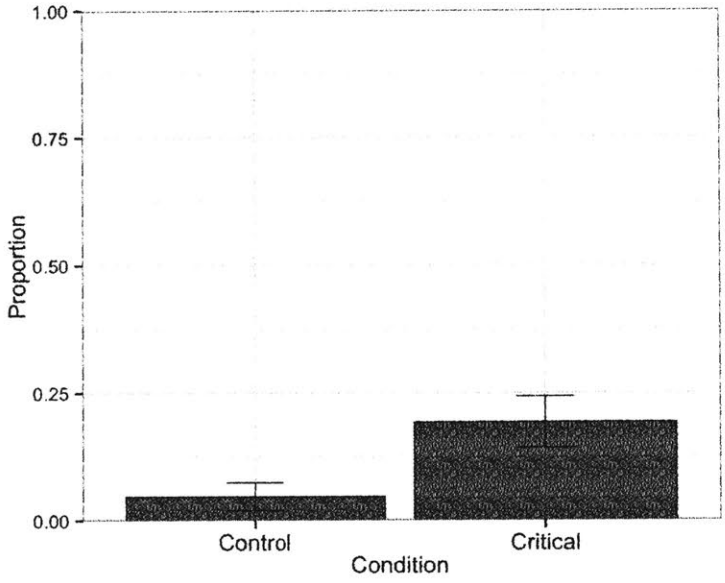
Four participants were excluded from the analysis due to low performance (<60%) on the filler items. Results from the remaining thirty-one participants are described below.

Figure 3-1 plots the rates at which the more knowledgeable character was chosen in each condition. Recall that in this study, we expected participants to choose the more ignorant character on both the critical condition and control conditions. These predictions are borne out in our results: participants did overwhelmingly choose the ignorant listener in both conditions. To analyze these trends statistically, we fit a mixed-effects logistic regression on the rates of knowledgeable listener choice, with condition as a fixed effect and random effects of subject and item. We found no effect of condition, with the odds of choosing the knowledgeable listener being comparable — and comparably low — for both conditions. Table 3.2 summarizes results from the regression.

Table 3.2: Summary of statistical analysis, Experiment 1

	β	SE	z	p
Intercept	-3.1553	0.58	-5.44	<.001
Condition (Critical)	0.98	0.75	1.30	0.194

Figure 3-1: Rate of choice of knowledgeable listener, Experiment 1



The goal of this section was to evaluate adults' underlying knowledge of the fact that

presuppositions can be used informatively. I asked whether in the right circumstances, adults expect sentences involving definite descriptions to be uttered to an audience that does not already take for granted the relevant presuppositions. In the experimental scenarios, the speaker's utterance of the presuppositional sentence to the more knowledgeable addressee, i.e. the one who already shared with the speaker the knowledge that the additive presupposition holds, would have been in violation of the conversational principle mandating informative assertions. In such cases, adults showed a reliable bias towards the more ignorant addressee. Thus, as expected, adults are tolerant of uses of presuppositional sentences against a context that does not already entail the presuppositions.

While these findings serve as the baseline against which children's biases can be compared, as pointed out earlier, they do not themselves help adjudicate between the two types of theories of informative presuppositions. On accommodation-based accounts, a listener who did not already know that p can make the necessary contextual adjustments to accommodate a speaker who has presupposed p. On approaches that do not involve such a repair strategy, presupposing p, by default, has the potential to introduce new information. Thus, both theories predict a choice of the ignorant listener to be the appropriate response in our paradigm. We now turn to the experiment with children, which can be more informative in this regard.

3.5 Children

3.5.1 Predictions

The theoretical debates about informative presuppositions and the validity of the felicity condition in (1) can be translated into predictions about the developmental trajectory of presuppositions. On the common ground approach, the partial semantics of presuppositional sentences and the principles governing cooperative discourse deliver the felicity condition in (1), and any child who knows these two ingredients should arrive at the conclusion that presuppositions must be presupposed prior to utterance. If the semantic and pragmatic ingredients resulting in this felicity requirement are primitives, then the expectation on the common ground theories is that children know, at a very young age, when a speaker has grounds to utter a presuppositional sentence. The findings from the previous chapter are consistent with this idea.

This system is supplemented with a second component, accommodation: when a presuppositional sentence is used against a defective context, listeners can add a failed presupposition to it to make things works; competent speakers can exploit this ability, and use presuppositions informatively when it is more efficient to do so. Though accommodation is part and parcel of our cooperative tendencies, it falls outside of the formal requirements on presupposition use. Consequently, on the common ground theories, knowing how to presuppose does not entail knowing how to accommodate presuppositions and they are not undermined by potential asymmetries in development. Children may very well acquire the ability to use and comprehend redundant presuppositions, i.e. those in keeping with the felicity condition, before they are able to handle informative presuppositions. Put differently, they may acquire the rule before they are able to strategically violate that rule or understand how their interlocutor could do the same.

There may also be independent reasons for expecting developmental delays with informative presuppositions if accommodation is indeed involved. Accommodation, as described earler, involves a non-trivial coordination problem. Many things must be settled implicitly. What, for instance, is the nature of the context that a user of an informative presupposition want the listener to shift to? Will the speaker's informatively used presupposition be compatible with the listener's beliefs and thus accommodated by them? In these respects, the ability to deal with informative presuppositions in an adult-like manner requires the ability to reason in sophisticated ways about one's interlocutor's mental states. Such social-cognitive abilities have been argued to show rather protracted development. It is only around ages of 4 or 5 years that children begin to fully appreciate the role of beliefs in guiding action (Astington 1993; Wellman 1992) and even later that they master recursive mental reasoning (Perner & Wimmer 1985; Sullivan, Winner & Hopfield 1995; Miller 2009). If accommodation is the way we deal with informative presuppositions, we might expect that children have difficulties with this aspect of presupposition use.

On the alternative approaches, on the other hand, informative presuppositions need not impose such demands on speakers or listeners. Knowing the pragmatics of presuppositions entails knowing that they can be used informatively. Thus, we have no reason to expect asymmetrically non-adultlike performance in this study compared to those discussed in Chapter 2.

3.5.2 Participants, Materials and Procedure

Thirty-seven between the ages of 4 and 6 (ranging from 4;0 to 6;9; Mean Age=5;4) were recruited from preschools and museums in the Boston area. Results from thirty-one are reported here, after the exclusion of 6 participants who were unable to perform accurately on the fillers. As with adults, the child study was only minimally different from the study involving definite descriptions in Chapter 2 (Experiment 2B). Children participated in a "game", where they were told a series of stories about an animal character,a Panda, and his two friends, Cat and Fox. In the critical items, Panda has an "adventure" with one of the two friends, over the course of which he comes into possession of something. The portion that differs crucially from Experiment 2B is that *while the friend is present*, something happens to the object or entity that Panda had just procured. Later on, one of the two friends visits Panda, but is hidden behind some object in the scene, and the child's task is to figure out which of the two friends it is based on what Panda says to them. As before, children saw 4 critical items, 4 control items and 4 fillers. Sample scenarios from critical and control conditions are given in Table 3.3 (visual support omitted). In addition, children saw 2 training items at the beginning of the game and 4 fillers. The controls, fillers and training items were identical to Experiment 2B from the previous chapter.

3.5.3 Results and discussion

The overall rates at which the more knowledgeable addressee was chosen in each condition are plotted in Figure 3-2. The rates at which children choose the knowledgeable listener in the critical condition are indeed greater than the rates of choosing the knowledgeable listener in the control condition. However, though children chose the knowledgeable listener more often than adults', the patterns are also quite different from those in the studies in Chapter 2. In those studies, the preference for the knowledgeable listener was near-categorical. So it is reasonable to ask whether these results are simply a noisier version of the adult patterns.

A closer look at the data split by age, however, tells us that this is not so. As Figure 3-3 demonstrates, in the critical condition, there is clear growth towards adult-like behavior across the tested age range. Children start out doing something strikingly different from adults — they choose the knowledgeable listener more than half of the time — but this behavior shows a steady decline over time. In contrast, children basically start out like adults

in the control condition. There is improvement over time, but it is by no means as radical as the behavioral shifts seen in the critical condition.

Table 3.3: Conditions, Experiment 2

Condition	Scenario	Expected Choice
Presupposition	In this story, Panda and Cat were playing together, and Panda said to Cat, "Cat, let's go to the animal shelter." The two of them went to the animal shelter, and Panda found a bird he really liked, so he decided to adopt it. As the two of them were watching, the bird flew right out of his cage — oh no! And Panda was very sad. Then, Cat had to go home so he left. Later on Panda was at home, and one of his friends came to see him. But, we can't tell who's there — they're hidden behind that big rock! I don't know if it is Cat or Fox behind the rock, but Panda said to them, "Guess what, the bird that I got flew away!" Does that give us a clue about who is with Panda?	Fox
No-Presupposition	In this story, Panda and Cat were playing together, and Hippo said to Cat, "Cat, I wanna go to the beach today." So they went to the beach. At the beach, the two of them found a very pretty seashell and Panda decided that he would keep it. After a while, Cat was feeling tired so he went home early. Panda stayed at the beach. But it was really windy, and the seashell got buried in the sand and Panda couldn't find it anymore — oh no! Later on, he was at home and one of his friends came to see him. But, we can't tell who's there — they're hidden behind the blueberry bush! I don't know if it is Cat or Fox behind the blueberry bush, but Panda said to them, "Guess what, I found a seashell earlier today!" Does that give us a clue about who is with Panda?	Fox

Figure 3-2: Choice of knowledgeable listener, Experiment 2

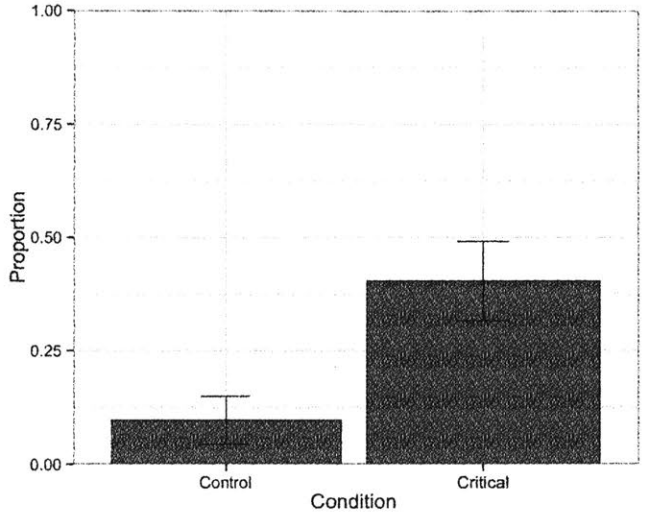
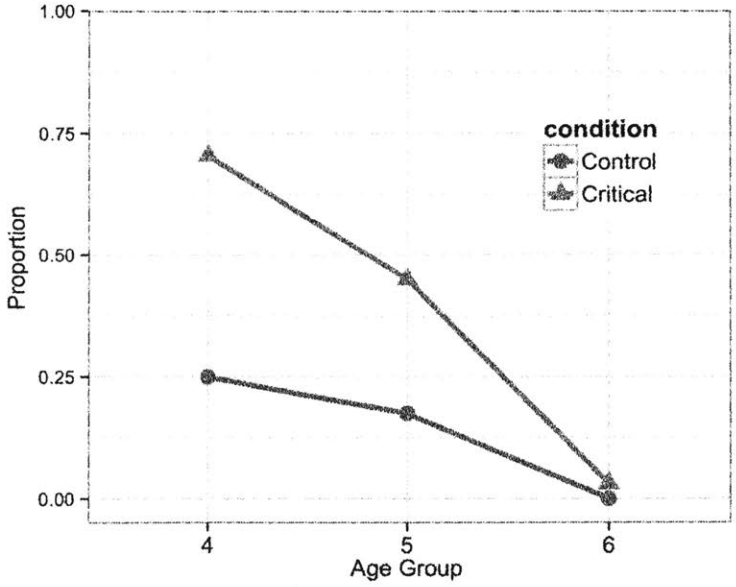


Figure 3-3: Choice of knowledgeable listener by Age Group



We fit two models to analyze these trends. In the initial analysis, we ran a mixed-effects logistic regression predicting knowledgeable-listener choice as an interaction of condition and age (measured in years and months), with random effects of participant and item. Age was initially treated as a continuous variable, but *post-hoc* analyses were performed making reference to age bins (4, 5, 6). Results from the omnibus test is summarized in Table 3.4. We find a significant interaction of condition and age. Recall that we also found an interaction in Experiments 2A and 2B in the previous chapter, but the directionality was different. In those experiments, adult-like behavior on the two conditions involved opposite choices and the interaction demonstrated an improvement with age in the strength of the pull in divergent directions. In contrast, in this experiment, the rates at which the knowledgeable listener is chosen become more similar across the two conditions as the children get older.

Table 3.4: Summary of omnibus test, Experiment 2

	β	SE	z	p
Intercept	4.42	2.67	1.65	0.10
Condition (Critical)	13.84	5.73	2.42	0.02
Age	-1.35	0.54	-2.50	0.01
Condition * Age	-2.21	1.10	-2.01	0.04

We then conducted a second analysis to explore the effect of age on performance. We grouped children into three age bins, 4-year-olds (n=11), 5-year-olds (n=10) and 6-year-olds (n-10), and fit a second mixed effects logistic regression now with condition and age-group as interacting fixed factors. We then used the *lsmeans* package (Lenth 2016) to conduct *post-hoc* comparisons of the relevant interaction with Tukey adjustments for multiple comparisons. The results from this analysis is summarized in Table 3.5. We find a significant effect of condition in the 4-year-old group, but not in the 5- or -6-year-old groups. There was a significant effect of age group within the critical condition: the 4-year-old group differed both from 5-year-olds and 6-year-olds, and the 5-year-olds from the 6-year-olds. In contrast, there was no significant changes across age groups within the control condition. Thus, there is genuine improvement with age only in the critical condition.

To summarize, then, children's behavior in this experiment, especially at the younger age groups, was radically different from that of adults. Whereas adults were shown to reliably choose the ignorant listener in the critical conditions, children at ages 4 and 5 did not show such a bias. Moreover, we find a clear developmental progression, with children

Table 3.5: Pairwise comparisons from post-hoc analysis

Contrast	z	p
4-yr-olds, Control vs. Critical	-3.65	0.004*
5-yr-olds, Control vs. Critical	-1.79	0.47
6-yr-olds, Control vs. Critical	-0.064	0.99
4-yr-olds vs. 5-yr-olds, Control	-0.25	0.99
4-yr-olds vs. 6-yr-olds, Control	0.76	0.99
5-yr-olds vs. 6-yr-olds, Control	0.077	1.00
4-yr-olds vs. 5-yr-olds, Critical	1.64	0.57
4-yr-olds vs. 6-yr-olds, Critical	3.51	0.006*
5-yr-olds vs. 6-yr-olds, Critical	2.84	0.05*

become increasingly adult-like between ages 4 and 6. This points to a developmental trajectory on which children start out unable to deal with informative presuppositions in an adult-like manner.

3.6 General Discussion

3.6.1 Summary

The main goal of this chapter has been to investigate's children's knowledge of informative presuppositions. To do so, I devised a variant of the listener-identification task from the preceding chapter, in which the possible listener who knew that the presupposition was true also knew the asserted content of the sentence to be true. Because of this, adults in this task showed a preference for the listener for whom the presupposition — and the assertion, for that matter — constituted new information. Children, on the other hand, did not reliably choose the more ignorant listener. Especially at the younger ages, they did not seem to understand that presuppositions might sometimes represent new information. This knowledge seems to emerge slowly, with children's behavior approximating that of adults only at around age 6.

This is the first instance thus far where we see a departure from adult-likeness. The finding is noteworthy for both our theories of presuppositions and for our theories of pragmatic development. With regards to the former, these data add an important data-point — a developmental asymmetry between redundant and informative uses of presuppositions — that

an adequate theory of presupposition must account for. In §3.6.2, we scrutinize the extent to which extant theories can account for these new facts. From the point of view of the developmentalist, the main question is this: what is it about informative presuppositions that make them difficult for the child to the master? This issue is the topic of discussion in §3.6.3.

3.6.2 Theoretical implications

On the common ground approach to presuppositions, the formal condition on using a presuppositional sentence is that the presuppositions must already be shared knowledge among all parties in the discourse. This is the common ground requirement, repeated from (1) above.

(14) **Felicity condition on presupposition use:** A sentence S with presupposition p may be used in a conversational context c if c entails p at the time that S is uttered.

This condition has been argued to be too strong, as speakers often successfully use presuppositions to introduce new information to the common ground. Proponents of the common ground theory maintain that (14) is nevertheless the underlying principle, violations of which are permitted because cooperative listeners are flexible and can accommodate a speaker's presuppositions. Thus, to explain the whole range of presuppositional phenomena, one needs to make reference to two different systems: (*i*) one that follows from formal and compositional properties of a given structure, and (*ii*) a repair strategy, part and parcel of cooperative communicative behavior, for when the formal requirements have not been met in a given context. There is thus an inherent asymmetry on this view. Informative presuppositions do not have the same cognitive or theoretical status as presuppositions that meet the felicity condition in (14).

I argued above that this asymmetric view of presupposition use might translate to an asymmetric view of the *acquisition* of presuppositions, where the categorical principle is figured out before the repair strategy is mastered. The experimental findings in this chapter, taken together with those in the previous one, offer support for such an asymmetry. Results from the previous chapter demonstrate that children show the same biases as adults in having a default expectation that presuppositions express common ground information. That

is, whatever principle is at work in adult grammar that leads to this bias, children by age 4 have acquired this principle. However, children do not make the same assumptions as adults when it comes to informative presuppositions: even in environments where adults let go of their bias to treat presuppositions as needing to be common knowledge, children are hesitant to do the same. Before the age of 6, children were split between the two listeners in the critical condition, which suggests that they do not yet know that the principle governing presupposition can be violated and these violations repaired.

Could these findings be explained by any of the alternative theories? Consider first Gazdar's consistency account, which imposes the weakest requirement on presupposition use among all of the alternatives. The presupposed proposition in each of the critical item is compatible with the information states of both of the potential addressees (i.e. the ignorant and the knowledgeable addressees). Thus the choice of the addressee in the experiment, on this account, cannot hinge on the presuppositional component. The asserted content, in contrast, differentiates between the two addressees, as it is informative and thus felicitously uttered only to the ignorant one. Now, children's adult-like performance on the control conditions, even at the youngest age group, shows us that they are sensitive to the informativity requirement on assertions. If the choice of listener in the critical condition hinged solely on this aspect, we would not expect children's performance to differ so drastically between critical and control conditions at age 4. Thus, the developmental patterns do not have a straightforward explanation on this account.

On Soames's approach, the utterance of a presuppositional sentence is appropriate so long as the presupposed content can be taken to be uncontroversial, where uncontroversiality is defined disjunctively as follows (repeated from (11-b) above):

(15) A speaker S takes a proposition P to be uncontroversial at *t* (or, equivalently, takes P for granted at t) iff at *t*, S accepts P and thinks:

a. that P is already part of the conversational context at *t*; or

b. that the other members of the conversation are prepared to add P to the context without objection.

Recall that adult participants in this experiment chose the more ignorant addressee — i.e. one who does not share with the speaker the knowledge that the presupposition holds — in the critical condition. In these situations, the felicity of the relevant utterances rested on

condition (b) in (15). That is, adult participants who chose the ignorant listener believed that this listener was prepared to add the unmet presupposition to the context without objection.

Now, why do children fail to make the same assumptions? One possibility is that the ability to decide when a member of a conversation is "prepared to add P to the context without objection" is itself late-developing, requiring perhaps a lot more communicative experience and social-cognitive maturity than what a 4-year-old is equipped with. This idea offers a plausible explanation for the present results. The problem with this explanation is that it makes the wrong predictions elsewhere. Of particular relevance are the findings from Experiment 2B in the previous chapter. The critical sentences used were exactly the same as the experiment here; the two experiments differed only in that the choice of the knowledgeable listener was unproblematic in Chapter 2, Experiment 2B. With this difference in mind, suppose it is indeed the case that children get better as they get older at recognizing that some presuppositions will be added to the common ground by the listener without argument, and moreover, that a sentence like "The bird that I got flew away" falls in this category (after all, it is the kind of information that the speaker and only the speaker would be the authority on). If so, we not only expect that the rates of choosing the ignorant listener increase with age in the present experiment — an expectation that is met — we also expect a corresponding increase in ignorant-listener choices in Chapter 2, Experiment 2B. However, what we find in that experiment is the reverse trend: as children get older, they were *less* likely to the choose the ignorant listener. Thus, weakening of (1)/(14) in the terms proposed by Soames would also fail to cover the full developmental path of presuppositional as discussed in this and the previous chapter. [2]

Finally, consider the QUD approach (Simons 2001; Simons et al. 2010, 2016; Beaver et al. 2017). On these accounts. presuppositions fall under a broader umbrella of phenomena that share the property of being *not-at-issue*, i.e. not directly pertinent to the QUD. The speaker and hearer mutually agree on the QUD and both parties commit to resolving it. However, there are no further conditions mandating what additional or subsidiary

[2] A second possibility is that the two ways of being uncontroversial listed in (15) are inherently asymmetric, and the condition in (15-a) is more basic. After all, the most sure-fire way of ensuring uncontroversiality is to ensure that the relevant piece of information has already been accepted by the listener and added to the common ground. The developmental asymmetry may in turn be taken to reflect this. Note, however, that this would make Soames's approach a mere description of the facts — that speakers prefer to presuppose something when it is common ground, but they sometimes deviate from this — and empirically indistinguishable from the common ground + accommodation theory.

information, beyond what is necessary to resolve the QUD, the speaker is allowed to put forth.

Let us first consider how this approach might explain our adult data. Recall that when the uttered sentence was something like, "The bird that I got flew away", adults preferred a listener who did not already know that the speaker had a bird that flew away. One way to explain this behavior is as follows. The situation makes salient a very plausible QUD: "What happened since I last saw you?" This QUD will either be unacceptable or unresolved were the speaker addressing a listener who already knew that there was a bird and that it flew away. Consequently, this listener is not a viable option, and adults go for the ignorant listener. What might this account say about children nevertheless choosing the knowledgeable listener? One possibility is their difficulty lies in identifying the right QUD and in turn, what content is (not-)at-issue. But if this were the crucial deficit at the heart of their failures in this study, we should expect it to generalize to other similar environments. For example, we might expect to find similar problems identifying the right QUD, and similar confused behavior, in the studies reported in Chapter 2. In those experiments, however, children were uniformly successful. The selective nature of their difficulties in this experiment, therefore, fails to receive a straightforward explanation on a QUD-based account.

The upshot of this discussion is the following: approaches to presupposition that aim to develop a unified account of presupposition that treats informative and redundant presuppositions as having the same cognitive and theoretical status have no explanation for the fact that the two come apart in development. On the other hand, such a developmental asymmetry is consistent with the common ground theory, on which there are two independent systems, which may very well develop independently. The formal rule governing all presuppositions is that the use of a presupposition is appropriate only if it is already *presupposed* in the common ground. As already demonstrated in the previous chapter, children know this rule by atleast age 4. This rule is not always met in everyday conversation, because speakers exploit listeners' ability to accommodate presuppositions. Findings from the present chapter demonstrate that children initially do not have command of this system for accommodating presuppositions.

In the case of adults, when faced with a choice of violating the use conditions on assertion and presupposition, violation of the latter is preferred. Thus, they show a robust bias that in these circumstances, the use of presuppositions can be informative. Children's lack of a similar bias is telling. Initially, they seem to take the rule in (14) to be as inviolable

as the rule about informativity of assertion. Neither violation is tolerated, leading to the chance behavior observed. This suggests that the formal requirements associated with sentence — whether presupposition or assertion related — are privileged in the child grammar and moreover, placed on an equal plane.

3.6.3 Learning how to accommodate

We have thus identified a component of presupposition use where adults and children initially look strikingly different: the ability to handle informative presuppositions. Assuming at this point in our discussion that the common ground + accommodation theory is basically right, we are left with the question as to how children eventually become adult-like. I would like to suggest that the development of the skills needed to use and accommodate informative presuppositions is intimately linked to the development of aspects of social cognition. To see this more clearly, let us take a closer look at what the process entails.

To use and accommodate novel presuppositions, participants in a conversation must make rapid inferences about each other's beliefs, intentions, desires and goals. For example, the speaker must reason about whether or not the presupposition is likely to be accommodated by the listener, such that the context can be updated as needed for the conversation to proceed. The listener, who must shift to a new context to accommodate the speaker's utterance, must also make a decision about which candidate context c, among many possible contexts in which the utterance might be felicitous, the speaker is likely to have in mind. What is more, the necessary actions on the interlocutors' parts are inter-dependent: each person's best decision depends on what the other does, and vice versa. And, in the vast majority of cases, they must do all of this without explicit communication. Accommodation thus involves a situation in which multiple individuals have a common goal and must converge on one of multiple possible solutions to achieve this goal by relying solely on inferential and implicit assumptions about each other.

The task necessarily implicates sophisticated mentalizing and reasoning abilities. This type of ability to represent and reason about others' mental states is a central topic in developmental psychology, often referred to as 'Theory of Mind' (ToM). ToM is an umbrella term for a broad constellation of skills that include the ability to ascribe mental states of various flavors (e.g. beliefs, desires, goals, knowledge) to oneself and others, the ability to recognize the potential for discrepancies between one's own and others' mental states,

and the ability to reason about others' mental states to interpret and make predictions about behavior, a set of skills that show a steady progression between late infancy and 6 years of age (see Perner (1999) for a review). For instance, 18-month-olds show sensitivity to the intentions and goals of an agent (Meltzoff 1995), and understand that different agents may have different desires and preferences (Repacholi & Gopnik 1997). On the other hand, the ability to predict or explain behavior based on an agent's potentially false beliefs appears to a later acquired skill (Perner & Wimmer 1985; Perner 1991; Wellman, Cross & Watson 2001).

Clearly, very many of these skills are prerequisites for being able to deal with informative presupposition, and presupposition *simpliciter*. Necessary for *any* kind of presupposition use is the ability to represent another's belief states (which is a needed for modeling the common ground). The fact that children generally succeeded in our listener identification tasks (that is, so long as informative presuppositions are not involved) tells us that by 4, these abilities are stably in place. However, accommodation goes beyond this; it requires representing others' information states, integrating these representations with contextual and historical information and plausibility considerations, and reasoning about these representations to make a rational decision. The process may just be beyond the mentalizing capabilities of younger children, resulting in the observed delay in the mastery of informative presuppositions. The fact that over the course of approximately two years, children become proficient users of informative presupposition also fits in well with the timeline that developmental psychology has independently established for the maturation of more complex aspects of ToM.

The hypothesis that aspects of the acquisition of presupposition causally depend on the development of other components of the mind would benefit both from further development and refinement, and more empirical work. A pre-requisite for this, however, is a set of more nuanced and detailed theories on the relationship between aspects of language use and ToM than what is currently available. The mapping out of the developmental path of presupposition — or any other pragmatic phenomena, for that matter — must go hand-in-hand with the mapping out of the developmental path of the intellectual achievements in social cognition.

Chapter 4

Maximizing presuppositions

4.1 Introduction

The preceding chapters focused on one of the requirements presuppositional sentences impose on the conversational context: that the proposition presupposed be part of the common ground prior to assertion. We determined that at least by age 4, children are sensitive to this requirement, and in fact, less tolerant than adults of *prima facie* violations of it (i.e. informative presuppositions). Having thus shown that children have an understanding of the formal condition determining when speakers *can* use presuppositional sentences, we now turn to the question of whether they know when a speaker *must* use them.

Consider the sentences in (1)-(3). These sentences seem to impose the requirement that some proposition *not* be entailed by the conversational context — they *anti*-presuppose that proposition. For example, the sentence in (1) would be odd if used against a conversational background in which it has already been established that a single woman attended the party.

(1) A woman that attended the party is an MIT graduate.
Anti-presupposes that there is exactly one woman that attended the party

(2) All of her children are MIT graduates.
Anti-presupposes that she has exactly two children

(3) Dana thinks that MIT has a swimming requirement.
Anti-presupposes that MIT has a swimming requirement

Compare these structures to the *presuppositional* variants in (4)-(6).

(4) The woman that attended the party is an MIT graduate.
Presupposes that there is exactly one woman that attended the party

(5) Both of her children are MIT graduates.
Presupposes that she has exactly two children

(6) Dana knows that MIT has a swimming requirement.
Presupposes that MIT has a swimming requirement

The sentences in (4)-(6) presuppose precisely what their counterparts in (1)-(3) anti- presuppose. In this regard, the two variants seem to be in complementary distribution. Sentences like (1)-(3) seem to be designed for contexts in which sentences in (4)-(6) would be ill-formed, and vice versa. Are the two types of effects computed by the same kind of process, then? That is, analogously to how the formal properties of presuppositional sentences lead to restrictions on the contexts in which they can be used, formal properties of sentences like (1)-(3) may lead to other types of restrictions on the contexts in which they can be used.

A closer examination of the phenomenon shows otherwise. If e.g. (4) requires uniqueness of the woman who attended the party and (1) requires non-uniqueness, neither would be appropriate for use whenever the number of female attendees at the party has not yet been established. However, our intuitions tell us that (1) would be used in such circumstances. It is now generally thought that the anti-presuppositional requirements imposed by (1)-(3) arise due to competition with the variants in (4)-(6) (Hawkins 1991; Heim 1991; Sauerland 2003; Percus 2006). In cases where e.g. (1) is unusable, this is because it is blocked by the possibility of using (4).

The empirical generalization, then, is that we avoid making claims based on structures with *a, all,* and *think* in situations where we can felicitously make claims based on parallel structures with *the, both,* and *know*. The part of the grammar that determines anti-presuppositional constraints does not merely look at a single structure (the one that is tied to an anti-presupposition), but compares that structure with a competitor and determines its usability based on the felicity of that competitor. What is the principle of grammar that leads to such effects? A standard answer, due to Heim (1991), is that a principle, *Maximize Presupposition!* (MP henceforth), is responsible. Informally, MP dictates that in conversational situations where two competing sentences are both in principle felicitous

and both would effect the same change upon the context, one must use the sentence that carries the stronger presupposition. On the assumption that cooperative speakers abide by this principle, use of the presuppositionally weaker variant licenses the inference that the presuppositionally stronger sentence is not usable in the context. This inference is, in effect, the anti-presupposition triggered by the weaker sentence, as exemplified by (1)-(3).

In this chapter, we ask whether children are sensitive to the anti-presuppositional requirements imposed by sentences like (1)-(3), and in doing so, probe their underlying knowledge of MP. While anti-presuppositional requirements are not computed in the same fashion as those imposed by presuppositions, knowledge of the latter is a pre-requisite for deriving anti-presuppositions. In order to assess the appropriateness of a presuppositionally weaker sentence in a given context, one must establish whether that context would make the presuppositionally stronger competitor felicitous. In this regard, the ability to compute anti-presuppositions is a more sophisticated skill, and a natural next step in our investigations into children's developing abilities with presupposition use. A pair of studies explore the following questions: (*i*) Do preschool-aged children avoid producing presuppositionally weaker structures when a stronger competitor is felicitous and would convey the same new information? (*ii*) Do they judge as more appropriate those structures that carry stronger presuppositions compared to an otherwise equivalent parallel structure?

As before, I use two different presupposition triggers (and their presuppositionally weaker competitors) to probe children's knowledge of MP: *both* (vs. *all*) and *another* (vs. *a*). As we have already seen, adult speakers show a preference for *both* over *all* in a situation where it is clear that the cardinality of the quantificational domain is exactly two. Similarly, adults show a preference for *another* over *a* when the context makes salient some other entity that satisfies the restrictor NP. As we will see shortly, both types of effects may be derived via MP-based competition. A child who knows MP and the meanings of the relevant expressions should show an adult-like preference for the presuppositionally stronger variant whenever it is felicitous. Moreover, modulo differences in lexical-semantic knowledge, application of MP should be uniform across the two types of test environments. Our results, however, reveal an unexpected asymmetry: children show a reliable preference for *another* when its presuppositions are met; however, they show no such preference for *both* over *all* in contexts where adults strongly prefer *both*. I take the non-uniformity in developmental trajectories to signal non-uniformity in the underlying phenomena. Specifically, I argue that unlike *all*, oddity of which can be attributed to an anti-presupposition, the odd-

ness of *a* in certain environments does not arise from MP-competition with *another*. Given this, children's behavior with *both/all*, the genuine indicator of competence with MP, leads to the conclusion that MP is not yet stably in place in preschool-aged children.

4.2 Background

4.2.1 Theoretical background

MP forces a speaker to use the structure associated with the strongest presuppositions compatible with the conversational context. The principle was originally proposed by Heim (1991) to account for speakers' preference for the definite article over the indefinite in certain circumstances, e.g. (7).

(7) *Context: We know that there is a unique sun*

a. The sun is shining.

b. #A sun is shining.

The definite article, unlike the indefinite, presupposes the existence of a unique referent. Whenever a sentence containing the definite, as in (7-a), is true and felicitous, a parallel sentence with the indefinite, as in (7-b), will be just as truthful a description of the relevant state of affairs — that is, the two sentences are equally informative. Nevertheless, replacing the definite with the indefinite leads to infelicity. MP explains this infelicity as the result of failing to abide by the conversational maxim to presuppose as much as possible. The principle has since been developed and refined (see e.g. Sauerland 2003, Percus 2006). For the moment, I adopt a fairly standard characterization of MP, with the following properties.

Following Percus (2006), I take MP to be triggered by *lexical items*, which have a predetermined set of presuppositional alternatives, e.g. {*the, a*}, {*both, all*}, {*know, believe*}. MP-competitors for a structure S are those structures S' obtained by replacing one or more lexical item in S with its presuppositional alternatives. (This assumption will be revised later.) Additionally, MP is assumed to compare structures that are contextually equivalent, i.e. they contribute the same amount of new information relative to the context. Contextual equivalence is defined as in (8), following Schlenker (2012).

(8) *Contextual Equivalence*

Let ϕ and ψ be two sentences whose presuppositions are satisfied in the context c. ϕ and ψ are contextually equivalent relative to c if the following holds:
$\{w \in c: \phi \text{ is true in } w\} = \{w \in c: \psi \text{ is true in } w\}$

An argument for *contextual* equivalence, rather than e.g. context-independent equivalence of non-presuppositional content, comes from MP-competition between *think* and *know*. As has been discussed at length in the philosophical and linguistic literature, there is more to the meaning of *know* than the doxastic entailment it shares with *think* and the factive presupposition. The belief must be justified to count as 'knowledge'. This means that the assertive contributions of *know* and *think* are not the same. Schlenker (2012) points out that only when *think* and *know* can be assumed to nevertheless have the same assertive component *in the context* does MP apply. Thus we have the contrast in (9).

(9) a. *Context: Speaker is talking to a friend*
John believes that I have a sister.
$\rightsquigarrow$Anti-presupposition: It's not the case that the speaker has a sister

b. *Context: A defendant is talking to a journalist*
My lawyer believes that I am innocent.
$\rightsquigarrow$Absent anti-presupposition: It's not the case that the speaker is innocent

In the context in (9-b), it is not reasonable to assume that someone's belief of the defendant's innocence is justified, even if happens to be true. In other words, the assertive contribution of the sentences *My lawyer believes that I am innocent* and *My lawyer knows that I am innocent* cannot be taken to be the same in this context. In turn, MP does not apply.

Finally, among contextually-equivalent structures that are competitors for MP, i.e. those derived via substitution of presuppositional alternatives, MP demands that the speaker choose the one carrying the strongest presuppositions. Presuppositional strength, in turn, can be defined as in (10). A sentence is presuppositionally stronger than another if it is undefined (or receives a stigmatized third-value) at more worlds.

(10) *Presuppositional Strength*

ϕ is presuppositionally stronger than ψ iff $\{w: \psi(w) = \#\} \subset \{w: \phi(w) = \#\}$

These assumptions are summarized more succinctly in (11).[1]

(11) For two sentences ϕ and ψ whose presuppositions are satisfied in a context c:

(i) If ϕ and ψ are competitors for MP, and

(ii) ϕ and ψ are contextually equivalent relative to c, and

(iii) ϕ carries stronger presuppositions than ψ, then

ϕ should be preferred to ψ in c

We now have the necessary ingredients to derive the infelicity of the indefinite in (7). By stipulation, *the* and *a* are presuppositional alternatives. Parallel structures involving the definite and indefinite articles thus compete for MP. Since the sentence with the definite entails the corresponding indefinite sentence, whenever the presuppositions of the definite are met, the two sentences will be true in all the same worlds. Contextual equivalence is thus met. Finally, the sentence with the definite is presuppositionally stronger than the indefinite variant, by the definition of presuppositional strength above: the indefinite presupposes

[1] I am taking several simplifying steps here. While the complicating factors are not relevant for present purposes, they are worth noting. For instance, I am characterizing MP as a global constraint, operative at the root, but as Percus (2006) first observed, this cannot be; MP-effects arise even when globally, the two competitors have the same presuppositions (i). These types of data suggest that competition for MP must be allowed to take place sub-sententially, perhaps at each local context (Singh 2011).

(i) a. If John has exactly two students and he assigned the same exercise to both of his students, then I'm sure he will be happy.

b. #If John has exactly two students and he assigned the same exercise to all of his students, then I'm sure he will be happy.

Our assumptions about about presuppositional strength in (*iii*) of (11) also likely need emendation. As mentioned earlier, Marty (2017) shows that formal alternatives of a sentence with logically independent presuppositions also enter into competition for MP. To illustrate, consider the pair in (ii). Intuitively, (ii-b) is odd because it suggests that the speaker does not believe that Sue has a unique mother, although this information is common knowledge. However, the uniqueness presupposition of (ii-a) is not logically stronger than the presupposition of (ii-b), which is that Sue has a unique mother who speaks German.

(ii) a. Sue's mother arrived. $\rightsquigarrow$Presupposition: Sue has exactly one mother.

b. #Sue's mother who speaks German arrived.
$\rightsquigarrow$Presupposition: Sue has exactly one mother who speaks German.
$\rightsquigarrow$?Anti-presupposition: It's not the case that Sue has exactly one mother.

Marty (2017) take these data to suggest that the generation of MP-effects is not restricted to presuppositionally stronger alternatives; rather, MP can in fact be activated by any alternative whose presuppositions are logically non-weaker than the uttered sentence.

nothing, so the set of worlds in which an indefinite-sentence receives the third-value is the null set, which is a subset of the worlds in which the definite counterpart is #. We are required by MP, then, to use the structure with the definite in contexts like in (7) where it is usable.

Beyond the definite/indefinite competition and the other cases we have already seen, MP has been invoked to explain a number of grammatical phenomena including the multiplicity inference of plurals (Sauerland 2005b, 2008) (12), person feature preferences with pronouns (Heim 2008) (13), the obligatoriness of additive particles (Amsili & Beyssade 2009; Chemla 2008; Singh 2011) (14).

(12) *Context: The speaker has exactly one child*

a. I am going to bring my child to the party.

b. #I am going to bring my children to the party.

(13) *Speaker points to herself*

a. I am a linguist.

b. #She is a linguist.

(14) Dana came to the party.

a. Sue did, too.

b. #Sue did.

At the same time, there have been debates about whether an MP-based analysis is right for these types of phenomena. It has been argued, for example, that the multiplicity inference in plurals is an implicature and not an anti-presupposition (Spector 2007, a.o.). The additive and additive-less variants in (14) have been argued not to compete in the first place. Instead, the obligatoriness of the additive is taken to be a rescue mechanism to circumvent unwanted exhaustivity implicatures that would arise otherwise (Bade 2016). Such debates highlight the difficulty of ascertaining what is and isn't a genuine MP-effect. The lack of clarity comes from the fact there are no independent criteria to help us diagnose an MP-effect. For the most part, we are left to reason based on the availability of a presuppositionally stronger sentence and the oddness of a weaker one in contexts supporting the stronger sentence. As we will see later on, some of the initial commitments in this chapter about MP-competition environments will need revising, in part motivated by our experimental findings. Given this

state of affairs, the present investigation should be seen as having two parallel aims: first, to investigate the developmental trajectory of MP as a principle governing utterance choice, and second, to use the developmental trajectory as an independent gauge for determining what is and isn't an MP-effect.

4.2.2 Developmental background

Very little is presently known about the actual developmental trajectory of MP. To my knowledge, the first discussion of the principle as relates to acquisition is found in Wexler (2003), where the author makes a case that MP is place in child grammar early based on patterns of errors in children's article use. The main thrust of his argument is the following. Young children over-produce the singular definite article when its uniqueness presupposition is not met in the context of utterance (see discussion in Chapter 2). Crucially, children do not over-produce the definite when existence of a referent is not already taken for granted, and moreover, they do not ever over-produce contextually equivalent indefinites. Wexler takes these patterns as evidence that: (*i*) children do not initially treat the definite article as encoding a uniqueness presupposition, although they know it comes with an existence presupposition, and (*ii*) their knowledge of MP ensures that whenever the context supports the existence presupposition, children will prefer the definite over the indefinite.

In comprehension studies, however, children do not always behave as if they have full command of MP. There have been two studies thus far that examine MP-effects in comprehension. Yatsushiro (2008) examined the acquisition of the German universal quantifier *jeder* 'every', which is taken to trigger a non-uniqueness inference by competition with *der* 'the'. In the study, 6-to-9-year-old children were first introduced to a scenario and a character in the scene who is depicted to be saying something (by means of a speech bubble). The task was to evaluate whether or not a given utterance can be something that the character would say in the relevant situation. In the MP condition, the child was shown a situation where it is established that the character has a unique mother, and asked whether a sentence like (15) would be appropriate for him to say.

(15) Jeder Mutter von mir sitzt hier auf einem Stuhl.
every mother of mine sits here on a chair
'Every mother of mine is sitting on a chair here.'

Adults rejected this sentence 90% of the time, whereas 6-year-olds rejected it only 34% of the time. From these results, the author concludes that anti-presuppositional effects are mastered late in development. It is important to note, however, that calculation of MP-effects in this study relied on a differential presupposition of uniqueness between *jeder* and *der*. If Wexler's (2003) proposal is correct that children initially don't associate the definite article with a uniqueness presupposition, the non-adult performance here could be due to a non-adult semantics for the definite article, rather than a lack of MP.

A second study by Legendre, Barriere, Goyet & Nazzi (2011) tested a much younger age group — 30-month-olds — on their comprehension of French personal pronouns. It has been claimed that 1st and 2nd pronouns encode the relevant person features as presuppositions. By contrast, 3rd person pronouns do not encode person as a lexical presupposition; rather, the relevant inference comes about as an anti-presupposition, via competition with the presuppositionally stronger 1st/2nd pronouns (Sauerland 2008). Legendre and colleagues found that 30-month-olds had more difficulties comprehending 3rd-person pronouns than 1st/2nd, which they took to indicate that anti-presuppositional effects are mastered later than lexically encoded presuppositions.

The disparity in age-ranges across the two studies discussed above and possible acquisition problems with the specific expressions tested makes it difficult to ascertain what the findings mean in relation to the development of MP. If we put aside this issue, a tentative conclusion we might draw from these studies may be that children have difficulties with MP. But Wexler's observations about children's apparent adherence to MP in their article production would still require an explanation. Thus, while these studies lay the groundwork for work on the acquisition of MP, the core questions still remain open.

4.2.3 Test environments

As mentioned above, beyond the core cases, identifying environments where MP is at play is non-trivial. Investigating children's knowledge of MP-effects comes with a further challenge: we cannot take for granted that children have learned the adult-like lexical meanings for expressions involved, a precondition for being able to apply MP in an adult-like way. For instance, although MP is most frequently discussed in relation to the competition between *the* and *a*, this would be a less-than-ideal environment to test children's knowledge of MP if Wexler is right that their representation of *the* is non-adult. The present studies,

therefore, employ expressions for which similar patterns of non-adult use have not been observed. Specifically, we look at competition between *both* and *all* and between *another* and *a*, expressions which are produced early and in a more or less adult-like manner. Comprehension studies provide further evidence that these expressions are acquired at least by the early preschool years (see Brooks & Braine (1996); Hurewitz, Papafragou, Gleitman & Gelman (2006) for comprehension evidence on *all*; Barner, Chow & Yang (2009); Tieu (2015) for evidence regarding *all* and *both*; Modyanova (2009) for *another* and *a*).

Before turning to the experiments, let us consider in more detail how the anti- presuppositional effects in question arise. I begin with *both* and *all*. In circumstances where *both* is felicitous, *all* is odd:

(16) a. I broke both of my legs.
b. #I broke all of my legs.

I assume a fairly standard analysis of *both* and *all* as universal quantifiers, where the crucial difference between the two lies in the fact that *both* carries a duality presupposition. Lexical entries for the two quantifiers are given in (17); the differential presupposition is underlined.

(17) a. $[\![both]\!] = \lambda P_{\langle e,t\rangle}$: $\underline{|P| = 2}$. $\lambda Q_{\langle e,t\rangle}$. $\forall y[P(y) \rightarrow Q(y)]$
b. $[\![all]\!] = \lambda P_{\langle e,t\rangle}$. $\lambda Q_{\langle e,t\rangle}$. $\forall y[P(y) \rightarrow Q(y)]$

Given these lexical entries and the particular formalization of MP above, repeated in (18), the oddness of the *all*-statement in (16-b) can be derived as resulting from competition.

(18) For two sentences ϕ and ψ whose presuppositions are satisfied in a context c:
(i) If ϕ and ψ are competitors for MP, and
(ii) ϕ and ψ are contextually equivalent relative to c, and
(iii) ϕ carries stronger presuppositions than ψ, then

ϕ should be preferred to ψ in c

Our world knowledge tells us that humans have two legs. In most normal contexts, the presupposition of (16-a) will be met. The presuppositions of *all* are trivially met, as the expression, on the definition above, is presupposition-less. Once you make the assumption that *both* and *all* are presuppositional alternatives, the pair of structures will be competitors:

they differ only with respect to the choice of the quantifier. In other words, condition (i) of (18) is met. The condition in (ii) regarding contextual equivalence is also met. On the lexical entries above, *both* and *all* are Strawson-equivalent. That is, it is impossible for a sentence with one to be true and an otherwise identical sentence with the other be false (rather than undefined). Thus, whenever the presupposition of *both* is met, the two sentences will convey the same new information.[2] Because the *both*-variant carries stronger presuppositions than the *all* counterpart, MP demands that (16-a) should be preferred to (16-b).

Let us now turn to *another* vs. *a*. In contexts like in (19) where *another* is felicitous, the plain indefinite *a* is odd:

(19) I had a coffee.

a. Then I had another coffee.

b. #Then I had a coffee.

The entries for the two expressions are given in (20). I assume that both *a* and *another* are indefinites that denote existential quantifiers. As suggested by its morphological make-up, *another* is taken to be composed of the indefinite *an*, plus the expression *other*, which contributes its presupposition. This presupposition is anaphoric: *another P Q* requires that the context makes salient an antecedent that is P. This anaphoricity is represented by means of a referential index *i* on *other*. The second contribution of *other*, at the level of assertion, is the removal from the domain of quantification the witness of the presupposition.

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[2]Many analyses of *both* assume further that it is strongly distributive, unlike *all* (Ladusaw 1982; Roberts 1987; Landman 1989). Thus, unlike *all*, *both* is unhappy in collective environments (i).

(i) a. All of the students work well together.
b. #Both of the students work well together.

One way of capturing this contrast might be to hard-wire distributivity into the meaning of *both*, as in (ii). An alternative would be to say that *both*, unlike *all*, obligatorily selects for an operator DIST, which contributes distributivity.

(ii) [[*both* P Q]] presupposes that there are exactly two individuals that are P
When its presupposition is true, [[*both* P Q]] = 1 iff $\forall y[P(y) \wedge atom(y) \rightarrow Q(y)]$

Either way, if distributivity is always a contribution of a sentence involving *both*, there will be some states of affairs where contextual equivalence between *both* and *all* sentences will not be met. While this is important to keep in mind, it will not matter for present purposes: the experimental scenarios are set-up in a way such that the two competitors would be contextually equivalent.

(20) a. $[\![an[other_i]]\!]^g = \lambda P_{\langle e,t\rangle}$: $\underline{P(g(i))}$. $\lambda Q_{\langle e,t\rangle}$. $\exists y[y \neq g(i) \wedge P(y) \wedge Q(y)]$

b. $[\![a]\!]^g = \lambda P_{\langle e,t\rangle}$. $\lambda Q_{\langle e,t\rangle}$. $\exists y[P(y) \wedge Q(y)]$

This latter component means that the two expressions differ also in their truth-conditions. In a situation where I met with the same student, say Mary, in the morning and in the evening and I met with no other student, a sentence like in (21-a) below would be true, but (21-b) would be false. This is because the domain of quantification for *another* is strictly smaller than that of *a*. The utterance of the first sentence makes salient an entity, Mary, who is a student that I met with in the morning, and the contextually-supplied assignment function would map the index on *other* to Mary. Mary would, in turn, be excluded from the domain of quantification of *another*.

(21) I met with a student in the morning.

a. I met with a student in the evening.

b. I met with another student in the evening.

Because of the truth-conditional difference between *a* and *another*, there will be circumstances where parallel structures involving the two expressions do not compete for MP. However, in special cases, the possibility of the claim being about the same individual as before, as in (21), is independently ruled out. For instance, consumption predicates like *have coffee* (20) can be true of an individual only once. In such circumstances, *a* and *another* are contextually equivalent and MP-competition becomes visible.

Here is how one might derive the oddness of (19-b) based on competition with (19-a). The speaker's preceding utterance that they had a coffee ensures that the presupposition of *another* is satisfied: an individual *x* such that *x* is a coffee, namely the witness of the preceding existential claim, is made contextually salient. The plain indefinite is presuppositionless, so its presuppositions are trivially satisfied. By stipulation, *a* and *another* are presuppositional alternatives, making (19-b) and (19-a) competitors, satisfying condition (i) of (18). Whenever the presupposition of *another* is met, and it is common knowledge that the VP cannot be true of the same individual in the domain of quantification twice, *another P Q* and *a P Q* convey the same information: that there is a coffee different from the one consumed before such that the speaker had that coffee. Condition (ii) of (18) is also met. The sentence in (19-a) is presuppositionally stronger than (19-b), so MP requires the use of

another-good over (19-b). In the experiments that follow, we will restrict our attention to environments where contextual equivalence between *a* and *another* obtains.

We now turn to the experiments. I examine the competition between *both* and *all* in §4.3. Competition between *another* and *a* will be the focus of §4.4.

4.3 Both vs. all

4.3.1 Experiment 1A: Elicited Production

Experiment 1A examines whether children use knowledge of MP to avoid using *all* when *both* is usable. We use an Elicited Production Task, where the dependent measure is a free-form response elicited in carefully controlled contexts. The elicitation prompts were preceded by brief stories involving interactions between two characters, A and B, about various foodstuff. For example, the topic of conversation may be the cupcakes that A brought for a snack. B leaves for a little while, during which time A eats the entirety of the set of cupcakes. B returns and asks A what happened to the cupcakes. Participants are tasked with stating how A will respond. Suppose A had exactly two cupcakes. In this situation, A might say "I ate both of the cupcakes", but not "I ate all of the cupcakes". On the other hand, if A had three cupcakes, the opposite is the case: "I ate all of the cupcakes" is now a licensed response, but the variant with *both* is not.

The elicited production task was chosen for two reasons. First, a child's ability to plan and produce an utterance is a direct indicator of her grammatical competence. Second, unlike tasks that require judgments of truth or acceptability of someone else's statement, the elicited production environment is a natural and familiar one to most children. As such, the task is suitable for young children who may have task-related trouble with judgment tasks.

The main downside to the task, however, is that there are many more degrees of freedom. That is, there might not be a scenario or context that is *uniquely* appropriate for the construction or phenomenon of interest. For instance, in the scenario sketched above, there is a range of possible utterances that could felicitously describe what A did with the cupcakes. We address this potential worry in two ways. First, to delimit the space of possible responses, there was always an explicit prompt question. For instance, B might ask A: "Which of your two/three cupcakes did you eat?". Second, the target expressions (*both* or

all) were mentioned in the preceding stories to prime the use of the quantifiers of interest. With child participants, the validity of this methodological move rests on a crucial assumption: that such priming has a facilitative effect if and only if the child can give a syntactic and semantic representation for the form in question. Priming effects have been observed with preschool-aged children in a variety of environments in previous research (Huttenlocher, Vasilyeva & Shimpi 2004; Savage, Lieven, Theakston & Tomasello 2006; Thothathiri & Snedeker 2008; Rowland, Chang, Ambridge, Pine & Lieven 2012). Moreover, a long line of research using imitation paradigms tells us that children repeat morpho-syntactic forms (see Lust, Chien, Chiang & Eisele (1996) and references therein) and lexical items (Kidd, Lieven & Tomasello 2006) only when they are capable of giving grammatical/semantic representations for them. Given these findings, we expect the manipulation in our task to facilitate, but not artificially inflate, the rate of quantifier responses by children. Despite these measures, there is likely still a range of allowed responses. Given this, the directly interpretable measure in this study will be the *difference* between rates of using *both* vs. *all*, and not whether they are used in the first place.

Participants

Participants in Experiment 1 were forty adults and thirty-eight 3-to-5-year-olds. Adults were recruited via Amazon Mechanical Turk. Children were recruited from preschools and museums in the Boston area. English was the dominant language for all participants. The aim in testing adults was to establish baselines. As mentioned earlier, the elicited production method is one where the form of the response is often underdetermined by the context. Since our main focus is on the relative rates of productions of *all* vs. *both* by children, it is important to have an estimate of the rates at which adults use these quantifiers in the relevant environments.

Materials and procedure

Both populations saw items belonging to two experimental conditions. The critical condition probed sensitivity to MP: it was made clear in the context that the presuppositions of the stronger alternative — *both* — was met, and therefore, its use was made obligatory by MP. The aim of the control condition was to assess knowledge of the lexical meaning of the relevant expressions. The cardinality presupposition of *both* was satisfied in the con-

trol scenarios, so a participant who knows the meaning of *both* should never use it in this condition.

Adults saw all experimental materials in written form on a computer screen. The elicited production method was adapted for adults by turning it into a "Fill-in-the-blanks" task. Participants first read brief scenarios as the one described earlier in §4.1. The last sentence in each scenario was a question posed by the second character (e.g. "Which of your two/three cupcakes did you eat?"). After reading the scenarios, participants clicked through to a second display with the prompt, "How did A respond?" followed by a partial response plus a blank, e.g. "I ate _____." Participants were asked to fill in the blank using the information they had gathered reading the preceding scenario. Sample scenarios for each condition are provided in Table 4.3.1. Each participant saw 8 items per condition and 16 filler items, in fully randomized order. There was a unique correct response for the filler items, as shown by the example item in (22). Accuracy on fillers was used as an exclusion criteria; this resulted in the exclusion of 1 participant whose accuracy rates was below 60%.

(22) **Example filler**
Seth and Sally were cooking together for a potluck and they made a pasta salad. Seth then left to go to the gym, but Sally continued with the cooking. She decided to make a quiche, too. Later on when Seth came home, he asked her: "What did you make while I was away?"
How did Sally respond?
I made _____. **Expected Response:** a quiche.

The child variant of the task was similar in structure and logic to the adult experiment. However, we made certain design modifications to ensure that the task was accessible to children as young as 3 years of age. First, the stories were narrated to the child participant by the experiment; they responded orally, as well. Second, there were fewer items in each condition: each child saw 3 items per condition, plus 3 fillers. Finally, we used a blocked design, where children saw each trials in each condition in a homogeneous block. We created two such blocked lists varying in order of presentation of the experimental conditions. In the "Critical-1st" Order, the critical condition appeared first, followed eventually by the control; in the "Control-1st" Order, the order was reversed. In both orders, the two experimental conditions were separated by a block of filler items.

Children were told that they were going to listen to some stories with the experimenter,

Table 4.1: Conditions, Adults

Condition	Scenario	Question	Expected Response
Critical	Lucy and Byron were shopping together. Lucy planned to buy a dress and showed Byron two dresses she really liked, a black one and a red one. Then Byron had to head home early, so he left Lucy at the store. After he left, Lucy decided to get both of the dresses. The next day, she saw Byron and he asked: "Which of the two dresses did you buy?"	How did Lucy respond? I bought _____.	 both of them
Control	Jack and Stella were at a bakery buying dessert for a party. Jack showed Stella three pies he really liked, an apple pie, a pecan pie and a pumpkin pie. Then, Stella got called into work and left Jack at the bakery. After she left, Jack ended up buying all of the pies. Later that day, Stella came home and asked him: "Which of the three pies did you buy?"	How did Jack respond? I bought _____.	 all of them

and tasked with helping the experimenter when she got stuck in telling the stories. All of the stories revolved around a Hungry Hippo and his various animal friends. In each story, Hippo tells a friend about the snack he brought with him, which may involve two or three of some type of foodstuff, and after the friend leaves, eats everything he had brought. Later, the character returns and asks Hippo a question of the form: "Which of your two/three NPs did you eat?" The child is then prompted with, "What did Hippo say then?". Examples of critical and control items are given in Table 4.3.1. The filler items involved situations where neither *both* nor *all* would be appropriate; an example is given in (23).

Table 4.2: Conditions, Children

Condition	Scenario	Expected Response
Critical	Hippo and Raccoon were playing together, but then Hippo got hungry. He told Raccoon, "I'm going to have a snack now" and showed him what he brought. He had brought some apples! Racoon said, "Have a good snack" and he went home. After Raccoon left, Hippo couldn't decide which apple to eat, so he decided to eat both of them. Later on Raccoon came back and asked Hippo, "Which of your two apples did you eat?" What did Hippo say to Raccoon?	I ate both of them
Control	Hippo and Penguin were playing together, but then Hippo got hungry. He told Penguin, "I'm going to have a snack now" and showed him what he brought. He had brought some donuts! Penguin said, "Have a good snack" and she went home. After Penguin left, Hippo couldn't decide which donut to eat, so he decided to eat all of them. Later on Penguin came back and asked Hippo, "Which of your three donuts did you eat?" What did Hippo say to Penguin?	I ate all of them

(23) **Example filler**
In this story, Hippo was playing with Tiger, but then Tiger got a tummy-ache and he said, "I need to go home and rest". After Tiger left, Hippo decided to have a snack. But his lunch-box was empty, oh no! But then, Hippo got very lucky because he spotted an ice cream truck! He got an ice cream from the ice cream truck and ate it right up. Later on Tiger was feeling better so he came back. He asked Hippo, "What did you do while I was gone?" What did Hippo say to Tiger?
Expected Response: I ate an ice cream.

Results

Participants' responses in the experimental conditions were categorized into one of three response types: "quantifier" (responses involving *both* or *all*), "conjunction", and "other"

(includes no-response as well as those involving bare plurals or indefinites). In addition, responses were coded for whether or not they matched the expected response. Thus, if the participant produced a statement with *both* in the critical condition, that response would be categorized as a "quantifier" response and coded as a match. If they produced an *all*-statement in the control condition, that would also be considered "quantifier" response that was a match to our expectations. However, if a participant produced *all* in the critical condition, that would be categorized as a "quantifier" response but not as a match to the expected response. All other types of responses, even when potentially felicitous, were coded as not a match.

Figure 4-1 and Figure 4-2 plot the proportions of the different response types in each condition for adults and children respectively. We see that while both populations preferred responses involving quantifiers, these were not the only types of responses produced. The other major response category involved a conjunctive statement. For instance, for the critical scenario in 4.3.1, a participant may respond: "I ate a red apple and a green apple". Crucially, the proportions of quantifier-responses vs. conjunction-responses did not vary across condition for either group. This was analyzed using a chi-squared test of homogeneity, which compared the distribution of response types across condition. There was no significant difference in the distribution of responses between critical and control conditions for either group (χ^2=0.18, p=0.91 for adults; χ^2=4.22, p=0.14 for children).

Figure 4-1: Response Types by Condition, Adults

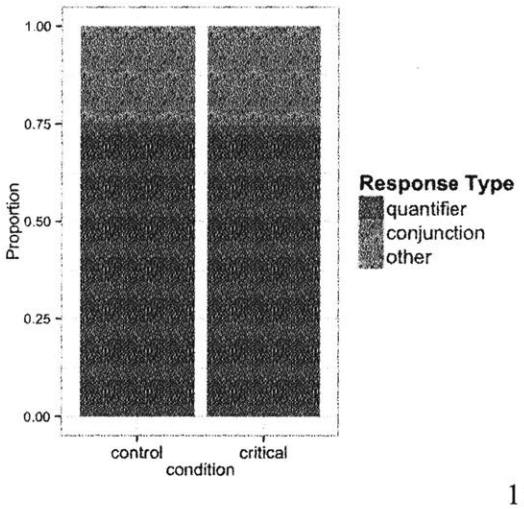


Figure 4-2: Response Types by Condition, Kids

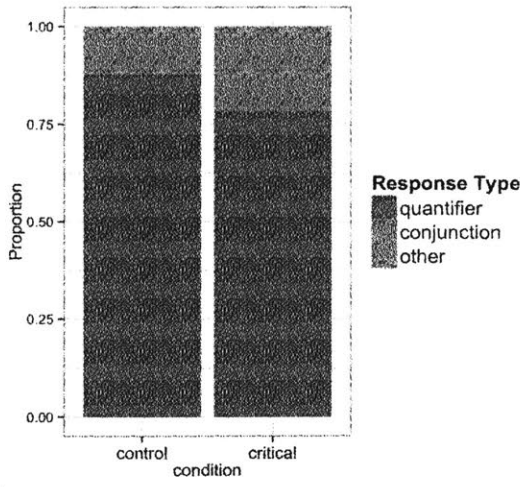


Figure 4-3 and Figure 4-4 plot rates at which participants responded in the expected manner in each condition. Recall that the expected response for the control condition was a description involving the quantifier *all*. For the critical condition, the expectation was a *both*-sentence. The majority of adult responses (Figure 4-3) matched the expected response. Most relevantly for our purposes, *both* was never produced in the control condition and *all* was never produced in the critical condition.

Figure 4-3: Expected Response Rates, Adults

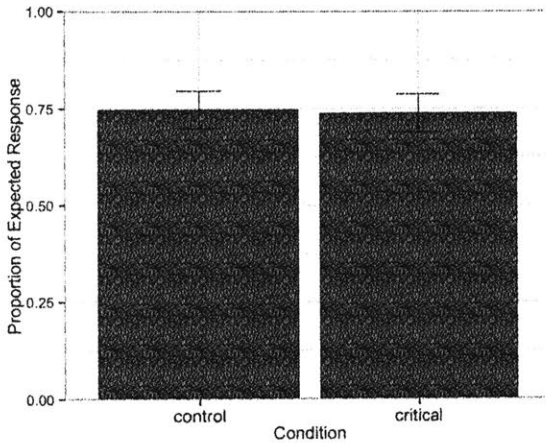
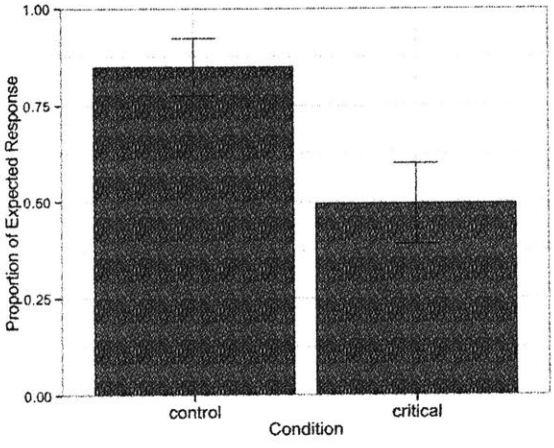
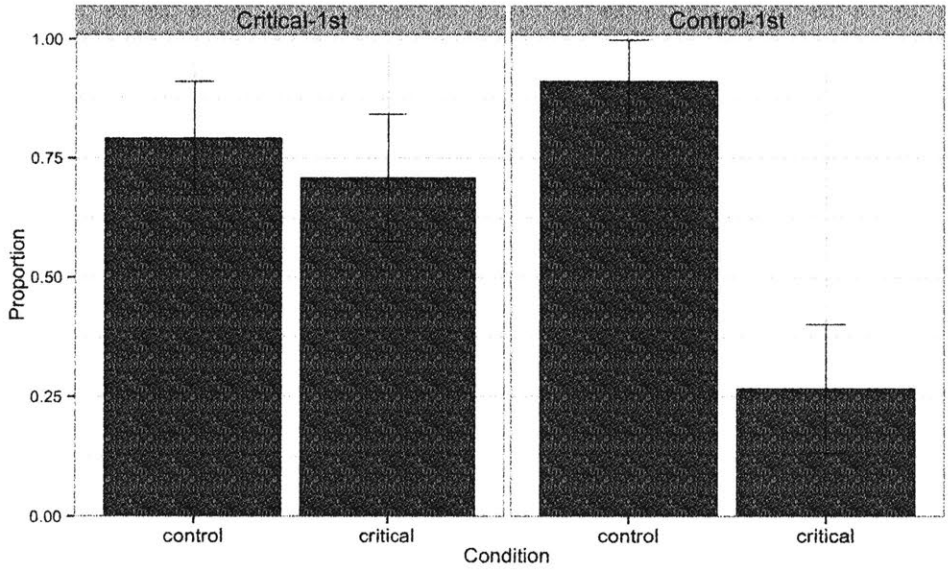


Figure 4-4: Expected Response Rates, Children



Children, like adults, responded as expected on the control condition. By contrast, they produced the expected response at a considerably lower rate in the critical condition (Figure 4-4). Moreover, as shown in Figures 4-5 and 4-6, the patterns of responses differed across the two orders. In the Critical-1st order, children produced *both* at a rate of 72%, which is comparable to the adult expected response rates. In contrast, in the Control-1st order, *both* was produced only at a rate of 32% in the critical condition. Instead, they produced *all* over half of the time. This over-production of *all* was specific to the Control-1st order. Though children in the Critical-1st order did sometimes erroneously produce *all* instead of *both*, this rate was negligible (<5%).

Figure 4-5: Children's Expected Response Rates, Split by Order



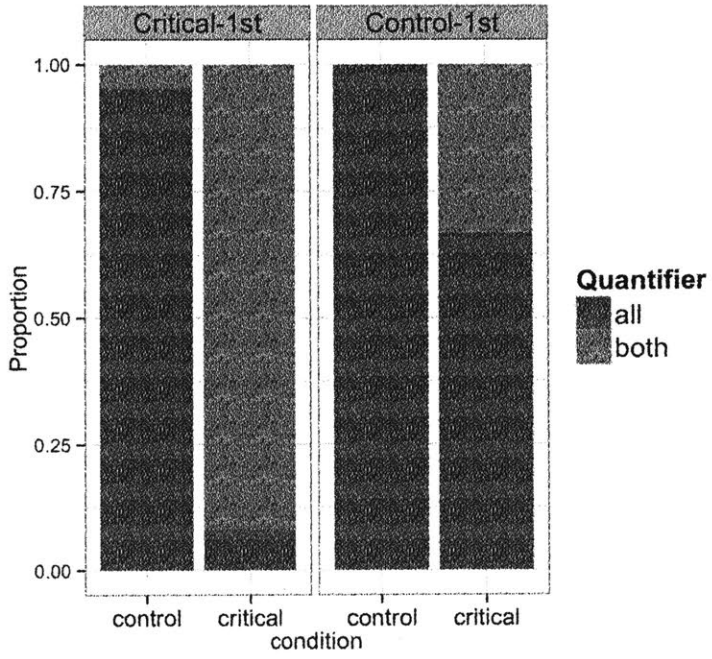
To analyze these trends statistically, we fit a pair of mixed-effects logistics regressions. The adult and child data were analyzed separately. We fit a model on the adult data predicting Expected Response Rate as a function of Condition, with random slopes for Participant and Item by Condition. Results from the analysis, summarized in Table 4.3, reveal no effect of condition on the rates of expected responses.

Table 4.3: Summary of statistical analysis, Experiment 1A, Adults

	β	SE	z	p
Intercept	2.25	0.60	3.73	<.001
Condition (Critical)	-0.12	0.46	-0.26	0.78

The model fit on the child data predicted Expected Response Rate as a function of Condition, Order and their interactions, with random slopes by Participant and random intercepts by Item (the maximal model with by-item random slopes did not converge). In addition, Age (in years and months; a continuous variable) was included as a covariate. Table 4.4 summarizes the results from this model. The interaction of Condition and Order was significant, with the odds of producing the expected response being much lower for

Figure 4-6: Children's Quantifier Responses by Order



critical items in the Control-1st order. We did not find a significant effect of Age: 5-year-olds were equally likely to over-produce *all* as 3-year-olds.

Table 4.4: Summary of statistical analysis, Experiment 1A, Children

	β	SE	z	p
Intercept	9.09	5.30	1.72	0.09
Condition (Critical)	-0.08	3.59	-0.02	0.98
Order (Control-1st)	0.82	3.31	0.25	0.80
Condition * Order	-19.51	5.50	-3.55	$< .001$
Age	0.97	1.27	0.76	0.45

Discussion

Besides the lexical choice between *both* and *all*, adults in this experiment did not behave differently across the two conditions. Though participants did not always respond using

a quantifier, when they did produce a quantifier response, their preferences were categorical — the quantifier chosen was always *all* in the control condition and *both* in the critical condition. The fact that adults do not use *both* in the control condition is unsurprising and indicates knowledge of the meaning of the quantifier — the duality presupposition of *both* makes the quantifier infelicitous in the control scenarios. The fact that they never use *all* shows us that adults not only abide by MP, but they do so seemingly without exception.

Children, however, diverge *asymmetrically* from adults. Though they were adult-like in the control condition, children did not reliably produce MP-compliant responses in the critical condition. Around half of their productions involved an *all*-sentence, even though *both* would have been acceptable and preferred. If *all* is blocked in *both*-environments via MP-competition, children's tolerance of the weaker expression gives first indication that they are not applying MP here in an adult-like way.

All else being equal, a lack of sensitivity to MP should lead to *both* and *all* being used interchangeably, each around half of the time. While the overall patterns are consistent with this expectation, our results are in fact richer: there is a significant interaction of Condition and Order. More specifically, children's non-adult uses of *all* varied across the two orders. In the Critical-1st order, children rarely over-used *all*, producing *both* at more or less adult-like rates. However, in the Control-1st order, *all* made up over half of the responses. It is likely that certain properties of our task are behind this order effect. Beyond the grammatical factors of relevance, there are at least two additional factors that could have influenced children's utterance choices. The first is the fact that the relevant quantifier was always primed in the corresponding stories. If this design choice had the intended effect, uses of the primed quantifier should have increased. The second is a more generalized tendency for young children to perseverate, i.e. continue to adopt in the same pattern of behavior across trials. This tendency may lead to an artificial inflation of certain response types, as the child may simply continue producing the same type of structures as they produced in the first trial. The order effect we observe could result from an interaction between the item-level priming effect and the experiment-level perseveration effect.

Let us consider how this interaction might play out. Starting with the Control-1st order, the first (relevant) trial they encounter is one where *all* is primed, facilitating the production of an utterance involving this quantifier. For the rest of the control block, priming and perseveration factors align to favor an *all*-response. This situation changes when they reach the critical block. Here, the item-level prime is of *both*, but children may prefer to continue

using *all*, in keeping with their previous productions. Indeed, the over-use of *all* in this order indicates that the tendency to perseverate is strong enough to over-ride any effect of the item-level prime.

Children's behavior in the Critical-1st order shows us that perseveration effects can, in turn, be over-riden by *linguistic* knowledge. In Critical-1st order, the first (relevant) trial they encounter is one where *both* is primed, facilitating the production of a *both*-response. But rather than continuing to produce *both* once they reach the control block, children reliably switch to *all*. Thus, the threat of presupposition failure (recall that the cardinality presupposition of *both* is not met in the control contexts) is sufficient to suppress the tendency to perseverate. Children's response patterns in the Critical-1st order, especially in light of their behavior in the Control-1st order, thus provide strong evidence that they understand the duality requirement of *both*.

The fact that children switch from *both* to *all* responses as needed tells us that the threat of infelicity is sufficient to over-ride a bias to perseverate. But *all*, for adults at least, is infelicitous in the critical condition. Why is this infelicity insufficient to trigger an analogous switch from *all* to *both*? On the hypothesis that children do not have command of MP, this failure is predicted. Unlike adults, there would then be no principle of governing the choice between parallel structures involving *both* vs. *all* when *both* is felicitous. In such cases, children's utterance choices may be exclusively determined by extraneous factor like perseveration.

This is, of course, not the only possibility compatible with our data. A weaker conclusion might be that children's abilities with the application of MP is more fragile than their knowledge of principles governing semantic presuppositions. This asymmetry may relate to the inherent differences in how presuppositions and anti-presuppositions are derived: one is a consequence of the linguistic structure of a given sentence, whereas the other is the result of competition with an alternative. As a consequence of this fragility, deployment of MP in a given environment may be more susceptible to interference by orthogonal pressures like perseveration. If this is the case, no conclusions about underlying competence can be drawn from children's failures in this task; rather, their adult-like behavior in the Critical-1st order should be taken as reflecting their knowledge of MP.

A final possibility is that they have adult-like command of all aspects of MP, but have localized problems with the competition between *both* and *all*. This failure could be because, despite what we see in the control condition, children do not have an adult-like

representation of *both*. Children's adult-like behavior in the control condition demonstrate *some* knowledge of the duality requirement of *both*. However, it could be that they treat *both* as akin to *exactly two*. Such a lexical entry would preclude the use of *both* in the control condition as there were always exactly three food items eaten. At the same time, if children are working such a representation of *both*, we would not expect them to treat it as a presuppositional alternative to *all*, since it would be neither contextually equivalent to nor presuppositionally stronger than *all*.

4.3.2 Experiment 1B: Felicity Judgment

Experiment 1B aims to address certain shortcomings of the previous experiment. To ensure that children's non-adult behavior was not due to orthogonal factors like perseveration, we shift away from production tasks to a Felicity Judgment task. In a Felicity Judgment task, participants are asked to directly compare alternative sentences that vary in acceptability. Previous studies on scalar implicatures have shown this task to be more sensitive than others (e.g. picture-selection, Truth-Value Judgment) in detecting children's underlying command of pragmatic phenomena. For instance, when children in these tasks were presented with logically true scalar alternatives (e.g. sentences with *some* vs. *all*), preschoolers reliably chose the stronger or more informative one, whereas in other types of tasks, children in this age range did not exhibit a contrast. In light of the worry about non-adult representations for *both*, this experiment also includes a different type of control from Experiment 1A. The control items require an understanding that *both* requires a domain of quantification with two elements. This helps to rule out the possibility that children's non-adult behavior is the result of their treating *both* on par with *exactly two*.

Participants, materials and procedures

Thirty-two native English speaking adults, recruited via Amazon Mechanical Turk, and thirty-two 4-to-6-year-olds, recruited from local area preschools, participated in this study. The age range for children were raised from the previous study after the task was found to be too demanding for younger children during piloting.

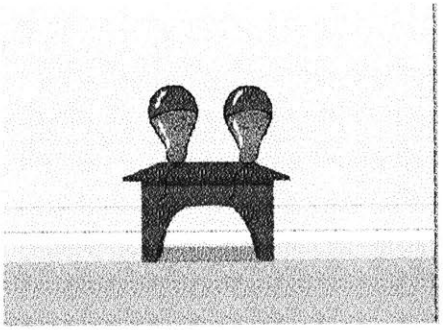
Participants in this task are first shown a pictured situation (a sequence of two related images) and presented with two alternative descriptions of that situation. One description might differ from the other in truth, grammaticality or felicity. They were tasked with

choosing the better alternative in a binary forced-choice.

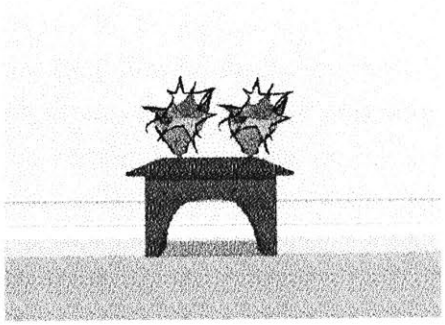
Both children and adults saw the same visual and linguistic stimuli, but the mode of presentation of the materials as well as the instructions varied. The stimuli were presented to adults using the IbexFarm experiment presentation tool. They saw a sequence of two images depicting an event, followed by a screen with a pair of sentences intended to describe what happened in the event. Participants were instructed to choose the better description by clicking on it. The order of presentation of the sentences in the pair was counterbalanced across two lists. Children were presented the stimuli as part of a PowerPoint presentation. Two cartoon characters, one male, one female, were displayed on either side of the scene, and children were told that these characters were looking at the pictures along with them. After each sequence, the two characters produced a pre-recorded sentence describing the event. The child was asked to reward the one who said the better sentence with a sticker. The speaker of the target sentence was counter-balanced across two lists. Because the character on the left side of the display always spoke first, this manipulation also meant that recency of the target sentence was also counter-balanced. Adults were explicitly instructed that one sentence may be worse than the other because it is false, ungrammatical or simply odd-sounding. For children, we included a brief training session at the beginning of the task, during which they received feedback. The training items involved comparisons between pairs of sentences that diverged in truth, as well as pairs of sentences that were both true, but differed in grammaticality. The latter type of training item was included to make sure that the child understood not to rely only on truth when making their choices.

There were two experimental conditions. In the critical condition, participants saw a two-sequence event involving exactly two objects. For example, the first image may depict two balloons, which the experimenter explicitly calls attention to (e.g. "Look, two balloons!"); the second would then show that both of them have popped. This scene would be accompanied by two alternative descriptions, "Both of the balloons popped" vs. "All of the balloons popped" (Figure 4-7). We expected adults to choose the *both*-variant. However, a child who is not sensitive to MP should performance at chance in this condition, rewarding both speakers at around the same rate. On the other hand, if children's difficulties applying MP in the previous experiment was an artifact of competing pressures like perseveration, we should find an improvement here, where analogous pressures do not arise.

Figure 4-7: Example critical item, Experiment 1B



Look! Two balloons!



Look what happened!
Both of the balloons popped.
All of the balloons popped.

The control condition was designed to rule out the possibility that children assign a meaning for *both* that corresponds to *exactly two*. The scenarios all involved exactly three objects, but something happens to just two of them. For example, there might be three balloons, only two of which pop. The two alternate descriptions would be "Both of the balloons popped" vs. "Two of the balloons popped". If the child understands that *both* requires the domain of quantification to contain exactly two elements, then they should choose the numeral-variant in this condition. If, however, the child assigns to *both* an *exactly two* meaning, they should pick at random.

In addition to the experimental items, participants also saw filler items which involved pairs of sentences where one was simply false. For instance, children may see a sequence with three balloons, two of which popped; they would then be asked to choose the better of two sentences like, "One/two of the balloons popped". Adults saw 16 such items; children saw 4. Accuracy on the fillers were used as exclusion criteria for both populations.

Results

Adult participants whose filler accuracy was lower than 60% accuracy were excluded from the analyses, as were child participants who got more than 2 fillers wrong. This resulted in the exclusion of 1 adult and 1 child participant. Results from the remaining 31 adults and

31 children are described below.

The rates at which adults and children chose the more appropriate sentence by condition are represented in Figure 4-8 Figure 4-9. Adults performed at ceiling on both conditions. However, child performance on critical vs. control conditions was asymmetric, in a manner parallel to Experiment 1A. Children's accuracy was considerably lower in the critical condition, where they rewarded the character who uttered an *all*-statement nearly half of the time. Accuracy on control trials, by contrast, was above chance and comparable to that of adults.[3]

Figure 4-8: Accuracy, Adults

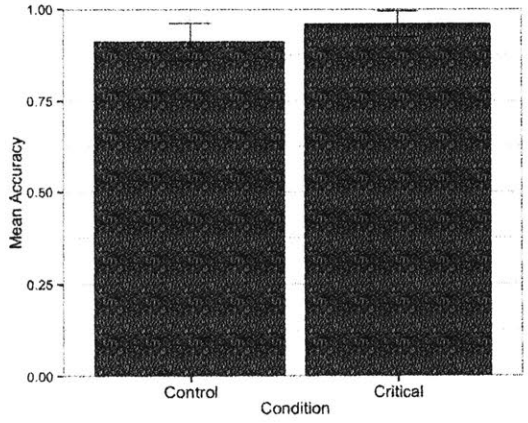
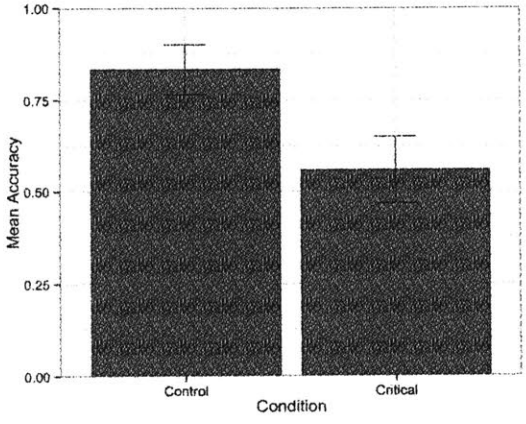


Figure 4-9: Accuracy, Children



We ran two separate mixed-effects logistic regressions to analyze these trends. We first analyzed the child data separately, predicting Accuracy by Condition, with Age (measured in years and months) as a covariate. A summary of the model is given in Table 4.5. The model revealed a significant effect of Condition, with the odds of making the accurate choice being lower on the critical trials. There was also a marginal effect of Age, which we did not find in Experiment 1A. The main reason for this cross-experimental difference seems to be the inclusion of the 6-year-old group in Experiment 1B. 6-year-olds' perfor-

[3]To be sure that the errors on the critical condition are not disproportionately made by children who also get the control items wrong and thus may simply not know the meaning of *both*, we examined the data from the subset of 22 children who made no errors on the control condition. Accuracy on critical items for this subset was still only 52.4%.

mance on the critical items was adult-like, at 93.7% accuracy, in stark contrast with 4- and 5-year-olds, whose accuracy rates hovered around chance, at 51% and 42% respectively.

Next, we fit a second mixed-effects model to probe for significant differences in performance between the two populations. Accuracy was the response variable, and Condition and Group (child vs. adult) and their interactions were included as fixed factors. As summarized in Table 4.6, the interaction between Condition and Group was significant, with the accuracy rates of the two groups diverging only on the critical condition.

Table 4.5: Child Performance by Condition

	β	SE	z	p
Intercept	2.14	3.09	0.69	0.49
Condition (Critical)	-5.38	2.63	-2.05	0.04
Age	0.76	0.39	1.95	0.052

Table 4.6: Performance by Group and Condition

	β	SE	z	p
Intercept	5.44	1.89	2.88	0.004
Condition (Critical)	-1.34	2.03	-0.66	0.51
Group (Child)	-0.90	1.15	-0.78	0.43
Condition * Group	-2.88	1.38	-2.09	0.036

Discussion

Findings from Experiment 1B replicate in comprehension the patterns of non-adult behavior found in Experiment 1A. We were able to establish in the control condition that children know that *both* requires a two-membered *domain*, unlike *exactly two*. Despite this knowledge, when sentences with *both* and *all* were presented as alternative descriptions of a situation where the cardinality presupposition of *both* was met, children did not show a reliable preference for the *both*-sentence. In this regard, they were different from adults, who chose the presuppositionally stronger sentence whenever it was felicitous. Our choice of experimental method, furthermore, allows us to rule out the possibility that genuine sensitivity to MP is masked by third factors. In previous work on children's developing abilities to compute scalar implicatures, the Felicity Judgment task has been found to facilitate access

to strengthened meanings, with children showing a reliable preference for (true) sentences with the stronger scalar terms. Clearly, children's behavior in Experiment 1B tells us that there is no such facilitative effect in computing MP-effects with *both* and *all*. Even when the competing structures are presented side-by-side, children do not show a preference from the presuppositionally stronger alternative. Their apparent lack of a contrast between *both* and *all* sentences in the critical condition lends support to the hypothesis that their command of MP is non-adult-like.[4]

4.3.3 Discussion of Experiments 1A and 1B

Experiments 1A and 1B examine children's sensitivity to MP using competition between *both* and *all* as a case study. In two experiments, we find a striking child-adult difference. Children found *both* and *all* equally acceptable in environments where, for adults, the felicity of *both* blocks the use of *all*. That is, children, unlike adults, did not seem to associate *all* with the anti-presupposition that it is not common knowledge that the domain is a two-membered set. It is only at around age 6 that children begin to look adult-like.

Children's performance on the control conditions was also significant. Though they are found *all* acceptable in a *both* environment, the permissiveness was not bidirectional. Children did not find *both* acceptable in what would be an *all*-environment for adults, namely when the cardinality of the domain is three or more. This tells us that they assign an adult-like meaning representation for *both*. We can in turn rule out some possible explanations for why children diverge from adults in the critical conditions, e.g. a non-adult lexical entry for *both* that precludes it from entering into competition with *all*. I take these results to

[4]One possibility we cannot yet rule out is that children treat the cardinality requirement of *both* as part of its asserted component. Thus, the hypothesized child lexical entry for *both* would be as in (i).

(i) **Hypothesized child representation**
$[\![\text{both P Q}]\!] = 1$ iff $|[\![P]\!]| = 2 \wedge \forall y[P(y) \rightarrow Q(y)]$

If so, *both* and *all* would fail to satisfy the contextual equivalence condition because now, the asserted contribution of *both* is stronger, and moreover, the two quantifiers would have identical presuppositions. So, MP would not be expected to apply.

We must first ask whether it is reasonable for a learner to hypothesize a meaning as in (i) to begin with. There are no simplex quantifiers that I know of, which encode similar meanings. But suppose this were the meaning the child initially posits for *both*. If so, a *both* sentence would have stronger entailments than the *all* counterparts and in upward entailing contexts, would be more informative. Thus, there should still be a preference for *both* given informativity considerations.

show that the component of grammar responsible for rendering *all*-sentences infelicitous in *both* environments, namely MP, is not stably in place before the age of 6.

If command of MP is lacking or fragile before 6, we should find it across environments where MP might apply. In the next section, I examine whether children show analogous difficulties with MP with another set of putative MP-competitors: *another* vs. *a*.

4.4 *Another* vs. *a*

In this section, we expand our investigations into the development of MP by examining the competition between the plain indefinite *a* and the presuppositionally stronger *another*. In parallel to the earlier test environment, we conduct two experiments. Experiment 2A attempts to elicit the relevant forms in a production task similar to Experiment 1A above; Experiment 2B utilizes a Felicity Judgment task, where participants choose the better of two parallel structures with *a* and *another*.

4.4.1 Experiment 2A: Elicited Production

Participants, materials and procedure

Thirty-six children ages 3-to-5 (mean age = 4;2) and forty adults participated in the task. English was the dominant language of all participants. As before, adults saw a "Fill-in-the-blanks" variant of the task, presented in written form via IbexFarm. Children heard brief stories from the experimenter while watching a PowerPoint with the visual materials.

The paradigm was very similar to that of Experiment 1A. Participants were first introduced to a conversational situation involving two characters. In the critical scenarios, character A would do something, e.g. eat an apple, in the presence of character B. Later, in the absence of B, A does the same thing again. For instance, they might eat another apple. B returns and asks A a question of the form, "What did you do after you ate an apple?". The participant is asked to say how A would respond to B's question. By virtue of it being mentioned in B's question, there is a contextually salient apple. The presupposition of *another* is thus supported and we find that an answer of the form, "I ate another apple" is both felicitous and required in this environment. The control scenarios are minimally different in the following way: though A takes part, once more, in two identical events, e.g. of apple-eating, B does not bear witness to either of those events. The question posed by B would

also differ accordingly. Crucially, the presupposition triggered by *another* is not satisfied in this context, blocking its use and mandating the choice of a non-presuppositional indefinite instead.

Sample scenarios from the child variant of the study are given in Table 4.7. Adults saw 8 items per condition, along with 16 fillers. Children saw 3 items per condition in a blocked design with counterbalanced order. As before, they were randomly assigned to two orders: Critical-1st and Control-2nd. The filler items were exactly the same across the two experiments.

There is one point of non-parallelism between Experiments 1A and 2A that is worth noting. Because of the nature of the stories and the expressions involved, it was not possible to exclusively prime the target response in the stories (i.e. use *another*, but not *a* in the critical stories, and vice versa). Instead, both expressions are primed in both conditions.

Results

Participants' responses were categorized into the following Response Types: 'another', 'indefinite', 'numeral' (specifically *two*), 'bare-plural' and 'other', where the 'other' category includes irrelevant responses or no response. In addition, the responses were coded for whether or not they matched our expectations about the acceptable response. The expectation for the critical condition was a statement involving *another*. There were more degrees of freedom in the control condition: various types of indefinite NPs, including the plain indefinite, numerical expressions, bare-plurals, were all coded as a "match".

Figures 4-10 and 4-11 plot the proportion of different types of responses produced by adults and children in each condition. The notable finding here is the uniformity across groups in their responses on the critical items: both populations overwhelmingly produced utterances with *another*. The pattern of responses on the control condition, in contrast, is not the same across population. One key difference is in the proportion of indefinite vs. numeral responses, with children showing a strong preference for numerals over indefinites. However, given that both indefinites and numerals are equally acceptable in the control condition, this difference is not directly relevant for our purposes. Figures 4-12 and 4-13 therefore collapse across these differences and plot the rates of expected response. Finally, as Figure 4-14 shows, children's rates of production of *another* did not vary by order.

Table 4.7: Conditions, Children

Condition	Scenario	Expected Response
Critical	Hippo was playing with his friend Raccoon. But he got a little hungry. So he got an orange from his basket and ate it right up. But he was still hungry, so he got an apple from his basket and ate that up, too! He was so hungry so he didn't even share with Raccoon! Then Raccoon had to go home. After he left, Hippo was still hungry, so he then ate another apple! Then, Raccoon came back to play and asked Hippo: "What did you do after you ate an apple?". What did Hippo say to Raccoon?	I ate another apple
Control	Hippo was playing with his friend Penguin. But he got a little hungry. So he got a bar of chocolate from his basket and ate it right up. He was so hungry so he didn't even share with Penguin! Then Penguin had to go home. After she left, Hippo was still hungry so he took out a donut and he ate that up, too. Hippo was still hungry, so he then ate another donut! Then, Penguin came back to play and asked Hippo: "What did you do after you ate a chocolate bar?" What did Hippo say to Penguin?	I ate a/two/some donuts

Figure 4-10: Response Types, Adults

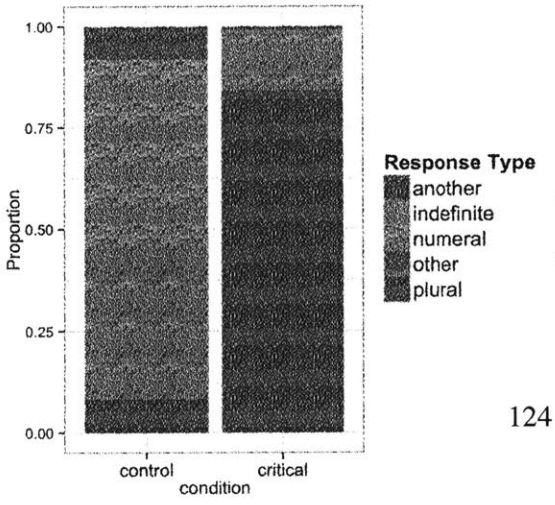


Figure 4-11: Response Types, Children

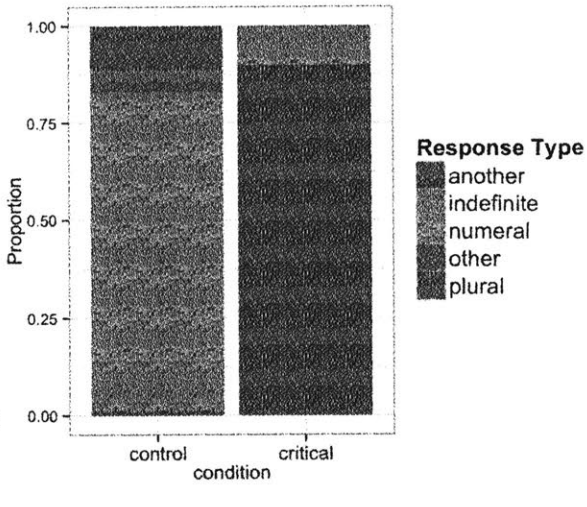


Figure 4-12: Expected Response Rates, Adults

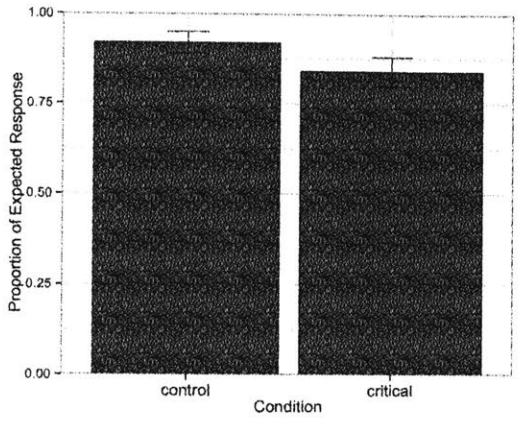


Figure 4-13: Expected Response Rates, Children

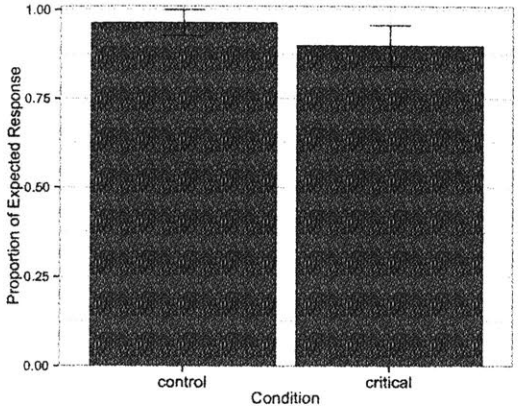
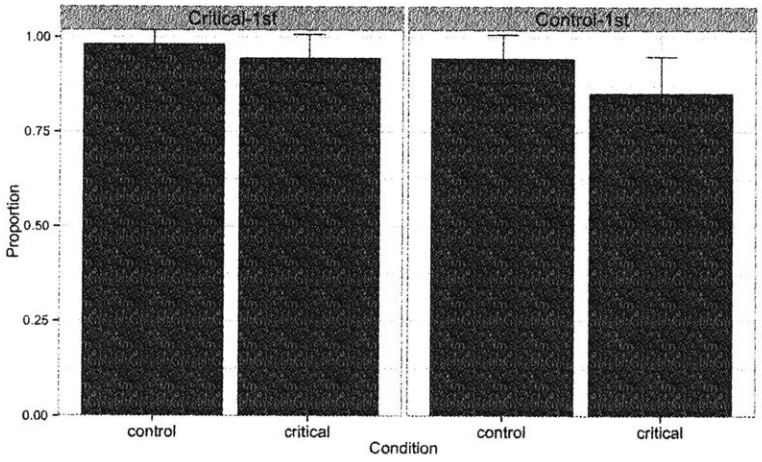


Figure 4-14: Children's Expected Response Rates by Order



We analyze the adult and child data separately. In both cases, we fit mixed-effects logistic regressions on Expected Response Rates. The adult model predicted Expected Response Rates as a function of Condition (control vs. critical), with random effects of participant and item. As the model summary in Table 4.8 shows, we find no significant difference

across conditions. For the child data, Expected Response Rates was again the dependent variable, but we include Condition and Order and their interaction as fixed factors, and Age as a covariate. Table 4.9 summarizes the results from this model. As with adults, we find no effect of condition. There was, furthermore, no effect of order or of age.

Table 4.8: Summary of statistical analysis, Experiment 2A, Adults

	β	SE	z	p
Intercept	3.43	0.61	5.62	<.001
Condition (Critical)	-0.99	0.75	-1.32	0.19

Table 4.9: Summary of statistical analysis, Experiment 2A, Children

	β	SE	z	p
Intercept	12.79	6.28	2.04	0.04
Condition (Critical)	-1.67	6.88	-0.24	0.81
Order (Control-1st)	-0.54	5.30	-0.10	0.92
Condition * Order	-1.65	6.11	-0.27	0.79
Age	1.48	1.91	0.78	0.44

The main result of this experiment, then, is that preschoolers display adult-like preferences when choosing between alternative sentences involving *a* and *another*. They did not over-produce the presuppositionally stronger expression when the context failed to support its presuppositions. This pattern is the same as in Experiment 1A, where *both* was never over-used, and suggests that children have an adult-like semantic representation for *another*. Moreover, children never over-produced the presuppositionally weaker *a* when the stronger *another* was felicitous. That is, to the extent that *a* is blocked in the critical condition due to MP-based competition with *another*, children seem to be applying the principle to correctly rule out the plain indefinite. In this respect, children's behavior in Experiment 2A diverge drastically from that in Experiment 1A, where they were seemingly insensitive to MP and over-used the weaker expression *all*.

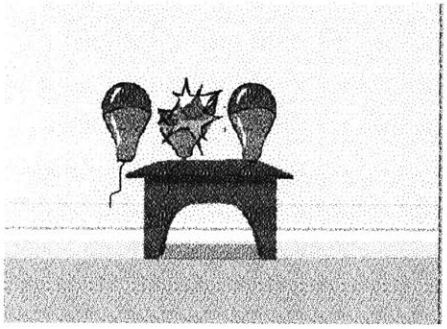
In the next subsection, we carry out a felicity judgment task, which aims at gathering converging evidence for these patterns in comprehension.

4.4.2 Experiment 2B: Felicity Judgment

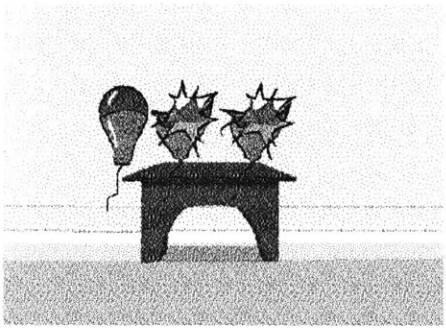
Participants, materials and procedure

Participants in this study were 35 children ages 4-to-6-years-old and 40 adult native speakers of English. The design of the experiment was parallel to Experiment 1B. Participants first saw a pictured event in a two-image sequence and were given two possible descriptions of that situation. The task was to choose the better description. As before, there were two experimental conditions. The critical condition depicted two identical events that took place in sequence, e.g. a balloon popping, followed immediately by another one. The first scene was introduced using a sentence with the indefinite, e.g. "Look! A balloon has popped!", so as to make salient an entity that could serve as the witness to the presupposition of *another*. The next scene displayed a second balloon also having popped, and participants were given a pair of competing descriptions of that event involving the plain indefinite and *another*. Figure 4-15 illustrates. We expected participants to prefer the *another*-variant in this environment, as mandated by MP.

Figure 4-15: Example critical item, Experiment 2B



Look! A balloon has popped!



Look what happened!
Another balloon has popped.
A balloon has popped.

The control condition was intended to assess knowledge of the presupposition of *another*. The scenarios set up a context where its presupposition was not met. For instance, participants would see a minimally different scenario from the critical condition involving, e.g.,

a single balloon-popping event. They would then be presented with the same pair of sentences as in the critical condition, involving the plain indefinite vs. *another*. Crucially, this time, the *another* sentence is infelicitous and the indefinite should be preferred.

Results

As before, adult participants whose accuracy rates on fillers were below 60% and child participants who made more than 2 errors on fillers were excluded from the analyses. This resulted in the exclusion of data from 1 adult and 2 child participants. Results from the rest are represented in Figures 4-16 (Adults) and 4-17 (Children). Unsurprisingly, adults were at ceiling on both conditions. More notably, children were also at ceiling on both critical and control conditions.

Figure 4-16: Accuracy, Adults

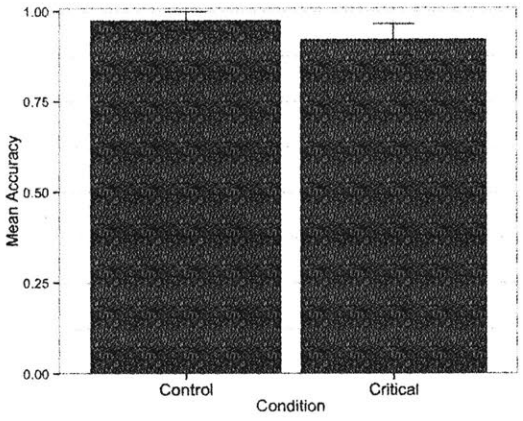
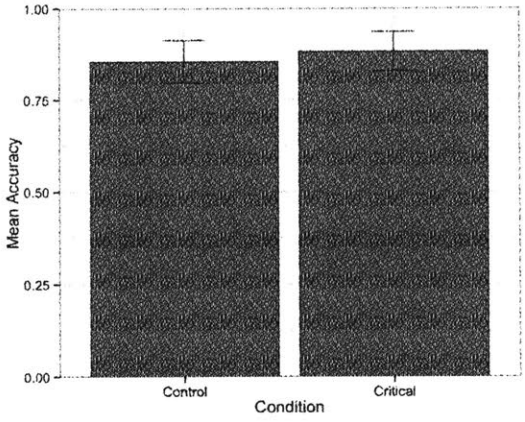


Figure 4-17: Accuracy, Children



We first fit a mixed-effects logistic regression on the child data, predicting Accuracy as a function of Condition, with Age as covariate. Results from the model, summarized in Table 4.10, reveal no significant effect of Condition or Age. We then fit a separate mixed-effects logistic regression on the adult and child data combined. The predictors in this model were Condition, Group (adult vs. child) and the interaction of these factors. Results from the model suggest that children are worse performers overall compared to adults. However, there were no other significant effects (Table 4.11).

Table 4.10: Child Performance by Condition

	β	SE	z	p
Intercept	-0.41	1.44	-0.28	0.78
Condition (Critical)	0.49	0.58	0.86	0.39
Age	0.43	0.27	1.60	0.11

Table 4.11: Performance by Group and Condition

	β	SE	z	p
Intercept	3.55	0.49	7.20	$< .001$
Condition (Critical)	-0.47	0.69	-0.69	0.48
Group (Child)	-1.77	0.53	-3.36	$< .001$
Condition * Group	1.05	0.69	1.52	0.13

In sum, these results both corroborate the findings from Experiment 2A and stand in stark contrast with Experiment 1B, where children were choosing randomly between *both* and *all* sentences in the critical condition.

4.4.3 Discussion of Experiments 2A and 2B

The main objective in Experiments 2A and 2B was to ascertain whether children's apparent lack of sensitivity to MP observed in Experiments 1A/1B is general in nature. To this end, we tested their sensitivity to MP with another pair of expressions commonly taken to be MP-competitors, *another* and *a*. The results from these studies sharply contrast with those from the previous pair. Children were found to be entirely adult-like in their uses of *another* and *a*, reliably using the presuppositionally stronger *another* whenever felicitous and rejecting weaker sentences with the plain indefinite. Given our assumptions thus far, successfully ruling out the plain indefinite in favor of *another* requires knowledge of MP and the ability to deploy this knowledge in an adult-like manner. The findings from Experiments 2A and 2B then indicate that MP *is* in place by the preschool years.

In other words, the two sets of results seem to be pulling us towards opposite conclusions regarding children's competence with MP. In what follows, I discuss a possible way of reconciling these findings, which involves eschewing with some of our starting theoretical assumptions.

4.5 General Discussion

4.5.1 Non-uniformity across test environments

This chapter set out to examine children's knowledge of MP as a principle governing utterance choice. I adopted a fairly standard formulation of MP, repeated below in (24), along with the assumption that competition is triggered by specific lexical items with presuppositional alternatives. Children's sensitivity to MP was assessed using two such sets of alternatives, {*both, all*} and {*another, a*}.

(24) For two sentences ϕ and ψ whose presuppositions are satisfied in a context c:

(i) If ϕ and ψ are competitors for MP, and

(ii) ϕ and ψ are contextually equivalent relative to c, and

(iii) ϕ carries stronger presuppositions than ψ, then

ϕ should be preferred to ψ in c

Independent measures were taken to ensure that children knew the meanings of the expressions involved. The expectation, then, was that if children have MP in place as a principle governing utterance choice, they should never use a presuppositionally weaker form when the stronger alternative was contextually felicitous.

What is striking about our findings, however, is that we find what looks to be *non-uniform* success in applying MP. With the competitors *a* and *another*, children displayed adult-like behavior, favoring the presuppositionally stronger *another* whenever it was usable. However, with *both* and *all*, they did not show a similar bias. Children found the two forms equally acceptable in contexts where the cardinality presupposition of *both* was satisfied. Taking these results at face value, we are left to draw conclusions in opposing directions: children's adult-likeness with *another/a* points to underlying knowledge of MP, whereas their non-adultlike behavior with *both/all* point to a lack of command of the principle.

How can we reconcile these seemingly contradictory findings? One possibility is that even after the principle itself is in place, there might be additional learning of when the principle should apply. Children might need to identify, in a piecemeal fashion, different sets of presuppositional alternatives. That is, in addition to knowing the lexical meanings of competing expressions and the algorithm for computing anti-presuppositional effects,

there might be a separate layer of learning, figuring out which lexical items belong on a scale of presuppositional strength. The idea that there is an additional step of learning of alternative sets was originally proposed by Barner, Brooks & Bale (2011) in the domain of scalar implicatures, another pragmatic phenomena where we observe non-uniformity across environments in the rates at which children compute the relevant inferences. On this view, our results can be taken as evidence that children have command of MP as a general principle, though the two sets of presuppositional alternatives are identified at different points in development.

The explananda on this approach are two-fold. First, why are certain alternative sets earlier-acquired than others? Second, how are they learned to begin with? With respect to the cases of interest here, we might ask: why do children associate *a* and *another* as scale-mates, but not *both* and *all*, and moreover, how do they eventually learn that the latter pair are indeed scale-mates? One answer to the first question is that the morphological make-up of *another* makes its ties to the plain indefinite transparent. No such cues are available with *both* and *all*. That said, it is less obvious what evidence the child might use to learn that *both* and *all* are presuppositional alternatives. In the case of scales involved in implicature-calculation, Barner et al. (2011) suggests that explicit contrasts like 'some but not all' could be highly informative pieces of evidence. However, the same strategy will not work for *both* and *all*, where the crucial difference lies in the presuppositional component of meaning. Rarely, if ever, do we make explicit the falsity of the presuppositions of an alternative when using a weaker term.

A different avenue, which I will pursue here, involves abandoning the goal of reconciliation, and instead taking the child data to inform us about the underlying phenomena. On our current assumptions, the oddness effects associated with *a* and *all* sentences are both treated as the result of problematic anti-presuppositions. However, what the observed developmental asymmetry might be telling us is that the two test environments do not implicate the same type of process, i.e. they are not both MP-effects. If this is the case, we will need to revise our initial assumptions in such a way that the two environments may be distinguished. I will show below that once we eschew with reliance on lexically-stipulated sets of presuppositional alternatives and adopt instead an intensional characterization of what constitutes a competitor, the core difference between the two test environments becomes visible. Specifically, we find that the oddness effect associated with indefinites can no longer be attributed to MP-competition.

4.5.2 Competition and complexity

So far in this chapter, we have been assuming that alternatives for MP are specified in terms of scales (Percus 2006; Chemla 2008; Schlenker 2012), much like alternatives for scalar implicatures (Horn 1972; Gazdar 1979). A scale is a set of lexical items, such that two structures will be considered alternatives of each other if they differ only in the substitution of one scale-mate for another. This seems necessary to capture the fact that not all structures that otherwise meet the other criteria for MP-competition give rise to MP-effects. By way of illustration, consider the two pairs in (25) and (26). The competition between the former pair is familiar to us by now. The presuppositionally weaker sentence with the indefinite (25-b) leads to the anti-presupposition that the stronger variant with the definite is infelicitous in the context. Now, the sentence in (26-a) is equivalent to (26-b) modulo its stronger presupposition. However, the presuppositionally weaker (26-b) is not tied to an anti-presupposition that it is not common belief that there are exactly two guests. What this contrast tells us is that a theory of MP must come with a formal condition on competitors, and that this condition should ensure that the pair in (26) are not generated as competing alternatives. On a scale-based account as we have been working with, we would rule out competition between (26-a) and (26-b) by stipulating the non-existence of the scale {*the*, *the two*}.

(25) a. The guest left. $\rightsquigarrow$Presupposition: There is exactly 1 guest.
b. A guest left. $\rightsquigarrow$Anti-presupposition: It's not common ground that there is exactly 1 guest.

(26) a. The two guests left. $\rightsquigarrow$Presuppositon: There are exactly 2 guests.
b. The guests left. $\rightsquigarrow$Absent anti-presupposition: It's not common ground that there are exactly 2 guests.

However, positing the existence or non-existence of such scales is not without problems, both conceptual and empirical. As pointed out in §4.2.1, determining what structures enter into MP-competition is a non-trivial task, and there are debates surrounding whether or not certain types of oddness effects should be characterized as anti-presuppositional effects. The stipulative nature of scales exacerbates the difficulty, as it fails to offer independent constraints on what structures can compete. Any two expressions can, in principle, be treated as scale-mates, and sometimes, scales stipulated to account for some phenomena

may lead to the wrong solution.

There are also empirical reasons for eschewing with such lexical stipulations. Consider the pairs of sentences in (27) and (28). The (a) and (b) sentences in the two examples are contextually equivalent (modulo certain implicatures) but differ crucially in that the (a)-variants carry stronger presuppositions. For instance, (27-a) would be felicitous whenever it is common knowledge that there were exactly two points scored by John; (27-b) would be felicitous so long as it is known that there were two or three such points. What is of interest to us is the fact that whenever the (a)-variant is assertable, the structure in (b) is judged odd. This clearly has the markings of an anti-presuppositional effect, though it is far from obvious how to generate the competing structures via substitution of lexical items from a scale. In order to subsume cases like (27) and (28) under the umbrella of MP, we must allow for competition to take place between structures on the whole.

(27) Context: It is common knowledge that John scored two points

a. The two points John scored impressed Mary.

b. #The two or three points John scored impressed Mary.

(Rouillard & Schwarz 2017))

(28) Context: It is common knowledge that every boy has a bike.

a. Every boy rode his bike to school.

b. #Every boy who has a bike rode his bike to school.

A promising solution, originally proposed within the domain of scalar implicatures by (Katzir 2007) and extended to MP in e.g. Rouillard & Schwarz (2017), is to replace scales with a structure-sensitive algorithm for generating alternatives (Katzir 2007). On this approach, a structure or Logical Form S' counts as an alternative to a sentence S only if: (*i*) S' is at most as complex at S and (*ii*) S' is derivable from S through successive steps of (a) substitutions (i.e. replacing an element in S with an element of the lexicon) or (b) deletions (i.e. removing subconstituents of S). Notice that the complexity-based algorithm would immediately rule out competition between (26-a) and (26-b) as desired (the former is strictly more complex). It also rightly rules in competition between the pairs in (27) and (28) (the stronger alternative is generated via deletion of a subconstituent).

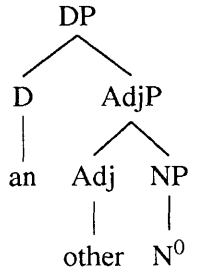
Does a complexity-based approach predict competition between sentences involving *both/all* and *another/a*? Let us take *both* and *all* first. The expressions are both quantifi-

cational determiners, which I take to head a DP in the syntax. The structure in (29-a) may be derived from (29-b) via a single replacement of the terminal node D^0, a licit operation. Thus, (29-a) would be generated as an alternative to (29-b).

(29) a. Phillip broke both of his hands.
b. #Phillip broke all of his hands.

On the other hand, competition between *an* and *another* no longer goes through. Although both *another* and *a* are standalone words in English, *another* is structurally more complex than the plain indefinite: it decomposes into an indefinite and the adjectival morpheme *other*, in a structure like (30).

(30)



Further evidence for such a decomposition comes from the fact that its sub-parts can be accessed independently. For instance, is possible to replace *an-* in *another* with another article, e.g. *the*, to form *the other*, and the meaning changes accordingly from indefinite to definite. Crucially, because of this complexity, the algorithm for deriving alternatives cannot generate a sentence like (31-a) as a competitor to (31-b). The former cannot be derived from (31-b) via substitution or deletion of constituents; addition of structure would be necessary.

(31) a. I had another coffee.
b. I had a coffee.

The upshot, then, is that while we can maintain our initial assumption that *all*-sentences are blocked in certain environments due to MP-competition with *both*, we can no longer call upon MP to derive the oddness of sentences with indefinites in *another*-environments; the two structures are not alternatives. Moreover, the experimental findings suggest that

whatever is responsible for blocking indefinites is acquired early on by children. The true representative of the MP-class, on this revised outlook, is competition between *both* and *all*. Children's apparent tolerance of *all* in *both* environments tell us that MP is not a stable part of young children's grammar.

4.5.3 Excursion: *Both* vs. *all* and the French problem

Unlike *another*, which decomposes into two separate morphemes, *both* was assumed to be monomorphic. Consequently, a structure with *both* can be straightforwardly derived as an alternative to the *all*-variant, as all it involves is the substitution of a single node in the structure. This line of thinking would make the following prediction: if a language does not have a lexeme with a meaning expressed by English *both*, the expression corresponding to English *all* would be felicitous in a sentence of the form *I talked to all of my students* even when it is common believe that I have only two students. This prediction follows from the facts that anti-presuppositional effects are derived via competition and that competition is limited to a certain types of alternatives. At first blush, however, this prediction does not seem to be met. As noted by Chemla (2007), French *tous* 'all' is associated with an anti-presuppositional effect of non-duality, despite the fact that French lacks a counterpart to *both* (32-a). The corresponding meaning is expressed periphrastically, with the expression *tous les doux* 'all the two' (32-b).

(32) a. #Philippe c'est cassé tous les bras
Philippe has broken all the hands
'Philippe has broken all of his hands'

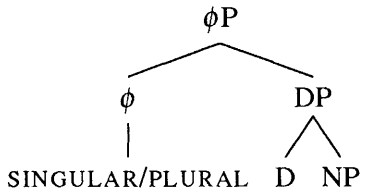
b. Philippe c'est cassé tous les doux bras
Philippe has broken all the two hands
'Philippe has broken both of his hands'

The puzzle posed by French is the following: what blocks *tous* 'all' in (32-a), given that the structure in (32-b), which is strictly more complex than (32-a), is not considered an alternative to it? The French facts suggests that a full account of anti-presuppositional effects with *all* cannot rest on the existence of a lexical item meaning *both*. Though it takes us slightly off-path, before moving on, I want to suggest a possible way of thinking about *all* and *both* that would account for both the English and French facts.[5]

[5]Thanks to Danny Fox (p.c.) for suggesting the analysis in this section.

The approach makes crucial use of Sauerland's (2003) system for interpreting grammatical number (see also Sauerland, Andersen & Yatsushiro 2005; Dvořák & Sauerland 2006). The key ingredients of this system are the following. First, plural and singular marking is not semantically interpreted on NPs; rather, number features head their own projections, ϕPs, which take DPs as arguments. This enriched syntax of nominals is represented in (33).

(33)



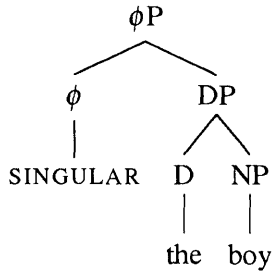
Number features represent $\langle e,e \rangle$ identity functions. The meanings for plural and singular features are given in (34).

(34) a. $[\![\text{PLURAL}]\!] = \lambda X \,.\, X$

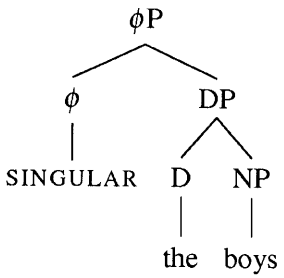
B. $[\![\text{SINGULAR}]\!] = \lambda X : \text{ATOM}(X) \,.\, X$

The feature [PLURAL] is an unrestricted function, i.e. its meaning is essentially that of the DP argument, but [SINGULAR] introduces the presupposition that the entity denoted by its argument is atomic. Consequently, the structure in (35) is interpretable, but the structure in (36) is not: the plurality *the boys* is not in the domain of [SINGULAR].

(35)

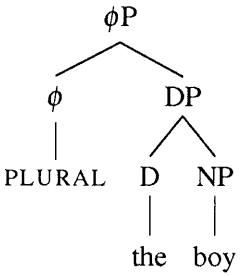


(36)



The entries in (34) alone do not fully capture the distribution of singular and plural morphology. This is because as it stands, we predict the following structure to be well-formed. Because [PLURAL] is presupposition-less, it should in principle be compatible with an atomic argument, so why do we find plural incompatible with singularities?

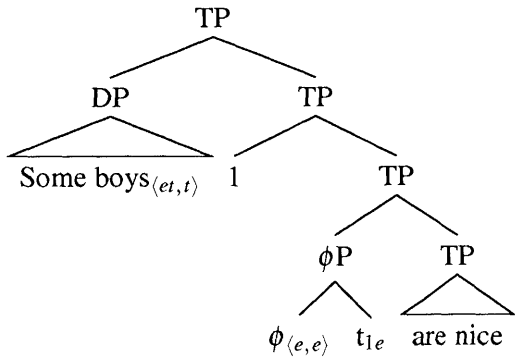
(37)



Sauerland argues that MP is responsible. Because [SINGULAR] carries a stronger presupposition than [PLURAL], MP demands that the former should be preferred whenever it is felicitous.

This general account of number straightforwardly extends to quantificational DPs once we make the assumption that quantifiers undergo QR and leave behind a type *e* trace. QR is necessary to resolve a type mismatch: a DP of generalized-quantifier type would otherwise be required to compose with a ϕ-feature, which takes a type *e* argument. This solution is illustrated in (38).

(38)



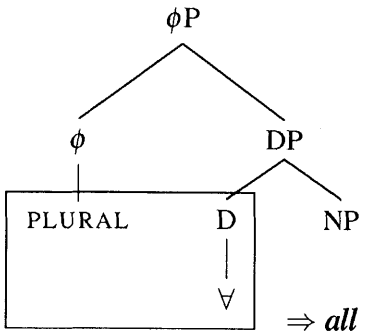
The presuppositional semantics for number marking above, together with MP, thus provides a general account of the distribution of number features on referential and quantificational DPs. Returning now to *both* and *all*, the core idea that I want to pursue is this: *both* and *all* are spell-outs of a universal quantifier plus number, where the crucial difference between the two expressions lies in the identity of the number feature itself. Specifically, *all* spells out ∀ + [PLURAL], whereas *both* spells out ∀ + [DUAL].

To pursue this idea fully, we would need to make the following assumption: every language, even those that lack the relevant morpho-syntactic correlates, is furnished with a feature [DUAL], with the meaning in (39).

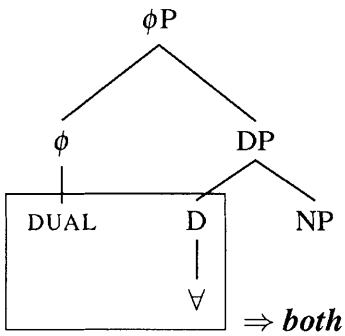
(39) $[\![\text{DUAL}]\!] = \lambda X : |X| = 2 . X$

In English, this feature is syncretic with [PLURAL] with respect to both number marking on nominals (e.g. *two boys* and *three boys* both surface with *−s*) or in verbal agreement (the verb must display plural agreement for both *two boys* and *three boys*). However, the distinction between a [PLURAL] ϕP and a [DUAL] ϕP becomes visible when they combine with a universal quantifier. Specifically, the framed portion of the structure in (40) spells out as *all*, whereas the corresponding elements in (41) spell out as *both*.

Parallel sentences with *both* and *all* would make universal claims, with the former carrying a duality presupposition. MP, moreover, would mandate the use of the structure in (39) over (38) whenever the duality presupposition is satisfied in the context. The main difference between our earlier assumptions and this one is source of the duality presupposition. Here, the presupposition is contributed by number morphology and not encoded as part of the meaning of the quantifier.

(40) 

⇒ ***all***

(41) 

⇒ ***both***

The English facts thus can be explained on this view. What we would need to say about French is that while its grammar generates the two structures in (41) and (40), there is a paradigm gap in the morphology. Parallel to English, French would spell out the framed part of (40) as *tous*. However, no analogous spell-out exists for (41). Importantly, since alternatives for MP are structures or LFs on our revised assumptions, a structure involving ∀ + [DUAL] would nevertheless compete with one involving ∀ + [PLURAL]. MP would in turn block the use of *tous* when the domain of quantification is a two-membered set. Given the paradigm gap, the only solution French-speakers have is to resort to a different structure, e.g. (32-b), altogether.

4.6 Summary and next steps

This chapter set out to investigate children's ability to adjudicate between structures diverging only in presuppositional strength, and in turn, their knowledge of *Maximize Presupposition!*, the principle governing this type of competition. We examined two sets of putative MP-competitors: *both* vs. *all* and *another* vs. *a*. The experiments revealed an asymmetry: preschoolers were able to detect the infelicity of a statement with the plain indefinite in *another*-environments, but unable to detect the infelicity of an *all*-statement in a *both*-environment. I took these findings to serve as motivation for revising some of the initial assumptions about MP, in particular about what constitutes a competitor for MP. These revisions led to the conclusion that the choice between *a* and *another* is not in fact modulated by MP.

We started with the question of whether preschoolers are sensitive to MP and whether they derive anti-presuppositional effects in an adult-like way. Regarding this question,

preschoolers' non-adult behavior with *both* and *all* leads to the conclusion that they do not have adult-like abilities with MP during this stage in development. In comparison, the component of grammar that renders *a*-sentences odd in *another*-environments seems to be earlier-acquired. The observed non-uniformity in development, on this new outlook, is no longer a puzzle, then. Rather, it reflects non-uniformity in the underlying phenomena.

The state-of-affairs raises a new set of questions: what is behind the oddness effects we observe with the plain indefinite, and why is this aspect of grammar easier for children to master? The goal of the next chapter is to explore these questions in-depth. More concretely, I pursue the hypothesis that the oddness of *a* in certain environments can be explained as a consequence of an independently needed theory of focus. No reference is made to parallel structures with *another*. Instead, expressions like *another* are simply rescue mechanisms that circumvent the problem caused by the plain indefinite.

Chapter 5

Obligatory presuppositions elsewhere

5.1 Introduction

The core finding from the preceding chapter was a developmental asymmetry. Faced with two seemingly similar competition environments — *both* vs. *all* and *another* vs. *a* — children showed an adult-like preference for the stronger competitor in the case of *another* and *a*, but not *both* and *all*. Children found *both* and *all* equally acceptable in contexts where adults strongly preferred *both*. Taking these findings as motivating a revision of the starting assumptions, I argued that the choice between *a* and *another* does not fall under the purview of the principle, *Maximize Presupposition!*. Consequently, preschoolers' performance in this environment does not inform us of their competence with MP. Rather, preschoolers' lack of a preference between *both* and *all* suggests that children in this age range are not sensitive to MP in an adult-like way.

The fact remains, however, that a sentence with the plain indefinite is generally odd in circumstances where the *another*-variant is usable. Understanding why this is may shed light on *why* the developmental trajectories look the way they do. Thus, a key desideratum is explaining what, if not MP, is at the source of the oddness of indefinites in *another*-environments. The aim of this chapter is to provide such an explanation.

My proposal, in a nutshell, is that sentences with indefinites are odd in "repeat instance" situations — situations where the presupposition of *another* is incidentally met — because

they cannot be associated with a licit focus structure. Such sentences make existential claims and when the claim is about an event that is identical to a preceding one, such an existential statement is either uninformative, or construed with implicit (i.e. covert) domain restriction. If the indefinite is covertly restricted, rules of focus require the restrictor to be F(ocus)-marked. Focus cannot, however, be realized on this constituent due to the simple fact that it is silent. An additional principle — MINIMIZE FOCUS — blocks focussing of some larger constituent with phonological content (which would resolve the issue of phonologically realizing focus), resulting in the ineffability of these sentences.

Before laying out the details of the analysis, it is worth spelling of why such an alternative is necessary in the first place. I will therefore begin with a discussion of why extant accounts, e.g. MP, cannot account for the relevant oddness effects. As I will point out in the next section, not only would our experimental findings remain a mystery on an MP-based account, it also makes wrong predictions. It over-generates oddness effects with indefinites, while also missing the generalization that the effect appears to be quite general, extending beyond sentences with indefinites. In §5.3, I lay out my proposal. While the main focus is on indefinites, I will also discuss how the key ideas may be carried over to other environments. In the final portion of the chapter, I return to developmental issues. The experimental findings from Chapter 4 are reconsidered in light of the account developed here. The broader implications of the account, especially in relation to the development of various types of pragmatic competition, are discussed.

5.2 Insufficiency of extant accounts

There are two existing candidate accounts for explaining the oddness effects in question. The first, as already discussed at some length, is *Maximize Presupposition!*. In §5.2.1, I show why an MP-based account is problematic above and beyond the conceptual issues already pointed out in the previous chapter.

The second possibility has more appeal. Recently, it has been argued that certain "obligatory presupposition" effects should be thought of as rescue mechanisms for circumventing unwanted exhaustivity implicatures (Bade 2016; Aravind & Hackl 2017a). The presuppositional expressions involved — *too, again* — have in common with *another* that they trigger "second-instance" presuppositions, and so a unification is *prima facie* desirable. However, I show in §5.2.2 that such an account is also empirically untenable.

5.2.1 *Maximize Presupposition!*

We already discussed two reasons to be suspicious of an MP-based story for the oddness effect with indefinites. The first is the observed developmental asymmetry. Children were adult-like in ruling out weaker indefinite sentences in *another*-environments, while failing to show an analogous dispreference for *all* in *both*-environments. One reason for children's divergent behavior across environments might be the fact that they implicate different processes, with different developmental trajectories. Competition between *both* and *all* appears to be a genuine MP effect, but the choice between *a* and *another* may not be governed by this principle. Secondly, treating *another* and *a* as competitors would mean losing a general, independently-motivated theory of alternatives. A structural-complexity based algorithm for alternative-generation *a la* Katzir (2007) — a general and non-stipulative theory that should apply to presuppositional alternatives, as well — would not generate a structure with *another* as an alternative to the variant with *a*.

In what follows, I want to show that even if we put aside these concerns, an MP-based account turns out to be inadequate. An explanation on which the felicity of *another* blocks the use of *a* is both too strong — not all environments in which *another* is usable block *a* — and too weak — intuitively similar oddness effects arise with sentences that do not involve indefinites at all.

Too strong

The lexical entries assumed in the preceding chapter for *a* and *another* are repeated below:

(1) a. $[\![an[other_i]]\!]^g = \lambda P_{\langle e,t\rangle}: \underline{P(g(i))}.\ \lambda Q_{\langle e,t\rangle}.\ \exists y[y \neq g(i) \wedge P(y) \wedge Q(y)]$

b. $[\![a]\!]^g = \lambda P_{\langle e,t\rangle}.\ \lambda Q_{\langle e,t\rangle}.\ \exists y[P(y) \wedge Q(y)]$

On an MP-account, when contextual equivalence obtains between parallel structures with *a* and *another*, the structure with *another* should be chosen. As explained in the previous chapter, contextual equivalence between *a NP VP* and *another NP VP* will obtain whenever it is common knowledge that the VP cannot be true of the same entity twice, e.g. with predicates of consumption. Thus, the second sentence in (2) is odd because MP mandates the use of *another* here: (*i*) a parallel structure with *another* would be contextually equivalent to (2) — the witness of the claim in both cases is a different coffee from before, and (*ii*) the presupposition of *another* is satisfied — the preceding sentence makes salient a coffee, as

required for the felicity of *another*.

(2) I had a coffee. #Then, I had a coffee.

However, as we observe in (3), not all environments where the two criteria are met force the use of *another*. In (3), contextual-equivalence would obtain between structures with *a* and the presuppositionally-stronger *another*, by virtue of the fact that the same coffee cannot be drunk twice. However, the indefinite is felicitous. This is unexpected on an MP-account. MP is generally thought to be a compulsory principle, in that if the conditions for its application are met, the stronger variant *must* be used.

(3) a. I had a coffee. Then, you had a coffee.
b. I had a coffee. Then, you had another coffee.[1]

Too weak

On the flip side, an account that relies on competition between *a* and *another* is arguably not general enough. Intuitively similar oddness effects arise with sentences that do not involve indefinites in the first place. Illustrative examples are given in (4) and (5).

(4) A: What did you do before lunch?
B: I worked.
A: Well what did you do after lunch?
B: #I worked.

(5) A: Where were they in the summer of 2016?
B: They were in Cape Cod.
A: Where were they last summer?
#They were in Cape Cod.

Though the ill-formed structures here do not involve an indefinite, they are similar to cases like (2) in that they describe a token occurrence of an event type that had happened before. Moreover, as with (2), the structure can be rescued with the insertion of a presuppositional

[1] *Another* does not feel entirely good here, and to the extent that it does, one is tempted to interpret *another coffee* as describing another *kind* of coffee. One reason for this could be that *another* is a more complex expression that would otherwise make no contribution.

expression, e.g. (6).

(6) A: Well what did you do after lunch?
B: I worked again/some more.

In these respects, the oddness effects exemplified by (7) and (8) seem to form a class with that of cases like (2). However, it is not obvious how to subsume these kinds of cases under the umbrella of MP, in part because it is not obvious what the ill-formed (a)-sentences are competing with. To the extent that there is competition, it seems to be between some presuppositional expression, e.g. *again, some more*, and its absence thereof.

5.2.2 Unwanted exhaustivity implicatures

While (4) and (5) do not look like paradigmatic MP-environments, they are reminiscent of a different set of environments where expressions triggering "additive" or "second-instance" presuppositions are obligatory. The cases that have received the most attention in the literature involve sequences like (7), where the second sentence in the pair is infelicitous without the particle *too* (Kaplan 1989; Krifka 1999; Saebø 2004; Chemla 2008; Amsili & Beyssade 2009; Singh 2011; Bade 2016; Aravind & Hackl 2017a).

(7) a. Dana went to the party.
#Lee went to the party.
b. Dana went to the party.
✓Lee went to the party, too

Though the obligatoriness of *too* in such cases has previously been analyzed as an MP effect[2](Chemla 2008; Singh 2008; Amsili & Beyssade 2009), Bade (2016) presents a series of arguments as to why this cannot be so. For instance, she points out that unlike canonical MP environments, where, as mentioned earlier, the use of a presuppositionally stronger expression is compulsory whenever that expression is felicitous, the obligatoriness of *too* is variable. In (8-a), for instance *too* no longer seems to be mandatory.

(8) a. Dana went to the party and Lee went to the party.

[2]Chemla (2008) argues that the competitor of *too* in these cases is a null morpheme that denotes the identity function.

b. Dana went to the party and Lee went to the party, too.

This is mysterious on an MP-based account. In both (7-a) and (8-a), the additive presupposition of *too* is satisfied (locally in the conjunctive environment; globally in cases like (7-a) and (7-b). If *too*-sentences compete for MP with variants without the particle, we predict a uniform preference for *too* in both cases. (Notice the family resemblance between these cases and the *a/another* examples from (3) earlier.)

Bade (2016) proposes an alternative account, on which *too* is inserted to block an unwanted exhaustivity implicature that would contradict contextual knowledge. Exhaustive interpretations arise due to the presence of a covert EXH operator (Fox 2007; Chierchia, Fox & Spector 2012), which conveys exclusivity as part of its meaning. EXH takes a proposition p and a set of alternatives (provided by the Question Under Discussion (QUD)) and asserts that p is true and all non-weaker alternatives to p are false. In the absence of *too*, the second sentence in sequences like (7) is, by default, interpreted exhaustively. This results in the implication that no one other than Lee went to the party, which of course is at odds with what was asserted just before. The insertion of *too* precludes the insertion of EXH, in turn circumventing the problematic exhaustivity implicature.

Notice how the account explains the acceptability of (8-a). In this case, EXH can attach above the entire conjunction. An exhaustive parse of the sentence would then be unproblematic: the implication would be that no one besides Dana and Lee went to the party. The account also predicts that when the form of the alternatives is such that negating them would not lead to a contextual contradiction, *too* is optional. We see this in (9). In (9), the second sentence is interpreted relative to the QUD, *Besides Dana, who went?*. The set of alternatives that serves as the restrictor of EXH is therefore a set of propositions of the form 'Besides Dana, x went'. An exhaustive interpretation of the second sentence leads to the implication that Lee is the only person besides Dana who went, which is consistent with — in fact, entails — the preceding sentence.

(9) A: Who went to the party?
B: Dana went to the party.
A: Besides Dana, who went?
B: Lee went to the party.

Could this account also explains the obligatoriness of *another* in the environments we

care about? An extension of Bade's (2016) analysis to *a* vs. *another* is appealing, both because of the similarities in the type of discourses in which the oddness effects arise, and because of parallels between *too* and *another*. Both *too* and *another* presuppose that the context makes salient some element different from the one the assertion is about; this element is of propositional type in the case of *too*, but an individual in the case of *another*.

In spite of its appeal, a unification of the two cases is not so straightforward. Bade's (2016) obligatory additive environments differ from the cases of interest here in the following way: *another* is required even when the additive-less variant would not create a contextual contradiction. In other words, problematic exhaustivity implicatures cannot be the full explanation. To see this, consider again a critical item from the elicited production task (Experiment 2A) described in the previous chapter.

(10) Hippo was playing with his friend Raccoon. But he got a little hungry. So he got an orange from his basket and ate it right up. But he was still hungry, so he got an apple from his basket and ate it right up! He was too hungry so he didn't even share with Raccoon! Then Raccoon had to go home and do some chores, so he said, I'll be back later! Hippo was still hungry, so he then ate another apple! Then, Raccoon came back to play and asked Hippo: "What did you do after you ate an apple?". What did Hippo say to Raccoon?

a. I ate another apple.

b. #I ate an apple.

The set of alternatives EXH takes as its argument is provided by the QUD, which in this case is Raccoon's question: *What did you do after you ate an apple?*. The alternatives are of the form: 'I did *P* after I ate an apple.' An exhaustive interpretation of the sentence in (10-b) is consistent with the context: eating an apple (and nothing else) is precisely what Hippo did after the first apple-eating event. Nevertheless, the plain indefinite is dispreferred.

The same is true of the other environments we saw in the preceding section, e.g. (11).

(11) A: What did you do before lunch?

B: I worked.

A: Well what did you do after lunch?

a. B: #I worked.

b. B: I worked again.

The QUD *What did you do after lunch?* delimits the time points of interest to those after lunch. An exhaustive interpretation of B's reply in (11-a) should be unproblematic. It conveys that all they did *after lunch* is work, which is consistent with their having done nothing else *before lunch.* An expression like *again* is obligatory here all the same.

What we observe, then, is that the structures in question are odd in certain contexts even when they are consistent with contextual information. This suggests that we are dealing with a different type of phenomenon from the obligatory additive effects that are the focus of Bade (2016).

5.2.3 Local summary

In this section, we have learned that existing explanations for the preference for presuppositionally stronger expressions cannot explain the oddness-effects associated with indefinites. An MP-based account, for instance, over-predicts ill-formedness, and an alternative exhaustification-based account wrongly predicts all of the cases examined to be felicitous. Moreover, the empirical terrain seems to be broader than sentences involving indefinites, further motivating an alternative account general enough to apply across various otherwise dissimilar environments.

My goal in the next section is to argue for such an alternative. Pre-theoretically, what is shared by the discourses of interest is that they describe two token events of the same type. My proposal takes this observation as its starting point. I will argue that the problem arises when a weak existential sentence is used to talk about a token occurrence of some event type that has been instantiated previously.[3] All that an existential statement requires for its truth is one witness instantiating the claim. When the sentence is about the second token of some event type that is known to have already taken place, such a statement will either be (*i*) unrestricted and uninformative, or (*ii*) construed with an appropriate covert domain restrictor that makes the sentence informative by excluding the prior token event. The introduction of a covert restrictor, while solving the problem of uninformativity, creates its own set of problems. Principles of focus will mandate that the covert restrictor must bear F(ocus)-marking and moreover, that it is the only constituent that bears Focus. However,

[3] I argue below that the relevant sentences without indefinites, e.g. (11-a), also involve existential claims, but over times rather than individuals.

because Focus cannot be appropriately realized prosodically on a silent element, ineffability ensues.

5.3 Proposal

In this section, I build the formal proposal. The analysis pursued here aims to derive the oddness of indefinites in certain environments from an independently needed theory of focus. In 5.3.1, I describe the framework for focus I will be assuming. After spelling out the necessary auxiliary assumptions in 5.3.2, I turn to the details of the analysis in 5.3.3 and 5.3.4. The discussion in the previous section demonstrated the generality of the phenomenon we are dealing with. With this in mind, 5.3.5 will show how the core proposal can be extended to non-indefinite environments.

5.3.1 Framework

Sentences must be pronounced with varying prominence patterns, depending on the context they occur in. Here and throughout, I use small caps to indicate when the expression bears a high level of prosodic prominence. B's utterances in both (12) and (13), for example, would typically be pronounced with a pitch accent on the subject DANA.

(12) A: John admires Sue.
B: No. DANA admires Sue.

(13) A: Dana admires Mary.
B: #No. DANA admires Sue.

Prosodic prominence on *Dana* in (12) and (13) signals that that constituent bears semantic focus, and focus imposes specific requirements on the context. For the focus on the subject in (12) and (13) to be felicitous, the context must provide an antecedent involving a contrasting subject, but is identical otherwise. The discourse in (12) provides such an antecedent; the discourse in (13) does not, hence its ill-formedness. Rooth's (1992) theory of contrastive focus, which I lay out below, is aimed at explaining these types of effects of focus.

Focus is represented in the narrow syntax with a formal feature "F" on focused constituents (Jackendoff 1972); this feature mediates between pronunciation (i.e. stress/accent

placement) and meaning (emphasis, highlighting). The principal interpretive effect of focus is to introduce alternatives to the F-marked constitutent. Thus, the focussing of the subject *Dana* in (13) results in the evocation of a set of alternative individuals x to Dana, and at the level of the entire sentence, a set of alternatives of the form 'x admires Sue'. The set of alternatives can be obtained by substituting constituents marked with the syntactic feature F with contextually relevant alternative meanings. On Rooth's (1992) theory, in addition to its the ordinary semantic value, $[\![\alpha]\!]^o$, constituents have a focus-semantic value, $[\![\alpha]\!]^f$, representing the set of alternatives.

In Rooth's system, focus-semantic-values are obtained by replacing the F-marked constituent with any element of the same semantic type. For instance, if the F-marked constituent denotes an individual, its focus-value will be a set of individuals; if it denotes a proposition, its focus-value will be a set of propositions. Here, instead, I adopt a structure-sensitive algorithm for computing focus-semantic values proposed in Fox & Katzir (2011), which is an extension of Katzir's (2007) theory for alternatives defended in the previous chapter. The set of possible substitutions for an F-marked constituent includes constituents of comparable complexity, as well as sub-constituents (14).

(14) a. **Structural complexity**

S' $\precsim$ S (to be read as: S' is at most as complex as S) if:

(i) S' can be derived from S by successive replacements of sub-constituents of S with elements of the substitution source

(ii) where the substitution source for a constituent X is the lexicon and the sub-constituents of X.

b. **Complexity-based algorithm for computing focus-values**

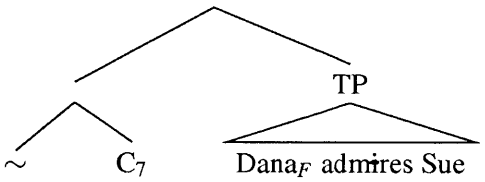
$[\![S]\!]^f$ = {S' : S' is derived from S by replacing focused constituents $x_1,...,x_n$ with $y_1,...,y_n$ where $y_1 \precsim x_1,...,y_n \precsim x_n$}

An example of where the two theories would diverge is the following: whereas a type-based algorithm for substitutions would take a complex, but entity-denoting DP *Dana and Lee* as a suitable substitution for *Dana* in e.g. (12), a structure-based approach would not. For further arguments that focus-semantic values must make reference to structured objects, i.e. LFs, the reader is referred to Fox (1999); Fox & Katzir (2011).

The focus semantic value by itself does not yet predict the interpretive effects of focus.

For this, Rooth introduces an operator, $\sim$, the Squiggle, which operates over focus-semantic values. The operator takes two arguments: a syntactic phrase α and a covert pronoun, typically represented as C_i. The phrase to which $\sim$ adjoins is referred to as the prejacent or the 'focus domain'. The pronoun is typically referred to as the 'focus anaphor'. Here, I make the simplifying assumption that $\sim$ attaches at the sentential-level, and in turn, that the focus domain is always a clause. This is schematized in (15). Here, the DP *Dana* is the focus within a focus-domain spanning the TP.

(15)



The $\sim$-operator accounts for the appropriateness of F-placement in a given structure by introducing presuppositions that restrict the possible values for the focus anaphor. As a free pronoun, C_i must receive a value made salient in the context. The $\sim$ −operator requires that the focus anaphor stand in one of two specific relations to the focus semantic value of the prejacent:

(16) $[\![[\alpha \sim C_i]]\!]^{g}_{o}$ presupposes that either:

a. $g(i) \in [\![\alpha]\!]^{f}$ & $g(i) \neq [\![\alpha]\!]^{o}$ CONTRASTIVE FOCUS

b. $g(i) \subseteq [\![\alpha]\!]^{f} \wedge \exists p[p \in [\![g(i)]\!]^{o} \wedge p \neq [\![\alpha]\!]^{o}]$ ANSWER FOCUS

Assuming α is a clause, (16-a) mandates that the discourse supply an antecedent sentence whose denotation (ordinary value) is an element of the focus-semantic value of α. Alternatively, the pronoun may pick up a *set* of alternatives, and the contextually privileged antecedent for the focus-anaphor is the denotation of an interrogative sentence that was either uttered in or inferable from the immediately preceding discourse. (16-b) requires that this question meaning be a subset of the focus-value of the prejacent, containing at least one distinct element from the prejacent.

All of the cases of interest to us here involve repeat-occurrence situations where one token event stands in contrast to another of the same type. Consequently, I believe it is reasonable to restrict our attention to the contrastive focus relation in (16-a). Consider

how it explains the contrast between (12) and (13) above. The first sentence in (12) is a member of the focus-value of the second: it is derivable by the replacement of the F-marked constituent with the DP *John*. Hence, it is an appropriate antecedent for the focus anaphor, and the discourse is predicted to be acceptable. However, in the case of (13), $\sim$ has us looking for an antecedent of the form *x admires Sue*. However, the only available antecedent is the first sentence, *Dana admires Mary*, which is not a member of the focus-value of the second sentence. This discourse is predicted to lead to a presupposition failure.

Finally, I assume that every sentence contains a $\sim$-operator. As we will see later on, one consequence of this is that every sentence is forced to contain an F-marked constituent.[4]

5.3.2 Further assumptions

Three further assumptions are needed before we can proceed. The first concerns quantifier domain restriction. The second is a ban against over-focussing, and the third a basic rule governing focus-realization. These are spelled out below.

Contextual domain restriction

I make the fairly standard assumption that the domains of quantifiers, including indefinites, are implicitly restricted. The sentence in (17), for example, almost never means that every student in the world passed. A more sensible interpretation is something along the lines of 'every student in the speaker's class passed'.

(17) Every student passed.

Following Westerstahl (1984); von Fintel (1994) and many others, I assume a *C*-variable approach to domain restrictions. Determiner quantifiers take as their first argument a variable over sets (or properties). This variable receives a value from the context via the contextually-supplied assignment function, which will then be intersected with the set (or

[4] In turn, every sentence would need to have an appropriate discourse antecedent. One may wonder whether this assumption would lead us into trouble when it comes to discourse-initiating contexts. As long as we assume that out-of-the-blue or "all new" sentences have sentence-wide focus, this should not be a problem. In such cases the focus-semantic value of the sentence will be the set of all sentences. So, any proposition made salient in the context, or any question that can be inferred from the context, including broad questions like *What happened?*, could serve as suitable antecedents for the focus-anaphor.

property) denoted by the nominal restrictor. The result is a more restrictive set that serves as the quantifier domain.

An illustration is given below using the *student* example from earlier.

(18) $[\![[[\text{ Every } C_7 \text{] student] passed}]\!]^g$

a. $\forall x[(g(7)(x)) \wedge \text{student})(x) \rightarrow \text{passed}(x)]$, where

b. $g(7) = \lambda x.$ in-speaker's-class(x)

Importantly, the restrictor variable is syntactically present, as evidenced by the fact that it can be bound (19).

(19) Only one class was so bad that no student passed the exam. (Heim 1991)
$\rightsquigarrow$Only one class x was so bad that no student in x passed the exam.

This will be crucial to us later on, as I will argue that the restrictor, being a syntactically represented constituent, is a suitable element for bearing an F-feature.

MINIMIZE FOCUS

In Rooth's theory of focus, any constituent within the focus-domain that is new and left unfocused will lead to infelicity. This is because the presuppositions of the $\sim$-operator ensure that anything in the focus-domain that does not have an F-mark has an antecedent made salient in the context.[5] We see this illustrated in (20). In the ill-formed (20-b), too few things are focused: there is F-marking only on the subject *Lee*. The focus-alternatives will then be of the form *x admires Courtney*. The $\sim$-operator presupposes that the value of the focus-anaphor be a member of this set of alternatives. However, the only available antecedent is *Dana admires Sue*, which is not in this set, and the result is a presupposition-failure. So, the constraints imposed by $\sim$ seem sufficient to explain problems of under-focussing.

[5]For ease of exposition, I am ignoring cases like (i), which involve what Rooth (1992) calls bridging by entailment. The focus-value of the second sentence is a set of structures of the form *x heard about them.* Though the preceding sentence is not a member of this set, intuitively, it licenses the focussing in [Sue$_F$ heard about them] because it entails, or at least implies, that Mary heard about the budget cuts, which *is* a member of this set.

(i) (First, John told Mary about the budget cuts.) And then, Sue$_F$ heard about them.

(20) A: Dana admires Sue.

a. B: Yes. And LEE$_F$ admires COURTNEY$_F$.

b. B': # Yes. And LEE$_F$ admires Courtney.

As it stands, however, the theory does not rule out cases of over-focussing, like (21-a). The presupposition introduced by $\sim$ — that the antecedent must be an element of the focus-value of the prejacent — is in fact satisfied by the infelicitous (21-a). The antecedent sentence *Dana admires Sue* is a member of the focus-alternatives of (21-a), which are of the form *x admires y*.

(21) A: Dana admires Courtney.

a. B: #Yes. And LEE admires COURTNEY, too.

b. B': Yes. And LEE admires Courtney, too.

This is a general problem in this system: since the well-formedness of $[\alpha \sim C_i]$ depends solely on whether the value of C_i is an element of $[\![\alpha]\!]^f$, any *superset* of $[\![\alpha]\!]^f$ will meet this condition if $[\![\alpha]\!]^f$ does.

To rule out cases like (21-a), various authors have proposed conditions requiring sparing use of F-markers. Different variants are found in e.g. Truckenbrodt (1995); Williams (1997); Schwarzschild (1999); Sauerland (2005a); Wagner (2005); Büring (2008); Mayr (2010, 2012). For present purposes, I will adopt the implementation in Fox & Spector (2009) provided in (22).

(22) MINIMIZE FOCUS

A focus-domain cannot have focus-value F if it would satisfy the presuppositions of the corresponding $\sim$-operator with another focus-value F' (derivable by different distributions of F-marking) and F' $\subset$ F.

This condition ensures minimal F-marking by requiring structures to have the smallest set of focus-alternatives that would result in that structure being contextually felicitous.

F-marked constituents are accented

According to Jackendoff (1972), focus has the following phonological effect: "If a phrase P is chosen as the focus of a sentence S, the highest stress in S will be on the syllable of P that

is assigned the highest stress by the regular stress rules" (p. 237). On a reformulation of this idea within the Roothian system we have adopted, this means that the main prominence within a focus-domain (i.e. the XP $\sim$ attaches to) must be within the constituent that is F-marked. We can capture this idea by positing the following condition:

(23) EXPONE FOCUS
For any focus domain α, the main stress/accent in α falls on the F-marked material in α.

A more precise formulation of the conditions that relate $\sim$ and prosodic prominence depends on assumptions about phonological and phonetic implementation that go beyond what can be discussed here, but it is a major area of study in and of itself (see e.g. Truckenbrodt 1995; Selkirk 1996; Williams 1997; Schwarzschild 1999; Wagner 2005; Büring 2016). The condition in (23), put simply, tells us that we need to be able to identify based on how a sentence is pronounced (plus rules of prosodic realization) where the F-marking lies in that sentence.

5.3.3 Ill-formedness of the indefinite

We now have the necessary ingredients to explain the ill-formedness of sequences like (24).

(24) a. I had a coffee.
b. #(Then,) I had a coffee.

The sentence in (24-b) expresses an existential claim. If the domain of quantification is the same as that of (24-b), asserting this sentence would be vacuous: it has already been established that there is a coffee (in that domain) the speaker has consumed. So that the second sentence can be contextually informative, the domain must be appropriately restricted. That is, the domain must be restricted so as to (minimally) exclude the coffee that the preceding sentence was about. Given the assumptions laid out in the previous subsection, this domain restriction is carried out by a C-variable in the syntax. In this case, the restrictor must pick out a contextually relevant subset of coffees that doesn't have as a member the witness of (24-a).

Thus, (24-b) could, in principle, have a meaning that is contextually unproblematic. As I will show below, it nevertheless lacks an acceptable focus structure. For a sentence with a

given F-assignment to be contextually felicitous, it must meet the following requirements: (*i*) the presuppositions of $\sim$, (*ii*) MINIMIZE FOCUS, and (*iii*) EXPONE FOCUS. However, no distribution of F-markers within a structure like (24-b) will be such that all three of these conditions are met.

Let us consider some candidate F-assignments. In (25), the F-marked constituent is the covert restrictor. Notice that this focus-structure meets the presuppositional requirements imposed by $\sim$ and MINIMIZE FOCUS. The focus-value of (25) will be of a set of structures that vary in the place of the restrictor, i.e. a set of alternatives of the form *I had a P coffee*. The $\sim$-operator, in cases of contrastive focus, presupposes that the focus anaphor be a member of this set. The context provides a suitable antecedent, namely the preceding sentence, which as we pointed out, must have a different domain from the one that follows. Moreover, F-marking on the restrictor variable yields the smallest alternative set that would have the value of the focus-anaphor as a member; in other words, MINIMIZE FOCUS is met. The problem, however, is that EXPONE FOCUS, that is, the requirement that stress must fall somewhere within the F-marked constituent, cannot be satisfied as a result of the fact that the F-marked element is silent.

(25) [[I had a $[C_7]_F$ coffee] $\sim C_i$]

a. ✓Presupposition of $\sim$
b. ✓Minimize Focus
c. ✗Expone Focus

Now consider the following alternative where a larger constituent, the object DP, is F-marked. The focus-value of this structure is a superset of that of (25). Given that the focus-anaphor receives the same value — the denotation of the preceding sentence — the presupposition of $\sim$ will be met. Moreover, EXPONE FOCUS may now be satisfied, as there is a phonologically realized F-marked constituent within which stress may fall. However, this structure violates MINIMIZE FOCUS. As we already saw in (25), F-marking on a sub-constituent of the object DP — namely, the restrictor — would be sufficient to satisfy the requirements imposed by $\sim$.

(26) [[I had [a C_7 coffee]$_F$] $\sim C_i$]

a. ✓Presupposition of $\sim$

b. ✗Minimize Focus

c. ✓Expone Focus

Finally, let us examine (27), which represents a completely F-less structure. Here, MINIMIZE FOCUS and EXPONE FOCUS are trivially satisfied by virtue of the fact that there is no focus. However, the presupposition of $\sim$ is not met. The focus-value of (32) is the singleton set consisting of the sentence itself: {*I had a* C_7 *coffee*}. The $\sim$-operator presupposes that the value of the focus-anaphor be a member of this set, *distinct from the prejacent.* Irrespective of what value the focus-anaphor is assigned, this requirement cannot be satisfied when the focus-value is a set consisting of only the prejacent.

(27) [[I had a C_7 coffee] $\sim C_i$]

a. ✗Presupposition of $\sim$

b. ✓Minimize Focus

c. ✓Expone Focus

In sum, complying with one requirement of the grammar of focus means that one or more of the others cannot be complied with. The result is either ineffability or presupposition failure.

The ill-formedness of indefinites in *another*-environments can thus be explained without recourse to competition with *another.* In fact, the focus-based account makes different — and welcome — predictions from an MP-account. On the present account, whenever the sole F-markable constituent is silent, we predict infelicity. We expect, therefore, that when some other expression can bear focus, an indefinite should be permitted. This is precisely what we find with cases like (28), discussed in 5.2.1 as problems for an MP-based account. What makes (28) different is that it allows for a possible focus structure as in (40), where F-marking is on the subject. All three of the aforementioned requirements are satisfied given this F-assignment. The focus-alternatives will be of the form *x had a* C_7 *coffee.*[6] The preceding sentence can serve as a suitable antecedent for the focus-anaphor. There is no other distribution of F-markers that would result in a smaller focus-value while satisfying the requirements imposed by $\sim$; MINIMIZE FOCUS is thus met. Finally, the sentence can be pronounced with stress on the F-marked constituent, *you*, thus satisfying EXPONE

[6]Notice that in this case, the second sentence will be informative without domain-shifting; the domain of quantification may be the same as the previous sentence.

FOCUS. (The reader can verify that on its most natural pronunciation, the second sentence in (28) is indeed pronounced with prominence on the subject.)

(28) I had a coffee. (Then,) you had a coffee.

(29) [[[You]$_F$ had a C_7 coffee] $\sim C_i$]

a. ✓Presupposition of $\sim$

b. ✓Minimize Focus

c. ✓Expone Focus

5.3.4 Well-formedness of *another*

Constraints on focus distribution and realization make sentences with indefinites ill-formed when describing a second-occurrence event. Incidentally, such contexts are also ones where the requirements of *another* — that the context makes salient some other individual that is in the extension of the NP restrictor — will be met. Thus, the utterance of the first sentence in sequences like (24) not only makes a subsequent sentence with the plain indefinite infelicitous, it also makes a sentence with *another* felicitous. Moreover, the *other* portion in *another*, defined in (30), can be taken to play the same role in sentences like (31-b) as the covert restrictor in the unacceptable (24-b) with the plain indefinite.

(30) $[\![\text{other}_i]\!]^g = \lambda P_{\langle e,t\rangle} : P(g(i)).\ \lambda x_e\ .\ x \neq g(i) \wedge P(x)$

(31) a. I had a coffee.

b. (Then,) I had another coffee.

Other, on the definition above, has an adjectival meaning. It combines with a predicate-denoting NP as its argument and (*i*) triggers an anaphoric presupposition that the context provide a suitable antecedent that is in this set and (*ii*) returns a subset of the original set that excludes this salient individual. It is in this latter respect that *other* is similar to the implicit restrictor discussed in the previous subsection. A crucial contribution of either is the further restriction of the domain of quantification to exclude some contextually salient entity.

With regards to focus, things proceed in a similar fashion as earlier. Being the only novel constituent in the sentence, *other* is F-marked. The focus-structure for (31-b) is as

in (32). This structure is superior to any of the candidates for the plain indefinite variant in that all three of requirements of focus under consideration are met. The focus-value for the sentence will be a set of alternatives derived by substitution or deletion of the F-marked constituent *other*. An antecedent for the focus anaphor that is a member of this set is made salient by the preceding utterance of (31-a). No other F-distribution will satisfy the requirements of $\sim$; MINIMIZE FOCUS is satisfied. Finally, focus can be exponed on *other*; the modifier does seem to carry stress in sentences like (31-b).

(32) [[I had an[other$_i$]$_F$ coffee] $\sim C_i$]

a. ✓Presupposition of $\sim$
b. ✓Minimize Focus
c. ✓Expone Focus

The core contrast has now received an explanation. We have accounted both for why in certain contexts, a sentence with *a* is unacceptable and why a structure with *another* is acceptable. The account diverges fundamentally from an MP-approach is in its treatment of *another* as a rescue strategy. That is, the (in)felicity of a sentence with *a* does not depend on the existence of a parallel structure with *another*. We expect, then, that a variety of expressions can do the same job as *another*, so long as there is a supportive context. For instance, in a situation where the order of events is relevant and clear, as in the examples in (33), *a second* feels as natural as *another*.

(33) I ran a lap, but I still had energy left, so...
I ran a second lap.

Non-presuppositional modifiers like restrictive relative clauses can also do the same, as illustrated by (34-a). In fact, you might add any contextually relevant modifier and that seems to do the trick.

(34) a. This morning, I phoned a politician. Later, I phoned a politician that I really despise.
b. This morning, I phoned a politician. #Later, I phoned a politician.

What is arguably special about *another* is that all its sole contribution is the exclusion of

some salient entity from the domain of quantification. Compared to other expressions that may serve a similar function, e.g. *a second*, the contextual requirements *another* imposes is maximally minimal.

5.3.5 Extension to other environments

One of the reasons for rejecting an MP-account of the oddness of indefinites was the observation that similar kinds of oddness effects arise with sentences which do not contain an indefinite. Cases like (35) and (36), where the additive particle *again* seems obligatory, illustrate the generality of the phenomenon in question.

(35) A: What did you do before lunch?
B: I worked.
A: Well what did you do after lunch?
a. #I worked.
b. I worked, again.

(36) A: Where were they in the summer of 2016?
B: They were in Cape Cod.
A: Where were they last summer?
a. #They were in Cape Cod.
b. They were in Cape Cod, again.

On the account developed here, cases like these can receive a parallel treatment as those involving indefinites. What drives the ill-formedness of certain sentences, on the present account, is the fact that the only F-markable constituent in the structure is silent. In this section, I show how this is also at the heart of the problem with sentences like (35-a) and (36-a).

Before we get to formal matters, some preliminaries are in order. In order to be able to extend our account to cases like (35) and (36), which are about different time points at which two identical events took place, we must enrich our semantic framework to include a basic type for time intervals, type i. Tenseless phrases — bare VPs or vPs — denote predicates of times, $< i,t >$, which combine with a Tense morpheme to yield a truth-value. I assume a quantificational analysis of tense (Prior 1957, 1967, Montague 1973, Dowty 1979, etc.),

where it introduces a temporal quantifier. The PAST tense morpheme introduces existential quantification over preceding times. A sentence in the past tense, such as (36-a), could be taken on this analysis to convey the following meaning:

(37) $\exists t'[t' < \text{now} \wedge \text{they were in Cape Cod at } t']$

Following Ogihara (1995, 1996) and Musan (1995), I assume that just like nominal quantifiers, these temporal quantifiers may be contextually restricted. That is, the domain of quantification (a set of times) can be further confined to some salient interval in accordance with the context. The necessity of such restrictions is demonstrated by sentences like (38). If a sentence in past-tense represents an existential claim about a prior time, B's response in (38) would be trivially true after the first time in life that she ate lunch. Clearly, we don't find B's utterance uninformative in this way; rather, it seems to be conveying that B has eaten lunch that day.

(38) A: Did you eat lunch?
B: Yes. I ate lunch.

Technically, this type of context-dependency can be modeled in exactly the same way as in the nominal case — via a restrictor variable that the temporal quantifier takes as its first argument. In this case, the C-variable must denote predicates (or properties) of times, rather than individuals. As illustration, B's response in (38) might be represented as in (39), where the contextually-supplied value for the C-variable might be, e.g. the set of time intervals that overlap with lunch-time that day. This set is intersected with the predicates of times denoted by the vP, and this more restricted set serves as the domain of quantification for the Tense-operator.

(39) a. $[_{TP}$ [PAST C_4] $[_{vP}$ I eat lunch]]
b. $g(4) = \lambda t.\ t \in \{t': t' \subseteq \text{today's-lunch-hour}\}$
c. $[\![(39\text{-a})]\!]^g = \exists t'[t' < \text{now} \wedge t' \in \{t'': t'' \subseteq \text{today's-lunch-hour}\} \wedge \text{B ate lunch at } t']$

With these assumptions at hand, let us turn to the analysis of cases seen above. I will use (35) to illustrate. The first and second statements by B in (35) express claims about the past. Given our treatment of the past tense as an existential quantifier, the domain of

quantification must be appropriately restricted in (35-a) so that the sentence can be informative. In other words, the sentence will be construed with a C-variable, which, given the preceding question, may receive as its value the set of times after lunch.

Notice that now we are in the same situation as before. The most restrictive, felicitous assignment of focus involves F-marking on the covert restrictor, as in (40). However, EXPONE FOCUS cannot be satisfied as the restrictor is silent.

(40) [[I PAST $[C_4]_F$ worked] $\sim C_i$]

a. ✓Presupposition of $\sim$

b. ✓Minimize Focus

c. ✗Expone Focus

In such environments, additive *again* plays the same role as *other* in sentences with indefinites. *Again* is a temporal adverb that indicates repetition. It comes with a presupposition about a prior time at which the situation described occurred. Thus, a sentence like (41) is felicitous only if the context makes clear that (41-a) is true. Furthermore, the content of the presupposition triggered by *again* is anaphoric (Soames 1989; Heim 1990; Kamp & Rossdeutscher 1994; Fabricius-Hansen 2001; van der Sandt & Huitink 2003; Beck 2006): we should be able to identify *the* relevant prior time that the presupposition triggered by *again* makes reference to.

(41) Dana won the race, again.

a. **Presupposition:** Dana has won the race before.

b. **Assertion:** Dana won the race at a time other than that earlier time.

The assertive contribution of *again* is a restriction of the time intervals under consideration to those distinct from this presupposed earlier time. In this regard, it is similar to *another*. But the distinctness implication contributed by *again* is stronger than that of *another*. *Again* does not just assert non-overlap between the two times under consideration. There is, in addition, a temporal order that is imposed: the time interval referred to in the presupposition must be an earlier one. This is illustrated by the examples in (42) from Heim (1990). The sentence in (42-a), but not (42-b), leads to the inference that John's birthday precedes Mary's birthday. Since the two sentences differ only in the presence/absence of *again*, this inference must be contributed by *again*.

(42) a. We will have pizza on John's birthday. So we shouldn't have pizza again on Mary's birthday.

b. We will have pizza on John's birthday. So we shouldn't have pizza on Mary's birthday.

I assume the entry for *again* as in (43), where it is a temporal modifier.

(43) $[\![\text{again}_i]\!] = \lambda P_{\langle i,t \rangle}.\ \lambda t_i : P(g(i))\ .\ t \in P \wedge t > g(i)$

The adverb attaches to a tenseless bare *v*P, which denotes the predicate of times, ϕ, that it then modifies. The result of modification by *again* is two-fold: (*i*) a presupposition that ϕ was true at some contextually salient time and (*ii*) the restriction of this predicate to a set of times that *follow* this contextually salient time. When the restricted predicate composes with past tense, the result is an existential claim that there is some preceding time point in this set that satisfies ϕ.

On this treatment of *again*, it — like *other* in *another*-sentences — does overtly what the covert restrictor would do in the additive-less sentences. A structure like (35-b) would have the representation in (44). The focus-alternatives for this structure will be those derived via substitution or deletion of the F-marked adverb. B's first sentence — *I worked* — is a suitable antecedent for the focus-anaphor. F-marking on the adverb is, moreover, minimal and phonetically realizable. Thus, the constraints on focus that need to be satisfied for the felicity of the sentence are indeed satisfied.

(44) $[[\text{I worked again}_F] \sim C_i]$

a. ✓Presupposition of $\sim$

b. ✓Minimize Focus

c. ✓Expone Focus

To recap, what goes wrong in cases like (35) and (36), as well as the ill-formed indefinite cases e.g. (24), is exactly the same: the mutually unsatisfiable need to exclusively F-mark a silent element and to phonologically realize the corresponding constituent as prosodically prominent. This means that the ill-formedness of structures without *other* or *again* and the insertion of these expressions are orthogonal. In fact, as briefly remarked earlier, the "remedy" for the oddness effect may be variable. The coffee examples from earlier

can be rescued by the insertion of *another* (45-a) or, for that matter, by *again* (45-b). On the present account, the main difference between the two rescue strategies below (beyond the specific presuppositions the speaker is committed to) lies in the nature of the alternatives being evoked.

(45) I had finished my coffee.

a. So I had another coffee.

b. So I had a coffee again.

5.3.6 Summary

In this section, I developed an account of the infelicity of indefinites in *another*-environments that did not make reference to competition with *another*. Instead, I argued that the oddness effects with indefinites fall out from an independently needed theory of focus. *Another* is nothing more than a rescue strategy; there are others besides this particular expression.

5.4 Implications for child language

We now have a new outlook on the phenomena of interest. The ill-formedness of the (a) sentence in (46) is due to competition with the presuppositionally stronger (b) variant; the ill-formedness of the (a) sentence in (47) is not. Rather, the oddity of the latter results from the failure to satisfy independently motivated constraints on focus.

(46) Context: I have two children.

a. #I brought all of my children to the party.

b. I brought both of my children to the party.

(47) Context: I had a coffee.

a. #Then, I had a coffee.

b. Then, I had another coffee.

In our experiments, children showed an adult-like preference for sentences like (47-b) over (47-a). In contrast, they were unable to choose between sentences like (46-a) and (46-b). Thus, aspects of grammar that govern the preference for (47-b) over (47-a) is in place

by the preschool age range, unlike those that are at play in the contrast in (46). In this section, I want to consider in more depth what these findings tell us about the development of presupposition and about pragmatic development more broadly.

5.4.1 What children know

Experiments 2A and 2B of Chapter 4 revealed adult-likeness in children's choices between *a* and *another* sentences. Most relevant for our purposes is the fact that children rejected sentences with *a* in *another*-environments. Their preferred productions in these environments involved variants with *another*, paralleling adults.

Children's ability to rule out indefinite sentences in "repeat-occurrence" environments shows us that they have command of the principles of focus-placement which render structures like (47-a) ineffable. They appear to have knowledge of the constraints imposed by the $\sim$-operator — i.e. they know what *must* be F-marked in a structure — and how this focus-placement affects pronunciation. This is largely consonant with what we already know about children's developing abilities with focus. Previous experimental results suggest that children mark focus in an adult-like manner very early on. For example, Hornby & Hass (1970) showed that when describing a sequence of two pictures differing by only one feature, children appropriately stressed the word that carried the contrastive information in the description of the second picture (e.g. a boy vs. A GIRL is riding a bike). Using a similar method, MacWhinney & Bates (1978) found that the use of stress to mark contrast was well-established and consistent by the age of three. More recently, Müller, Höhle, Schmitz & Weissenborn (2005) conducted a study where SVO sentences were elicited from 4-and-5-year-olds in a question-answer task. The results support the conclusions from the earlier studies: in the critical trials, children produced the constituent corresponding to the wh-word with a higher mean pitch than in control trials, where the same expression in the same position was not an answer to the question.

The present studies go beyond these existing findings in two significant ways. First, whereas the previous studies demonstrated early knowledge of what must bear focus, the studies reported here show that children also know what must *not* be focused. Recall that on the present account, the ill-formedness of indefinite sentences in *another*-environments results from an interaction between various constraints, one of which is MINIMIZE FOCUS. The fact that children reliably reject such sentences is evidence, albeit indirect, that this

constraint is in place.

Secondly, on this account, an understanding that the plain indefinite is unacceptable in certain environments is independent of an understanding of what to produce instead. This leads to a different set of developmental predictions compared to an MP-competition account. More specifically, the present account would be consistent with a two-step acquisition path where children initially recognize the unacceptability of the relevant indefinite sentences, but fix the problem in non-adult ways. For instance, rather than use *another*, they might choose to adjust their contextual assumptions in a way that would allow for the F-marking on something other than the silent restrictor. What our experimental findings suggest, however, is that by the age of 3, children also have the requisite rescue strategies in place: children's preferred response in the relevant environment involved *another*.[7]

A final point worth noting that if this analysis is on the right track, children's success in ruling out indefinites in repeat-instance environments can be taken to demonstrate their understanding of a broader phenomenon. Children who succeeded in this task are predicted to show comparable success ruling out sentences like (48-a).

(48) A: What did you do before lunch?
B: I worked.
A: Well what did you do after lunch?
a. #I worked.
b. I worked, again.

5.4.2 What children don't know

At the same time that young children display sophistication in their treatment of sentences with indefinites, they behave in a strikingly non-adultlike manner with *all*. Concretely, they were happy to produce and accept sentences with *all* in contexts where *both* would have been felicitous. We established in the previous chapter that unlike *a* vs. *another*, the choice between *both* and *all* is governed by competition for MP. Children's difficulties making this choice in an adult-like way — even when they seemingly know the meanings of the items in question — point to difficulties with MP as a principle governing utterance choice.

[7]This might be a richer interpretation than warranted. The fact that our experiments privileged *another* — by priming *another* in the production study and by presenting *another* as the alternative description in the Felicity Judgment study — may have inflated their use of this particular rescue strategy.

What could be behind these difficulties? One possibility is that children in this developmental stage lack MP altogether. That is, they simply do not have a principle that governs the choice between contextually-equivalent, but presuppositionally-divergent alternatives, and thus, use them interchangeably. If so, the development of this principle of language use would be qualitatively different from the principle that was the focus of the first half of the dissertation — the common ground requirement on presuppositions. The latter seems to be in place early and in spite of the noisy input that children are privy to. The development of this felicity condition on presupposition could thus be thought of as an illustration of the Poverty of the Stimulus argument: children demonstrate underlying knowledge of the principle in spite of experience which fails to provide sufficient evidence for the principle. By contrast, the possible lack of command of MP could serve as an illustration of an Abundance of the Stimulus argument. Because of adult speakers' adherence to MP, children never hear *all* used in a context that makes clear that the domain of quantification has exactly two members. Nevertheless, they tolerate *all*-sentences in *both*-contexts. If this is indeed due to a lack of MP, the input may not ultimately be very helpful in the development of this principle. Instead, there must be a maturational shift in some relevant component of grammar or language use between birth and $\sim$6 years of age, which is the age at which children in our experiments seemed to be recruiting MP in an adult-like way.[8]

The conclusion that knowledge of MP is altogether missing from children's grammars might be too strong, however. One cause for concern is Wexler's (2003) observation that children do not over-use indefinites in environments where existence can be taken for granted (we return to this data-point later in this section). I therefore want to argue for a somewhat weaker alternative interpretation of the experimental results. Children may very well have the underlying principle in place. However, they could find it difficult to always deploy it in adult-like ways for the same reasons, as I argued in Chapter 2, they have difficulties meeting the common ground requirement despite knowing that it is in force. Specifically, a general problem coordinating on what is common ground might govern both their over-use of certain presuppositional items (e.g. the definite article) as well as their

[8]The precise statement of what is delayed in development will vary with diverging approaches to MP. For example, recently, there have been attempts to reduce MP to a grammatical theory of implicatures (Magri 2009; Singh 2011; Marty 2017): MP-effects are simply exhaustification at the level of presupposition. A formal implementation of this idea is found in Marty (2017). The operator responsible for exhaustification, EXH, is treated as a partial function, defined only if the presuppositions of the contextually-equivalent alternatives are false. On this approach, a child who lacks MP may be lacking the right semantic representation of this operator.

under-use.

Consider what adult-like application of MP entails. Knowing the nature of MP and knowing the meanings of the relevant competitors will only get the child so far. Beyond this, the child must be able to ensure that the context is one that meets the criteria for MP to kick in. Specifically, it must be established that the presuppositions of the stronger competitor are met, and moreover, that the competing alternatives are contextually equivalent. As discussed in Chapter 2, this task is made difficult by the fact that the common ground of conversation is rarely, if ever, settled explicitly. As a result, speakers are always working under some degree of uncertainty about what is mutually known or accepted. Not only are adults adept at solving this coordination problem in the face of such uncertainty, even if a mistake is made, they know how the situations may be remedied — unmet presuppositions may be accommodated. Consequently, in most circumstances where the speaker knows the presupposition p of the stronger competitor is true, it would be rational to adhere to MP: p is either common belief or will be made common belief by the fact of speaker's uttering the sentence (*cf.* Schlenker 2012). However, the costs associated with maximizing presuppositions may be very different for children. As suggested by the findings in Chapter 3, children do not have the same expectations about accommodation as adults. For them, presupposing something that is not common ground may be very well result in a conversation breakdown. This could lead to a certain amount of over-cautiousness on the part of young children. From the child's perspective, the utterance of a sentence with an unmet presupposition poses a more serious problem than a failure to adhere to MP, given that the utterance of a presuppositionally *weaker* utterance could still lead to a successful context update. If this is right, then children's over-use of *all* in our experiments is not due to a lack of sensitivity to MP, but because they deemed it the safer option compared to the stronger *both*.

Before concluding, it is worth pointing out that the connection between accommodation and MP plays an important role in Schlenker's (2012) theory of MP, where MP is taken to derive from Gricean Maxim of Quantity. The starting point for his approach is the observation that in circumstances involving presupposition accommodation, a sentence may be more informative than an assertively equivalent one. Maxim of Quantity would then require a speaker to choose a sentence S over a weaker sentence S' not due to its assertive contribution, but because of its presuppositions. This special case is extended to situations where the presuppositions of the relevant sentence is common ground by invoking a notion

of *Fallibility*: even if a proposition was at some point t entailed by the common ground, there is always a non-zero chance that the addressee has forgotten (or isn't adequately attending to it) at time t+1 when the utterance is being made. If agents are fallible in this sense, there is some expected utility in reintroducing the presupposition into the common ground, even when it was previously common knowledge: there is a non-zero chance that the information is informative. On this account, mastery of accommodation is then a prerequisite for mastery of MP, because it is precisely the expectation that a fallible agent will accommodate informative presuppositions that motivates presuppositional maximization. If this approach is on the right track, a lack of sensitivity to MP is precisely what we would expect given the findings in Chapter 3.

5.4.3 Competition effects in child language

Divergent acquisition paths

In this chapter and the last, we encountered two types of competition effects. The first, *Maximize Presupposition!* has been a main focus of our discussions. The second is MINIMIZE FOCUS, a principle that compares structures with diverging Focus distributions and chooses the most restrictive one compatible with the context. If what we have said so far in these chapters is on the right track, an important conclusion that follows is that children have trouble with the first type of competition effect, but not the second. We must now ask: what are the properties of MINIMIZE FOCUS that facilitate its earlier development compared to MP?

Both MINIMIZE FOCUS and MP involve comparing forms and selecting the optimal candidate. There are various aspects of MINIMIZE FOCUS, however, that make this task easier compared to MP. First, the issue of determining whether two structures compete is trivial in the case of MINIMIZE FOCUS. If alternative-generation is indeed constrained by something like structural complexity, one of the tasks when determining whether a structure S' competes with S involves ensuring that S' is at most as complex as S. The complexity requirement will always be met in the case of MINIMIZE FOCUS: the competitors under consideration are the variants of the *same* structure with different constituents bearing F-marking. Put differently, the competitors for MINIMIZE FOCUS are invariably equally complex.

A second, related aspect of the acquisition task where MINIMIZE FOCUS and MP di-

verge is with respect to their dependence on lexical knowledge. The presence vs. absence of a piece of relevant vocabulary affects whether or not the use of another piece of the lexicon gives rise to MP-effects (Matthewson 2006; see also Deal 2011 for similar claims with regards to scalar implicatures). Consequently, a prerequisite for full command of MP is knowing the structure of the lexicon of one's language. In order for a child to recognize that the use of an expression X makes a true sentence unacceptable in a context c, she must know, first and foremost, that there is a stronger competitor Y that is usable in c. If at some point in development, the child lacks this knowledge, she will find X acceptable in c irrespective of her knowledge of MP.[9]

The learning task is different with MINIMIZE FOCUS. There are two elements of the lexicon of the language that the child needs to have acquired: the feature F and the focus-interpretation operator $\sim$. Because focus is intrinsically related to general rules governing cooperative discourse, a reasonable assumption is that every language makes use of this machinery. In Roothian terms, this could very well mean that the syntactic feature F is part of the featural inventory of every language, and the operator $\sim$ is part of the lexicon of every language. It is plausible then that these are aspects of language that the child does not need to learn.[10] In turn, the scope of the application of MINIMIZE FOCUS is maximal: every discourse involving a declarative statement constitutes potential evidence for this principle.

Different, but the same?

The picture that emerges from the above discussion is this: MP and MINIMIZE FOCUS represent two different types of competition effects in natural language, whose developmental trajectories vary accordingly. This picture, however, is complicated by the fact the two principles have been argued to be related. More specifically, a number of authors have posited that Minimize Focus is a species of *Maximize Presupposition!* effect (Truckenbrodt 1995; Sauerland 2005b; Wagner 2005; Mayr 2010; Goodhue 2018). The conceptual motivation for a unification of MINIMIZE FOCUS and MP is clear. Both are competition effects where the candidate that imposes the strongest requirements on the context is selected as the win-

[9]This alone does not offer an explanation for the experimental results, as already pointed out. The control conditions in the experiments demonstrated that children have the right semantic representations for *both* and *all*.

[10]In fact, given that these are both covert elements at least in English, it is not obvious how the English-acquiring child could learn it in the first place.

ner, and a unification would be parsimonious. On the other hand, the conditions imposed by focus are about the salience of its antecedents — that an antecedent belonging to the focus-value of the prejacent is made contextually salient — and not about their truth being shared knowledge. Because this requirement imposed by $\sim$ is world-independent — whether some sentence is a member of the alternative-set is a matter that is either logically true or logically false — the metric of strength that MP draws upon, *presuppositional strength* (49), simply does not apply.

(49) *Presuppositional Strength*
ϕ is presuppositionally stronger than ψ iff $\{w: \psi(w) = \#\} \subset \{w: \phi(w) = \#\}$

Arguably, structures with less F-marking impose stronger contextual requirements because they admit fewer assignments that render the structure felicitous. To see this, consider the pair in (50).

(50) a. [[Dana admires [Sue]$_F$] C_7 $\sim$]
b. [[Dana [admires Sue]$_F$] C_7 $\sim$]

The presupposition associated with (50-a) is that the value assigned to the focus-anaphor by the contextually supplied assignment function, $g(7)$, be a member of its focus-value, a set of alternatives of the form, 'Dana admires x'. The presupposition associated with (50-b) is that $g(7)$ is a member of the set of alternatives of the form, 'Dana V-s x'. A structure like (50-b) has an interpretation relative to an assignment function g which maps 7 to the proposition *that Dana dislikes Lee*, but (50-a) does not. Put differently, the structure in (50-a) may be thought of as being *anaphorically* "stronger" than (50-b), where anaphoric strength is defined as in (51).

(51) *Anaphoric Strength*
ϕ is anaphorically stronger than ψ iff $\{g: [\![\psi]\!]^g = \#\} \subset \{g: [\![\phi]\!]^g = \#\}$

In other words, while minimizing focus does not correspond to "defined at fewer worlds", it does correspond to "defined at fewer assignments". Making formal use of this notion of anaphoric strength, however, requires modifications to the standard theory of *Maximize Presupposition!*, as well as the semantic and pragmatic machinery we have been assuming thus far. Below, I will briefly sketch one way of refining our assumptions such that the

two competition effects can be subsumed under a single "umbrella" principle requiring that speakers maximize links to the context, whether it be presuppositional links (i.e. reminders about the sort of worlds still under consideration) or anaphoric links (reminders about the conversational record).

We have thus far been working with the assumption that the meaning of a sentence is to be identified with a set of worlds, the worlds in which that sentence is true. The context was taken to be a set of worlds, such that an update of it with a proposition results in a smaller set of worlds. A simple enrichment to this system would involve treating propositions not as a set of verifying worlds, but a set of verifying world-assignment pairs $\langle w, g \rangle$ (see e.g. Heim 1983). Let us call these ordered pairs *information states*, written s. We write: $s_w = w$, $s_g = g$. Correspondingly, the Stalnakerian model of the context-set must be enriched from a set of worlds compatible with the participants' common knowledge to now a set of information-states. We will continue using the symbol c to represent such sets. Intuitively, a context now is a set of all the ways the world and discourse model might be, in view of the mutual beliefs and conversational record of the discourse participants. An assignment-function is generally thought to be partial, with a just a few variables in its domain. We assume that every assignment in a given context has the same domain. If s_g assigns no value to an index i, then $s_g(i) = s(i) = \#$.[11]

Equipped with this enriched system, we can now devise a general principle that demands that one choose, from among a set of alternatives, the felicitous sentence that is compatible with the smallest set of world-assignment pairs. For lack of a better term, we might think of this as "linking strength":

(52) *Maximize contextual linking*

If two sentences ϕ and ψ are alternatives whose presuppositions are satisfied in c, and

a. ϕ and ψ are contextually equivalent relative to c, and

b. $\{s\colon \psi(s) = \#\} \subset \{s\colon \phi(s) = \#\}$

[11]There will be inevitable further ramifications of this type of enrichment that I will simply gloss over here. For instance, whereas the Stalnakerian update of a context-set always corresponds to elimination of worlds (i.e. a monotonically decreasing context set), in the more fine-grained conception of the context-set, we can conceive of other types of updates. An obvious one is expanding the domain of the assignment functions, where the world-assignments pairs in the context are updated to pairs of worlds and extended assignments, where the extended assignments are constrained by the old ones, but add on possible values for new referents.

ϕ should be preferred to ψ in c

This principle would reproduce the effects of *Maximize Presupposition!*, while also imposing requirements based on possible assignments. Specifically, the principle would also require that the contextually felicitous sentence which would have an interpretation relative to the fewest assignments be favored. Beyond MINIMIZE FOCUS, a principle along these lines may be needed independently to account for preferences for anaphora in various domains, e.g. use of pronouns, ellipsis, etc. For instance, (52-b) would have something to say about why we prefer the sentence in (53-a) over (53-b) given the context in (53). Whereas the sentence in (53-a) only has an interpretation relative to assignments with 3 in its domain, (53-b) is not assignment-dependent and so would be defined under any assignment. The principle in (52), in turn, would require that whenever felicitous, (53-a) be used instead of (53-b).

(53) I saw John today.

a. He_3 looked angry.

b. John looked angry.

If there is indeed an umbrella principle such as MC that leads both to MP-effects as well as MINIMIZE FOCUS, children's apparent command of the latter would be evidence that the general principle itself is in place. The divergence between the two types of effects remains to be explained, but to start, we might consider an important conceptual difference between anaphoricity and presuppositionality. At various points throughout the dissertation, including in §5.4.2, I raise the possibility that children have more difficulties coordinating on the common ground. With respect to MP, they may be unsure of whether the presupposition of the stronger competitor is in fact shared knowledge. When combined with an inability to shift the context in necessary ways when faced with a missing presupposition, this uncertainty leads to an under-application of MP. Anaphora, by contrast, does not involve accessing facts about the world; rather, it involves accessing information about the history of the discourse. That is, they need not reason about what their interlocutor knows, but rather, what they may be 'attending to'. This distinction might be key to the child, who is likely much more confident in her assessment of when an anaphoric link is possible compared to when a proposition is mutually accepted. The former does not require reflecting or

reasoning about another agent's mental states, but only the consideration of facts about the conversational record.

This distinction between presuppositionality and anaphoricity might also help reconcile the experimental findings reported here and Wexler's observation about definite/indefinite use. The relevant facts, once again, are as follows: children have difficulties maximizing presupposition with *both* and *all*, but, if Wexler is right, they seemingly have no difficulties maximizing presupposition with *the* and *a*. If this is a stable contrast, it is a puzzling one. If utterance choice in both cases is governed by a requirement to choose the presuppositionally strongest felicitous sentence, nothing I have said so far would suffice in explaining why children over-use *all* but not *a*. However, a crucial difference between *the* and *both* is that the former is arguably ambiguous between anaphoric and non-anaphoric uses (Schwarz 2012). In so-called anaphoric uses the interpretation of a definite seems to depend on that of a preceding expression, typically an indefinite noun phrase. Thus, in (54-a), the definite description *the book* is understood to be the very book that John was said to have bought in the first sentence. Moreover, anaphoric definite descriptions, like pronouns, can be bound variables, as well, as shown by (54-b).

(54) a. Mary bought a book and a magazine. The book was expensive.
b. John gave every child a gift that he himself enjoyed more than the child.

If the environments in which children seemingly adhere to MP with *the/a* are ones in which *the* can receive an anaphoric construal, the source of their adult-likeness might be the same as with MINIMIZE FOCUS.

5.5 Conclusion

This chapter began with the question of what blocks indefinites in environments where *another* is felicitous. I proposed that the oddity of indefinites follows from principles governing focus. In certain environments, where *another* is incidentally felicitous, a sentence with an indefinite lacks a licit focus-assignment, resulting in ineffability.

Crucially, the idea that sentences involving *a* and *another* compete for MP was abandoned. Nevertheless, the account made use of another type of competition, MINIMIZE FOCUS, where different possible focus-assignments for a structure are considered and the

representation with the most restrictive focus-distribution is chosen. This set up the second part of the chapter, which considered issues relating to the development of seemingly similar competition effects. I suggested various reasons why MINIMIZE FOCUS shows a faster acquisition trajectory compared to MP, including its potential universality and lack of susceptibility to idiosyncrasies of the lexicon. Finally, I speculated on the possibility that MP and MINIMIZE FOCUS ultimately come down to the same thing: a general preference for structures that maximize links to the conversational context. The divergence in developmental trajectories may then have to do with children's difficulties assessing what might be common knowledge versus part of the conversational record. A full assessment of these ideas, and a more thorough investigation of what is shared and distinct between the two principles is a broader research program that I must leave for future work.

Chapter 6

Conclusions

To conclude, I'd like to offer a brief summary of the preceding chapters, discuss its implications for models of presupposition and models of pragmatic development, and speculate on some directions for future research.

6.1 Summary of findings

Overall, the thesis aimed at arriving at a better understanding of children's knowledge of presuppositions and anti-presuppositions. Specifically, two broad questions were addressed:

1. Do children know what the conversational context must look like in order for the use of a presuppositional sentence to be appropriate? Specifically, do they know the *common ground requirement* — the requirement that presuppositions be previously established common knowledge — and do they know how this requirement can be violated?

2. Do children know the circumstances under which the use of a presuppositionally stronger sentence over an otherwise equivalent, but presuppositionally weaker, alternative is forced? That is, are they sensitive to *Maximize Presupposition!* (Heim 1991) as a principle governing utterance choice?

The Stalnakerian view of presupposition invokes a constraint on the common ground, which requires "logical priority" of presupposed content. The most obvious way in which

this priority shows up in language use is as temporal priority — that is, presuppositions are *pre*suppositions of the interlocutors. However, the formal requirement can also bet met in a more nuanced and less straightforward way: via accommodation, where listeners adjust the context *post-hoc* so as to meet the requirements of an already uttered sentence. The existence of these two systems poses serious challenges to the learner. The formal requirement that presuppositions be entailed by the context prior to assertion is not always transparently met in everyday conversation and thus, the child's input. She must still somehow extract the right principle from a set of data that doesn't look like it adheres to it.

The difficulty with (2) lies in identifying all and only those environments where *Maximize Presupposition!* applies, a difficulty reflected in the fact that there is often disagreement in the literature about what types of oddness effects are in fact anti-presuppositional effects. Consequently, even if the child is biased to posit that a principle like *Maximize Presupposition!* is operative in grammar, the non-trivial task of figuring out whether it applies in a given environment lies ahead.

In spite of these apparent challenges, the findings from the studies here reveal in preschool aged children remarkable sophistication in at least some of the skills implicated in presupposition use. We find also an equally illuminating lack of command with others. In what follows, I recapitulate some of the core findings.

In the first half of the dissertation, I examined participants' biases about the intended listener of an uttered sentence as a proxy for their biases about the state of the conversational context. In Chapter 2, it was shown that 4-to-6-year olds, like adults, preferred that the presuppositions of an uttered sentence be entailed by the context prior to the utterance of that sentence: when given a choice between two possible addressees, they displayed a strong bias towards the one who already knew that the presupposition holds. This bias, moreover, was uniform across triggers that resist accommodation, e.g. *too*, and those that readily allow for accommodation, e.g. definite descriptions. These findings thus indicate that an important aspect of presupposition use — the common ground requirement — and in turn, the crucial distinction between asserted and presupposed content in natural language, is understood by children at least by the early preschool years.

Chapter 3 focused on apparent counter-examples to the common ground requirement. Speakers sometimes violate the common ground requirement and use presuppositions to introduce information that is new to the listener; cooperative listeners accommodate the novel presupposition by adjusting their beliefs to bring it in line with the requirements of the ut-

tered sentence. With respect to their tolerance for such informatively used presuppositions, children diverge from adults. The experiments in Chapter 3 created a conflict between the use conditions governing presuppositions — that they are common knowledge — and assertions — that they are not common knowledge. The choice was between (*i*) a potential addressee who knew both the presupposed and asserted content of an uttered sentence vs. (*i*) a potential addressee who knew nothing. In such circumstances, adults chose the latter, indicating a preference for violating the use condition on presupposition over that governing assertion (presumably because accommodation can remedy violations of the former). Children up until age 6, on the other, were at a loss in this situation. They chose at random, suggesting that they treat the pragmatic conditions governing assertion and presupposition on par and equally inviolable. Together, the findings from Chapters 2 and 3 suggest a developmental path where the formal requirement — that presuppositions be *pre*suppositions — is acquired before an understanding *that* this requirement can sometimes not be met in practice, and *how* competent language users can tacitly make adjustments to allow the conversation to move forward.

Chapter 4 turns to *Maximize Presupposition!* (MP), a pragmatic principle that dictates that one choose, from a set of contextually equivalent competitors, the presuppositionally strongest alternative compatible with the context. I examined sensitivity to this principle in 3-to-6-year-olds with two environments commonly thought to implicate MP-competition: (*i*) the preference for *both* over *all* when the cardinality of the domain is exactly two (*ii*) the preference for *another NP* over *a NP* when there is a different salient entity that satisfies NP other than the witness of the current statement. Our results revealed an unexpected non-uniformity across environments: children were adult-like in their preference for *another* over *a*, but found *both* and *all* equally acceptable in situations where adults strongly preferred *both*. I argued that this non-uniformity should be taken as indication that the two environments are underlyingly different. Specifically, I suggested that unlike *both* and *all*, *a* and *another* do not directly compete for *Maximize Presupposition!*.

Chapter 5 pursued this idea, and developed an alternative analysis for the oddness of indefinites in *another*-environments. I derived the oddness effects from an independently needed theory of focus. The problem with these sentences, in a nutshell, is that they lack a viable focus-structure. More concretely: In environments where the claim is about a second occurrence of an event type known to have occurred previously, a sentence with an indefinite is either uninformative (and thus ruled out for assertability reasons) or restricted by a covert,

but syntactically real, restrictor pronoun. Principles of focus ensure that the restrictor bears Focus-marking, and moreover, that it is the *only* constituent that bears Focus-marking. F-marking on the restrictor is necessary to meet the presuppositions of the focus-interpretation operator, $\sim$. The latter restriction, that nothing else bear Focus, is due to a different principle that leads to competition, MINIMIZE FOCUS, which forces the choice of a representation with the minimal felicitous F-distribution. The problem, however, is that because F-marking cannot be prosodically realized on silent elements, the resulting structure will be ineffable. On this analysis, *another*, along with a range of other additives, are rescue mechanisms for circumventing this situation.

The upshot of this discussion was that the relationship of *another* to *a* is fundamentally different from that of *both* to *all*, and it should then not surprise us that adult-likeness in the two environments emerges at different points. Children's success in ruling out *a*-sentences in the right environments tells us many things. For instance, they know the relevant properties, including the presuppositions, of the $\sim$-operator. Moreover, they know and can deploy the principle MINIMIZE FOCUS and identify the best candidate out of the various competitors. They have difficulties, however, with *Maximize Presupposition!* as the principle at the heart of another type of competition. In trying to explain this divergence, I pointed to various possible reasons why MINIMIZE FOCUS may pose fewer challenges to the learner: it is at play in every utterance, it does not demand knowledge of the potentially idiosyncratic lexicon of the language (not every language has a *both*, for instance). Alternatively, the key difference may lie in children's developing abilities evaluating assessing world-dependent and assignment-dependent phenomena. MINIMIZE FOCUS, like *Maximize Presupposition!*, could be an instantiation of our general tendencies to signpost links to the context, but whereas the latter involves signaling overtly what set of worlds are still under consideration, the latter involves marking anaphoric links, i.e. what has already been *said*.

6.2 Theoretical Implications

No aspect of presupposition has escaped theoretical debate and controversy. Part of the reason for this is that the empirical facts are far from clear and speakers' intuitions often seem unreliable (Soames 1976; von Fintel 2004). As Soames (1976) puts it, "logical presupposition is not a relation about which we have direct intuitions, but rather is a theoretical

construct that can be used to account for certain inferences." Given this state of affairs, results of studies in child language offers a new and much-needed kind of empirical evidence that can help arbitrate among theories of presupposition.

In this regard, there are things to be learned from those points where children show early mastery as well as places where children show difficulties. A major point of contention in the literature on presupposition, discussed at length in Chapters 2 and 3, is the question of whether presuppositions should be characterized as categorically imposing a common ground requirement. The difficulty for such a theory is that it is surface-false: in everyday conversation, speakers routinely presuppose information that was not already shared knowledge. However, children's behavior in our studies is consistent with a strict adherence to this common knowledge requirement, despite all the evidence to its contrary in their experience. In fact, although adults are tolerant of (certain) novel presuppositions, children initially do not consider such uses a possibility for any kind of presupposition trigger. The behavioral patterns exhibited by children thus provide significant support for thinking of presuppositions as uniformly imposing constraints on the incoming context, even though this fact is masked in adult language because of the existence of cooperative strategies like presupposition accommodation. On the other hand, these data are difficult to reconcile with theories that impose weaker conditions on the common ground (Gazdar 1979; Soames 1982), or ones in which the presuppositional status of some content depends on third-party properties, such as discourse structure and QUD (Simons 2001; Simons et al. 2010; Beaver et al. 2017).

At an even more fundamental level, these developmental data suggest that children go through a stage of development where they treat the pragmatic conditions governing assertion and presupposition as being equally inviolable. That is, to the child, assertion and presupposition are at the same level of pragmatic import. This supports a theoretical perspective where presupposition is treated as a primitive category of natural language, at least in as much as assertion. Put differently, the child data suggest that attempts at deriving presuppositions from a single level of content plus general conversational principles (e.g. Simons 2001; Abusch 2002; Abbott 2006; Beaver et al. 2017) would be a step in the wrong direction. Thus, child behavior, which is uncolored by other factors that may complicate adult language use, demonstrates the true nature of the underlying principles in a clearer way.

The results from Chapters 4 and 5 could be taken as another illustration of this general

idea, this time in the domain of *Maximize Presupposition!*. As already mentioned, a major issue in theorizing about MP has been the identification of the right competitors. Developmental data can bring independent evidence into the mix, helping determine whether some environment implicates MP. In the present studies, children'a asymmetric success with *another* vs. *a* led to the eventual conclusion that the two expressions do not directly compete.

These results, in a somewhat indirect way, can also be taken as an argument for a complexity-based approach to alternatives, in all domains. The environment that we took to be outside the purview of MP based on the child data is precisely the sort that a complexity-based approach would independently rule out from direct competition.

6.3 Developmental Implications

The question of how children acquire presuppositions is among a broader set of questions about how minds develop. It is an especially interesting one because it is not at all obvious that a child should come in hypothesizing that some pieces of information are grammatically marked as old. The learning problems exposed earlier deepen the puzzle. Presuppositions convey information that is already taken for granted by all conversation participants, except when they are not (e.g. accommodation). There is pressure towards presupposing as much as possible when all else is equal, but only when certain, sometimes hard-to-evaluate, criteria are met. How does the child converge on the adult-like use of presuppositions given the inconclusive, and sometimes seemingly contradictory, evidence in the input?

A broad conclusion from the results reported in this thesis is that children at a fairly young age know what presuppositions are and how they are subject to a specialized set of use conditions. In light of these findings, the picture that I am drawn to is this: Children never have to learn that a linguistic device such as presupposition exists. This is part of their hypothesis space. Children's minds, moreover, must be furnished with innate capacities for social interaction. Knowledge of the semantic category *presupposition*, in conjunction with a basic set of skills underlying cooperative social interaction, might be sufficient to converge on the core use conditions on presuppositional sentences: that one should not take for granted what their interlocutor might not be taking for granted, that one signpost and remind the listeners of the presumptions being made at a given point in the conversation, etc..

Children's early competence in presupposition use also has broader implications for

models of pragmatic development. Much of the early work in language development underestimated children's pragmatic abilities: children were argued to be egocentric (Piaget 1959; Maratsos 1976; Karmiloff-Smith 1979), oblivious to their conversation partners' goals and intentions (Pechmann & Deutsch 1982; Perner & Leekam 1986; Sonnenschein & Whitehurst 1984; Epley, Morewedge & Keysar 2004; Davies & Katsos 2010), insensitive to general concerns about informativity (Noveck 2001; Pouscoulous, Noveck, Politzer & Bastide 2007; Huang & Snedeker 2009), etc. Recent years, however, has seen a paradigm shift. Studies using new and sophisticated paradigms have revealed that children are capable of fairly complex reasoning about the social world from infancy (Baillargeon, Scott & Bian 2016; Tomasello, Carpender, Call, Behne & Moll 2005; Saxe 2013). For instance, infants can formulate accurate expectations about others' actions and intentions, like reaching for an object you saw a moment ago. Moreover, they can utilize these skills when making communicative choices (see e.g. Matthews 2014 for a review). Even though children's pragmatic abilities continue to develop throughout early childhood and beyond, rich social skills seem to underlie human interactions from the very beginning. The present findings add to this growing body of evidence. Children success in aspects of presupposition use show that they can (*i*) construct models of others' mental states, (*ii*) track the conversational record and the common ground, and (*iii*) consider alternative linguistic forms to choose the most appropriate one in a given context.

Our results show, then, that by the early preschool years, some non-trivial mentalizing abilities are be available to young children. At the same time, it is still possible that their abilities not include more sophisticated aspects of reflection, deliberation and revision. That is, the full complexity of an adult "Theory of Mind" — which has much larger scope, greater precession, and more flexibility — may be continuing to develop over the preschool years. This, in turn, might lead to difficulties deploying, in an adult-like manner, principles of presupposition use that are nevertheless underlyingly present. A recurrent idea throughout the dissertation was the notion that children have difficulties making accurate guesses about the nature of the common ground. That is, they may not always be able to infer correctly what information their interlocutor may already be taking for granted or be willing to take for granted. This difficulty may lead to (*i*) over-use of presuppositions, e.g. the well-known over-use of the definite article, (*ii*) under-use of presuppositions, e.g. the difficulties maximizing presupposition with *both*, and (*iii*) a failure to anticipate the listener's willingness to make certain contextual adjustments, e.g. their lack of adult-like expectations about ac-

commodation.

In this respect, presupposition use differs fundamentally from anaphora, where no reflection of another's information state is needed. Rather, what needs to be consulted is the nature of the preceding discourse record, which suffers from much less indeterminacy. This gives a new way of thinking about the earlier acquisition of anaphoric triggers like *too* compared to non-anaphoric ones. The early appearance of triggers like *too* in child speech need not mark these types of expressions as belonging to a fundamentally different category from other presuppositional expression. Rather, children may simply be more certain about the success of their utterances with these expressions compared to non-anaphoric ones.

6.4 Future Work

We have made progress, but many questions remain. I will conclude by pointing to some of the more pressing ones.

The system underlying presupposition seems to be stably in place by the preschool years, in spite of the noisiness of the empirical terrain is noisy and the routine collapsing, in ordinary conversation, of important distinctions between presupposition and assertion. Based on this fact, I argued that the semantic and pragmatic components that underlie this system are not learned. But when do these components emerge, or mature? Are there conceptual shifts that must take place before children the conversational principles governing presuppositions can develop? For instance, infants' social behavior starts undergoing dramatic changes at the end of the first year. They begin reliably sharing attention and information (Brooks & Meltzoff 2005; Liszkowski, Carpenter, Henning, Striano & Tomasello 2006; Beier & Spelke 2012), engaging in helpful actions toward others in the absence of explicit request (Warneken & Tomasello 2006), and learning from the communications and actions of others (Agnetta & Rochat 2004), all at around 10-12 months of age. Relevantly for our purposes, the absence of these types of social abilities in infants younger than 10 months could signal an inability to represent of something like the common ground. In turn, conversational principles that impose constraints on the common ground might also be non-existence at this stage.

At the same time, children know the meanings of several words much earlier than that, at least at 6 months (Bergelson & Swingley 2013; Bergelson & Aslin 2017). Do they also know some presuppositional words? Or does the learning of presupposition-triggering

expressions depend on the mastery of the relevant pragmatic principles, like the common ground requirement and *Maximize Presupposition!*?

This brings us to a very hard problem, and thus an important area for future work: How do children map onto the meanings of the various presuppositional words to begin with? The learner's task, when trying to identify presuppositional content, is two-fold. She must: (*i*) distinguish presupposed content from entailed content (e.g. distinguish a lexical item like *again* from *twice*) and (*ii*) distinguish between content that is formally required, as opposed to incidentally present, in the context. What tools might the child bring to the task? One option might be to simply keep track of the fact that some lexical item never occurs in a situation where the presupposition is not already established common knowledge. For reasons discussed at various points in the dissertation, relying on this alone would be a mistake: presuppositions *are* used informatively, and even if they weren't, children are not always adept at correctly guessing what is and isn't common knowledge in the first place. A second possibility is that they rely on logical properties of presuppositions as a semantic category (which, too, may be something they don't have to learn). For example, they may pay selective attention to linguistic environments where presupposition projects, which distinguishes presupposed content from garden-variety entailments. A final possibility is that there are principled ways of predicting what information conveyed by an expression will end up being a presupposition. One such algorithm is provided in Abrusán (2011) for verbal presupposition triggers. She proposes, roughly, that any information conveyed by an utterance that is separable from the event time of the matrix predicate ends up being presupposed. It remains to be seen whether this type of algorithm is broad enough in scope to cover the whole range of presuppositional phenomena, but something like a 'triggering algorithm' might make the learner's task considerably easier.

There are important aspects of presuppositions that this dissertation has not touched upon, even though they interact with topics that were under discussion. A case in point is presupposition projection. Do children know, for any given embedding environment, how the presuppositions of embedded constituents are inherited by the complex structure on the whole? Are these properties mastered in a uniform fashion across projection environments? These questions are non-trivial precisely because presuppositions do not project uniformly across embedding environments. Presuppositions of elementary clauses are sometimes inherited wholesale when the clause is embedded under a truth-conditional operator (1-a), but sometimes, the presuppositions associated with complex sentences (so-called "filters"

in Karttunen's (1973) terminology) seem to be weaker than those of its simplex constituents (1-b)-(1-d). Thus, whereas (1-a) presupposes that Sam has a guitar, the presupposition associated with (1-b)-(1-d) is of conditionalized form: If Sam is a musician, he has a guitar.

(1) a. Sam didn't bring his guitar to the party.
b. If Sam is a musician, he will bring his guitar to the party.
c. Sam is a musician and he will bring his guitar to the party.
d. Either Sam is not a musician or he will bring his guitar to the party.

This non-uniformity is not predicted on the view of semantic presuppositions I have been assuming so far, where the third-value, '#', represents undefinedness, or lack of a semantic value (Heim & Kratzer 1998). All else equal, what is expected on this approach is that an XP dominating a presuppositional clause will also lack a semantic value if that presuppositional clause lacks a semantic value. In other words, we predict that if Sam turns out not to have a guitar in *w*, all of the sentences in (1-a)-(1-d) be undefined at *w*. The empirical inadequacy of this perspective is clear from the above examples. Fortunately, there are several semantic theories of presuppositions on which the observed projection patterns are in fact predicted. Such theories either encode projection behavior (*i*) directly as a lexical property of connectives (e.g. Heim 1983), (*ii*) a consequence of the way presupposition failure is repaired within trivalent system (Beaver & Krahmer 2001; George 2008; Fox 2008), or (*iii*) a consequence of how contexts evolve over the course of evaluating a complex sentence (Stalnaker 1974; Karttunen 1974; Soames 1982; Schlenker 2009).

While all these theories capture the adult data, they make potentially divergent acquisition predictions, making child data, once again, an important theory arbitrator. For instance, Heim (1983) predicts that as soon as the child knows the meaning of a given connective, she also knows how presuppositions project from the scope of that connective. On the other hand, this is not a given on trivalent approaches, e.g. Beaver & Krahmer 2001; George 2008 and Fox 2008. These proposals adopt a different conceptualization of '#', as standing for something like 'either true or false, but we don't know which'. From this perspective, a conjunctive sentence need not denote # just because one of the conjuncts does. For instance, if it turns out that Sam is *not* a musician, it does not matter that the second conjunct in (1-c) contains a presupposition trigger; the sentence will simply be false. With respect to acquisition, these approaches are consistent with a stage at which children know the bi-

valent meaning for a connective, but posit a non-adult trivalent expansion. For instance, children may initially project presuppositions cumulatively (i.e., presupposition-failure is always inherited globally) and only later arrive at an understanding that a proposition can have a definitive truth value even when its component parts fail to.

A final point worth mentioning concerns what is known as the 'Proviso Problem' (Geurts 1996; see brief discussion in Chapter 3), where we find projection and accommodation interacting in interesting ways. Consider the complex sentences in (2), which contrasts from their counterparts in (1-b)-(1-c) above in that they seem to be associated with the stronger presupposition that Sam has a guitar.

(2) a. If Sam is happy, he will bring his guitar to the party.
b. Sam is happy and he will bring his guitar to the party.
c. Either Sam is not happy or he will bring his guitar to the party.

One way of approaching this problem has been to say that though the semantics generates a conditionalized presupposition of form 'if Sam is happy, he has a guitar', but there is an additional strengthening mechanism at work. Specifically, *q*, rather than *if p, then q*, is accommodated by listeners in communicative situations where it is implausible that the speaker takes for granted that *if p, then q*. For instance in the above examples, it would be odd for a speaker to believe that someone's ownership of a guitar is contingent on their current state of happiness. Listeners, treating their interlocutor as rational, shift instead to a more realistic context, one where the person in question is assumed to have a guitar, period. In light of the findings in Chapter 3 — that children do not have adult-like expectations about accommodation — Proviso environments become an especially interesting environment for testing children's understanding of presupposition projection, their reasoning about the information states of their conversation partner, and their expectations about the nature of the common ground.

As this brief discussion shows, the domain of presupposition acquisition has by no means been exhaustively explored. What we have learned through the present investigation teaches us that children know a whole lot about presuppositions. But while we have covered some of the basics, there is also a whole lot more to learn. Much work remains.

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