

Introduction: Aspects of Meaning in Context - Theoretical Issues and Experimental Perspectives

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Abstract In the study of natural language meaning, theorists commonly assume that the overall conveyed meaning of an utterance includes various different types of meaning that differ in both how they arise and what their status is. This chapter first provides a brief introduction to the main types of meaning that are commonly assumed and their relation to the context of utterance. The main part of the chapter then reviews the experimental literature on phenomena in this area in general, and in particular with regards to presuppositions. In the course of this, key theoretical issues are introduced and the results presented in the chapters of this volume are situated in the context of the existing literature. The chapter closes with an overview of claims put forward in the literature based on existing results and open questions and directions for further research.

1 Introduction

The study of natural language meaning within formal linguistics has its roots in philosophy of language and logic, and this tradition sees truth-conditions at the center of study of semantics. As Heim and Kratzer (1998) put it in the first sentence of their influential textbook: ‘To know the meaning of a sentence is to know its truth conditions.’ One of the central concerns of current semantic research then is to characterize natural language phenomena in truth-conditional terms. One key question is how the truth-conditions of sentences can be derived from suitable meanings of their atomic parts, given an assumed hierarchical grouping stemming from the syntactic component of grammar. While most theorists might agree that truth-conditions are at the core of what linguistic meaning is all about, it is also clear - and widely accepted - that there are further aspects of the overall conveyed meaning of a sentence uttered

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in a context that go beyond what we could call the literal, truth-conditional meaning of linguistic expressions. Such additional layers of meaning can be introduced in a number of ways. They could be a part of the conventionally encoded meaning for a given lexical item that is somehow differentiated from its literal truth-conditional contribution. Alternatively, they could result from general reasoning about communicative situations. Finally, they could arise through an interaction of both of these factors. In characterizing these phenomena in these terms, it is common to divide up the work in one way or another between related but distinct components of the language comprehension system, namely semantics and pragmatics, where the former crucially involves conventionally encoded content, whereas the latter depends (at least in large part) on information from the context of utterance. The lines between the two, are by no means agreed upon, and for many phenomena, key arguments in the literature are precisely about the level at which a given expression contributes to the overall meaning.

Based on this perspective, a natural way of thinking about the make-up of the notion of ‘overall conveyed meaning’ of a given sentence uttered in context is that it is a conglomerate of inferences, each of which is introduced in the form of one of these aspects of meaning. For naive speakers, there is no simple way of divvying up those inferences in terms of what their source or status is. It is the job of the theorist to come up with criteria for differentiating what inferences are introduced in what way, and to identify the corresponding properties of the relevant aspects of meaning. Right from the early days of the modern study of meaning on, providing theoretical arguments for differentiating between distinct aspects of meaning and identifying their key properties - both on their own and in contrast with other aspects - has been a central concern in the field. However, until very recently, the empirical scope of these investigations has been limited in a number of ways, and few efforts were undertaken to study the relevant questions systematically with tools from experimental psycholinguistics. Similarly, much of the research has focused on English (and perhaps a handful of other languages), without much of a perspective on cross-linguistic comparisons. But over the course of the last decade or so, a shift has started to take place, with more and more researchers bringing together experimental approaches and theoretical questions about linguistic meaning, as well as exploring details of semantic phenomena across a wider set of languages.

A large amount of experimental work on meaning from a linguistic perspective indeed has focused on the issue of understanding what the various ingredients of meaning are and how they relate to one another both in theoretical terms and with respect to their processing properties.¹ Within this general area, in turn, the primary focus has been on implicatures (and amongst those, primarily scalar implicatures) in the sense of Grice (1975) (see discussion below). But other aspects of meaning lend themselves to similar investigations, and ultimately we will want to inform our theoretical considerations using empirical and experimental investigations that explore the relevant phenomena to the fullest possible extent. The present volume presents recent work that extends experimental approaches to another central aspect

¹ For surveys of psycholinguistic work on semantics more generally, see Frazier (2012) and Pylkkänen and McElree (2006).

of meaning, namely that of presuppositions, and it is - to the best of my knowledge - the first to focus on that topic specifically. While by now there is a small but growing body of experimental work on presuppositions, the hope is that a focused presentation of current results within one volume will help to galvanize efforts in this area further, both by serving as a point of reference on the current state of research and as a starting point for future investigations.

This introductory chapter is intended to situate the overall endeavor that the later chapters contribute to in a broader context by a) providing a brief overview of the basic theoretical background, b) summarizing key existing results in related areas of research, c) outlining theoretical issues and experimental perspectives with regards to presuppositions specifically and reviewing results in this area, both from prior research and based on contributions to this volume, and d) taking stock of the current state of research and reflecting on future directions.

2 Background

2.1 *Ingredients of Meaning*

From the perspective of early work in the tradition of philosophy of language focused on logic, natural language could naturally be regarded as deficient and messy, as it seemed clear that many aspects of the way it conveys meaning did not squarely fit into simple logical analyses. However, at least since the middle of the 20th century, the *prima facie* non-logical aspects of language have been taken to be subject of rigorous formal analysis themselves. The following is an extremely brief introduction to some of the central notions in this area for readers without a background in semantics and pragmatics. For a recent overview that's also short and accessible but more comprehensive, see [Potts \(to appear\)](#).

One of the earliest relevant discussions involved the analysis of definite descriptions. [Russell \(1905\)](#) had famously argued these to yield statements that entail the unique existence of an individual with the property expressed by the noun phrase headed by *the*. [Strawson \(1950\)](#), following a line of thought already put forward by [Frege \(1892\)](#), argued that in cases where the existence (or uniqueness) condition of a definite was not met (as in *The king of France is bald.*), the sentence did not simply become false (as predicted by Russell), but rather resulted in it having no truth-value at all. Existence and uniqueness then were taken to be a type of pre-condition, or presupposition, for truth-evaluable sentences that could felicitously be uttered in a given context.

While subsequent debates about definite descriptions continue to this day, it soon became clear that there is a wide range of expressions that systematically exhibit properties similar to those found with definites. In particular, presuppositions are commonly assumed to have two key characteristics ([Karttunen, 1973](#); [Stalnaker, 1973, 1974](#)). First, they (at least typically) do not convey any new information, but

rather consist of backgrounded information that the interlocutors take for granted (at least for purposes of the conversation). Secondly, they remain present at the level of the overall sentence even when introduced under embedding operators that (loosely speaking) cancel the embedded literal, truth-conditional content. This can be illustrated with the family of sentences test (Chierchia and McConnell-Ginet, 1990), which includes variations such as the following:

- (1) John stopped smoking.
- (2)
 - a. John didn't stop smoking.
 - b. If John stopped smoking, then he should be healthier now.
 - c. John might have stopped smoking.
 - d. Did John stop smoking?

The verb *stop* in (1) introduces the presupposition that whatever activity is expressed by the verb phrase is something that has gone on prior to some contextually salient time in the past (introduced by the past tense). It asserts that this activity was not going on after the relevant point in time. These two aspects of what is conveyed behave very differently in various embedding environments. None of the sentences in (2) convey that John's smoking did not go on after a salient point in time. They either convey the opposite (in the case of negation), or remain neutral in that regard. However, the notion that prior to the relevant point in time John was smoking remains constant across all variations. This global presence of the relevant inference, also referred to as 'presupposition projection', is a hallmark of presupposed content (as we'll review in more detail below, projection does not always result in the global presence of inferences).

A second important class of meaning that has been differentiated from the core semantic content as encoded conventionally in the lexicon is that of conversational implicatures Grice (1975). These are inferences that hearers make based on the literal meaning of certain expressions in combination with general assumptions about how rational agents behave in cooperative communication. A prototypical example is that of the scalar implicature associated with the quantifier *some*, illustrated in (3):

- (3) John ate some of the cookies.
 - a. John ate some, and possibly all, of the cookies.
 - b. John did not eat all of the cookies.

Although naive speakers might commonly take (3) to entail (3b), it turns out that the literal meaning based on what is conventionally encoded as the meaning of *some* is best characterized as (3a). This can be seen, for example, by considering contexts where an implication along the lines of (3b) is clearly not present, such as in the downward entailing context of antecedents of conditionals:

- (4)
 - a. If John ate some of the poisoned cookies, he will get sick.
 - b. If John ate some but not all of the poisoned cookies, he will get sick.

If *some* literally meant *some but not all*, we would expect the two conditional variants above to be equivalent. However, they clearly are not, as under any normal circumstances, the simple *some*-version would be taken to suggest that any amount of cookies consumed - including all of them - would lead to John getting sick. This suggests that the inference (3b) is not entailed by the literal meaning of (3). Further evidence for this comes from the fact that it can be cancelled without any sense of contradictions:

(3') John ate some of the cookies. In fact, he ate all of them.

Nonetheless, barring such continuations or the relevant embedding contexts, (3b) seems to be standardly inferred from (3). So where does this inference come from? Grice (1975) proposed that it is based on the hearer's reasoning about the speaker's role as a rational, cooperative interlocutor. In particular, cooperativeness can be characterized by a number of maxims that speakers generally adhere to. Two maxims play a crucial role in inferring (3b): the maxim of Quantity requires speakers to be as informative as necessary, and the maxim of Quality requires them to speak truthfully. Based on these, a hearer can then reason as follows: the speaker did not make the logically stronger claim that John ate all of the cookies, despite being required to be as informative as possible. Assuming she is cooperative, there must have been something else that kept her from asserting the universal claim. The maxim of Quality is a prime candidate - she must have not been in a position to make the stronger claim while also observing this maxim. Thus, the hearer concludes that the stronger claim is not true.²

The final class of inferences that are distinct from the literal, truth-conditional content to be considered here in detail is that of conventional implicatures, a term also introduced by Grice (1975). Perhaps even more so than in the other cases, several very different characterizations of this aspect of meaning have been proposed in the literature over the years. I will here follow the influential recent view introduced by Potts (2005). Conventional implicatures share some properties with presuppositions and some with implicatures. They are not part of the main asserted content, but at the same time, they are not taken for granted, i.e., they standardly convey new information. As the name suggests, they are conventionally encoded, rather than being inferred via general reasoning. They are not cancelable, but they are generally unaffected by embedding operators (arguably more generally so than presuppositions). Standard examples are nominal appositives (5) and expressives (6).

(5) Sue, a pianist, teaches music lessons on the weekends.

(6) The damn cat knocked over a glass of water.

The notion that Sue is a pianist introduced by the appositive in (5) is by no means something that had to be established prior to the utterance, but at the same time, it does not contribute to the main point that is asserted when uttering the sentence.

² The actual reasoning is more involved than that, and as I hinted at, other maxims (such as Relevance) could come into play as well.

Rather, it seems to introduce a side-comment of sorts. In a way similar to presuppositions, the relevant inference remains constant under various types of embeddings (as can be seen if adapting the family of sentences test above to this example). In fact, conventional implicatures have been argued to (almost) always be present at a global level, unlike presuppositions. Furthermore, in denying (5), one would not standardly deny that Sue is a pianist (but see Syrett et al., 2013, for experimental data that suggest a more nuanced picture in this regard).

Similar considerations apply to the expressive *damn* in (6). These furthermore highlight another feature of conventionally implicatures, namely that they are generally speaker-oriented, i.e., even when embedded under attitude verbs or verbs of saying, the expressive content (in this case, some negative attitude towards the dog) is attributed to the speaker of the sentence, rather than the attitude holder.³

While the presentation of the three aspects of overall meaning above more or less reflects the most standard, traditional perspective on these phenomena, note that the boundaries between them are by no means clear. As will be seen both below and throughout several of the contributions to this volume, there are many cases of expressions where theorists have argued about the precise nature of certain related inferences. Furthermore, it's not even clear that the distinctions made here are exactly at the right level. A more fine-grained classification may ultimately be required to capture variation at a more detailed level, based on specific properties. Tonhauser et al. (2013), for example, propose a view based on an overall class of projective content (i.e., content that remains unaffected in certain embedding environments) that would encompass both presuppositions and conventional implicatures, with more fine-grained distinctions amongst different sub-classes. The overview articles by Beaver and Geurts (2012) and Potts (to appear) also suggest that more fine-grained classifications may well be called for. That being said, the distinctions laid out above clearly continue to be of central importance, and even if overly simplistic, the three-fold distinction provides a useful basis for further theorizing, as well as for experimental investigations that precisely contribute to a more fine-grained understanding of the properties of the relevant types of expressions.

There are, of course, numerous further ways in which linguistic utterances can give rise to inferences beyond what is literally expressed. To begin with, there are various other types of conversational implicatures involving other maxims proposed by Grice (1975). There may also be a useful distinction between such implicatures that are quite generally associated with certain expressions (such as the scalar implicature of *some* discussed above), and ones that are more heavily dependent on specific aspects of the context of utterance (which Levinson, 2000, calls Particularized Conversational Implicatures). Furthermore, phenomena such as metaphor and irony, also fall into this category. While all of these merit more in-depth investigations of their own, we will not discuss these in detail, but rather keep our focus on phenomena that are more closely related to the literal meanings of linguistic expressions and which have been explored extensively in formal terms.

³ For some debates leading to qualifications, see section 4.5.

2.2 *Prior Experimental Work in Related Areas*

While the main focus of both this introduction and the volume as a whole homes in on presuppositions, it seems nonetheless useful to consider the broader context of experimental work on meaning-related phenomena, especially ones in which context plays a crucial role. This section provides a very general and rough sketch of some of the relevant work in related areas. This by no means comes with any claim to comprehensive coverage. I simply aim to highlight examples of several lines of work that are fairly closely related to the phenomena central to this volume.⁴ Two general areas of research seem particularly relevant. First, a vast amount of work has been done on phenomena that involve reference resolution with various types of noun phrases. Second, a more recent, but by now also extremely lively, area of research has investigated implicatures in processing (as well as acquisition).⁵

As already mentioned above, definite descriptions were the original poster-child for presuppositions. Figuring out, in a given context, whether the presuppositions are met in general, and what individual is accordingly referred to by the definite in particular, involves a variety of processes and factors, some of which have been studied experimentally in quite some detail.⁶ For example, the seminal study by [Crain and Steedman \(1985\)](#) showed that the context for definite noun phrases affects syntactic parsing decisions, by looking at locally ambiguous sentences like the one in (8).

- (7) a. Complement Inducing Context
A psychologist was counseling a married couple. One member of the pair was fighting with him but the other one was nice to him.
- b. Relative Inducing Context
A psychologist was counseling two married couples. One of the couples was fighting with him but the other one was nice to him.
- (8) The psychologist told the wife that he was having trouble with. . .
 - a. . . her husband.
 - b. . . to leave her husband.

In (8a) the *that*-clause is interpreted as the complement of *told*, while in (8b), it is a relative clause modifying *wife*. The latter reading is much harder to see due to a typical garden-path effect (especially out of context). The preceding contexts were varied in introducing either one or two couples, the idea being that if two couples are introduced, the definite description consisting of the noun only (*the wife*) cannot

⁴ Note also that work directly on presuppositions will be reviewed in the next section. The line between what relates to presuppositions directly and what indirectly is hard to draw and thus somewhat arbitrary. The main criterion I used was whether the work in question actually had the investigation of presuppositions as its primary aim.

⁵ For another recent review of similar topics, see [Noveck and Reboul \(2008\)](#).

⁶ See [Gibson and Pearlmuter \(2011\)](#) and [Gundel and Hedberg \(2008\)](#) for recent collections of relevant work.

refer successfully, while the complex description consisting of the noun and the following *that*-clause analyzed as a relative clause does have a unique referent. The sentences were judged to be ungrammatical 54% of the time in a grammaticality judgment task when (8a) was presented in the relative-inducing context, but they were judged to be grammatical 78% (8a) and 88% (8b) of the time when the contexts matched the target sentence. Crucially, even the garden-path in (8b) was ameliorated by putting it in a matching context. This finding motivated Crain and Steedman to propose a principle of parsimony, which guides the selection between different syntactic parses in their parallel parsing architecture, so that the reading carrying the fewest unsatisfied presuppositions will be the preferred one. Similar designs are used in more recent work by van Berkum and colleagues (van Berkum et al., 1999, 2003), which shows that there are ERP-effects related to whether the definite description can refer successfully or not.

In a similar vein, much of the work within the visual world paradigm (Tanenhaus et al., 1995), where eye movements relative to visually presented scenes are recorded while linguistic stimuli are played back auditorily, utilizes definite descriptions in critical parts of the sentences. For example, typical stimulus types involve instructions for clicking on one of several presented pictures, with the crucial material introduced in the context of the instructional phrase *Click on the [NP]*, or for moving (actual or virtual) objects around (on a screen or within a physical display). In line with the findings by Crain and Steedman (1985), work within this paradigm has revealed various context-related factors influencing parsing decisions both in adults and children (e.g. Sedivy et al., 1999; Hurewitz et al., 2000; Sedivy, 2003; Chambers et al., 2002, among many others). While these works do not necessarily focus on the definite article per se, they nonetheless make crucial use of its presuppositional requirements, and thereby also inform the role of presuppositional information in processing.

Yet another related area of research takes a more interactive perspective by looking at conversations between two people, who jointly have to manipulate some set of objects. Crucially, the experimental setup occludes some of the objects from one of the interlocutors, thus implementing a distinction between common or shared ground (including the objects visible to both) and privileged ground (including objects only visible to one). Once again, definite descriptions are used as part of instructions, and the identity of the referents crucially depends on which ground the listener is considering (e.g., by using *the tall cup* in a context where there is a relatively tall cup in the shared ground, but also an even taller cup in the privileged ground). The central question in this area turns on how easily listeners can keep track of the shared ground, and to what extent they may, at least initially, be tempted to include privileged ground objects as candidates for referents when following instructions uttered by the speaker. While some studies provide clear evidence for the general ability to focus on the shared ground (Hanna et al., 2003; Nadig and Sedivy, 2002, e.g.), other studies report delays in homing in on the referent of the definite as interpreted relative to the common ground (Keysar et al., 2000, 2003).

Beyond keeping track of the distinction between privileged and common ground, interlocutors continuously face choices about the domain relative to which to inter-

pret a variety of expressions within a given sentence. The phenomenon of domain restriction has long been known to come into play for individual phrases (e.g., noun phrases), and both choice of referents and truth of statements crucially depend on which domain is chosen (Westerstahl, 1984; von Stechow, 1994). This is obviously relevant for quantificational expressions: sentences such as *Everyone came to the party last night*, generally are not uttered with a global domain being intended, i.e., *everyone* is contextually restricted to some salient set of people. But the felicity and choice of referent for definite descriptions can of course also depend on domain restriction (Neale, 1990). Only a small number of studies have directly investigated questions concerning the process of domain selection and restriction experimentally. Warren (2003) finds facilitation effects in self-paced reading for both quantifiers and plural definites when a plural set antecedent that can provide the domain is present in the context. Harris et al. (2013) investigated the choice of domain for adverbial quantifiers such as *mostly*, which can quantify either over parts or times, and find a general preference for the former. And Schwarz (2012) varies the linguistic context for definites which - on their own - have multiple possible referents in a visual display, with varying effects on the choice of domain for the definite in both response behavior and eye movements. This variation is argued to be driven by listeners' reasoning about what the question under discussion is, based on the context. This area of research clearly is in need of more detailed investigation, and as it relates directly to presuppositional phenomena (e.g., because domains are often thought to be presupposed, but also because presuppositions in general have to be evaluated relative to contextually provided domains), a better understanding of the processes involved in domain selection and restriction will be of central importance for work on presupposition processing moving forward.

In addition to work that mainly focus on definite descriptions, there is a vast psycholinguistic literature on anaphora resolution for other types of noun phrases, such as pronouns and demonstratives. One line of work investigates, and in many ways confirms, the predictions of Centering Theory (Grosz, 1977; Grosz et al., 1995). The Givenness Hierarchy (Gundel et al., 1993) has been tested experimentally in similar ways. A central aspect of both of these is that there is an inverse relationship between the complexity of referring forms and the salience of the referents, with more reduced forms picking out more salient referents. For example, repeated proper names tend to give rise to a penalty in processing (in contrast with pronouns, Gordon et al., 1999), and topical antecedents for pronouns are better than non-topical ones. Brown-Schmidt et al. (2005) compare pronouns and demonstratives, and find that the latter are preferably used for composites of previously mentioned entities. While all of these types of noun phrases are relevant for the study of presuppositions, the topic of anaphora resolution in general goes beyond what can be covered in any detail here. However, in light of theoretical proposals such as Discourse Representation theory (DRT, Kamp, 1981) as well as recent findings by Schwarz and Tiemann (2012, 2013b) and Kim (this volume), integrating work on presuppositions with the anaphora-processing literature is an important task ahead.

The second line of research I want to highlight as part of the more general backdrop for the studies in this volume directly concerns the more general issue laid

out above, namely that of classifying different types of inferences that are part of the overall conveyed meaning of utterances, and investigating their properties in processing. In particular, much work over the last decade or so has focused on conversational implicatures. Central questions in this area have been about what factors affect whether or not implicatures are computed in the first place, and what the time-course of computing implicatures in online processing is, especially in comparison with literally encoded content. Some of the early work in this realm has asked related questions from the perspective of language acquisition (Teresa Guasti et al., 2005; Noveck, 2000; Chierchia et al., 2004), where children are generally found to be more willing to accept ‘logical’ interpretations (without any implicatures) than adults, though the exact timing in acquisition and the extent to which this holds depends on a host of factors (see, e.g., Papafragou and Tantalou, 2004; Gualmini et al., 2008).

Many experimental studies with adults have focused on the question of whether implicatures are present by default, or whether they need to be generated in online processing and involve a cost reflected in a delay of implicature-based effects relative to ones based on literal content. One prominent default view is that of Levinson (2000), and Chierchia (2004) has proposed another perspective that suggests implicatures are automatically present (at least in simple cases). First experimental investigations by Noveck and Posada (2003) and Bott and Noveck (2004) provided evidence based on reaction times and ERP data that interpretations of *some* as ‘some but not all’, based on a scalar implicature, arise later than literal ‘some and possibly all’ interpretations. Breheny et al. (2006) found similar evidence in self-paced reading for both *some* and disjunction, and Chevallier et al. (2008) found further reaction time evidence for implicature delays with disjunction. Even more fine-grained time-course evidence from the visual world paradigm is reported by Huang and Snedeker (2009, 2011). Most recently, Bott et al. (2012) looked at speed-accuracy tradeoffs with implicatures and find more subtle behavioral evidence for delays in implicature computation.

However, there also are studies that suggest a more rapid availability of content based on pragmatic enrichment. First of all, the above-mentioned studies by Sedivy and colleagues, among others, can be seen in this light, for example by involving reasoning about the presence or absence of items for comparison along some scale introduced by an adjective. Furthermore Grodner et al. (2010) and Breheny et al. (2013) report results based on the visual world paradigm that are argued to show immediate availability of implicatures in online processing. Similarly, Atanassov (in progress) finds variable effects for implicature delays based on the presence or absence of preceding ‘priming’ items (involving implicatures with *might*), and Degen and Tanenhaus (2012) investigate various contextual factors that play a role for the availability of implicatures (as well as the felicity of implicature triggers). All in all, these studies suggest that the previous results supporting generally delayed computation of implicatures have to be integrated into a broader perspective that allows us to understand factors affecting the availability of implicatures in online processing as well as the precise timing thereof.

Work on the processing of scalar implicatures is directly relevant to the present enterprise of investigating presuppositions experimentally, in more than one respect. First, the methodological approaches used in that literature can, in many cases, be straightforwardly extended to the study of presuppositions. Second, given the overall perspective of understanding how various aspects of meaning relate to one another, we will ultimately want to conduct comparisons in all directions, i.e., not only compare implicatures and presuppositions to literal, truth-conditional content respectively, but also compare presuppositions to implicatures directly (the same can be said for conventional implicatures, which have hardly been investigated experimentally; see section 4.5 for some brief discussion). This is all the more relevant as various pragmatic proposals for analyzing presuppositions exist that make them more similar to implicatures than on the classical approaches in the formal semantic literature. I provide a brief review of the theoretical landscape for the study of presuppositions in the next section, and then turn to experimental work in this area.

3 Presuppositions: Theoretical Issues and Experimental Perspectives

The theoretical literature on presuppositions is quite vast, and I will make no attempt to review all aspects of it here (for a recent survey, see [Beaver and Geurts \(2012\)](#)). Rather, I will proceed by providing a rough sketch of some of the central approaches, both traditional and current, and then discussing specific issues in connection with the relevant experimental work, both in the existing literature and in this volume. The aim is to situate the results from the chapters to come in their broader context, both in terms of the theoretical questions and existing experimental work.

3.1 Presupposition Theory

Theoretical approaches to presuppositions can be divided along various fault-lines. For purposes of presentation, I will lump together those that share a fundamentally dynamic view of interpretation on the one hand, and static ones on the other. Needless to say, there are substantial differences between proposals within the respective classes as well. I begin with the dynamic tradition, as it has long occupied the perhaps most prominent place in linguistics, even though the original non-dynamic proposals pre-date it. The main focus in the latter category then will be on recent developments of so-called modular accounts, which maintain a non-dynamic semantics but incorporate the incremental unfolding of discourse at another level.

3.1.1 Dynamic Variations

Starting with the seminal work by Robert Stalnaker from the 1970's (Stalnaker, 1970, 1973, 1974, 1978), presuppositions have commonly been seen as imposing requirements on possible contexts of utterance. For Stalnaker, this is a fundamentally pragmatic notion. Based on his model of a context of utterance in terms of the Common Ground - the set of worlds compatible with what is mutually supposed for purposes of communication -, and in contrast with the notion of assertion, which serves to reduce the Common Ground, what is presupposed is understood most generally to be what is entailed by the Common Ground. This, of course, directly encodes the notion that presuppositions are an aspect of meaning that is taken for granted by the discourse participants. On Stalnaker's pragmatic perspective, it is speakers that presuppose, and the connection between certain expressions and speakers' general tendency to presuppose a corresponding presupposition has to be spelled out further. It's possible to combine a conventional encoding with this pragmatic view (see, for example, von Stechow's (2004) notion of 'Stalnaker's bridge'), but Stalnaker himself remains relatively non-committal in this regard. The dynamic aspect of Stalnaker's proposal gets introduced by considering just in what context a presupposition has to be met. To illustrate with the simplest example, presupposition triggers introduced in the second clause of a conjunction are evaluated relative to a context that already includes the first conjunct. This provides an explanation for the specific projection patterns we find with conjunction (and some other operators), in particular the fact that

- (9) John is married and he's on a trip with his wife.

does not presuppose that John has a wife. The fact that the first conjunct (plus the assumption of traditional marriage laws!) establishes that he has a wife suffices to satisfy the presupposition introduced by the possessive description *his wife*. In contrast, variations of the sentence where the first conjunct does not entail that John has a wife will indeed require presupposing that he has one. While this approach may not be extendable to all cases of presupposition projection (see, e.g., Schlenker, 2010a), it nonetheless provided the starting point for following work on projection phenomena.

The dynamic semantic proposal of Heim (1982, 1983), also called context change semantics, adopts Stalnaker's idea of capturing projection in terms of incrementally changing the context so that later parts of a complex sentence with certain operators are interpreted relative to a context that includes earlier parts of the same sentence, but it builds this dynamic aspect directly into the semantics. Instead of the traditional truth-conditional notion of sentence meanings, it understands sentence meanings to encode the sentence's potential to change any given context when uttered - its context change potential. Since contexts still are construed as sets of worlds, at least in their basic form,⁷ the truth-conditional contribution of a sentence can easily

⁷ The full system of Heim (1982), which provides an analysis of anaphoric interpretations of definites, extends this basic view of contexts to include assignment functions.

be reconstructed from the context change potential. But this approach also makes it possible to directly encode presuppositions as introducing requirements on context by utilizing partial context update functions, i.e., functions that would only be able to update contexts with certain properties (namely ones that entail the relevant presupposed proposition). What was truly novel in Heim's approach was that the presupposition projection phenomena could now be characterized in terms of the context change potentials of the relevant operators, including conjunction and conditionals. To illustrate, the context update procedure for the conjunction of p and q would be as follows:

$$(10) \quad c + p \text{ and } q = (c + p) + q$$

The '+' operation here amounts to set intersection, and the potential partiality of p and q encodes the requirements introduced by the corresponding presuppositions: a context c can only be updated if it entails the relevant proposition. Crucially, the context for q is the result of updating the original c with p , so that any presuppositions of q need not necessarily be entailed by c , but only by the combination of c and p . Parallel definitions can be given for other operators in such a way that they generally capture projection data successfully. But note that both the extent of this success and the question of the explanatory adequacy of the proposal have been questioned in the subsequent literature (see below for brief discussion).

Another prominent proposal that also can be characterized as dynamic in general terms is that of Discourse Representation Theory (DRT; [Kamp, 1981](#)). It was developed independently of Heim's proposal, and largely aimed to capture the same anaphoric phenomena that [Heim \(1982\)](#) addressed. Later work by [van der Sandt and Geurts \(1991\)](#); [van der Sandt \(1992\)](#); [Geurts \(1999\)](#) developed an explicit theory of presuppositions in this framework, which fundamentally sees presuppositions as a type of anaphora. The basic idea is that there is a representational level that keeps track of the discourse as it develops, in the form of variables that represent discourse referents and conditions that the referents have to meet. The various operators introduce hierarchical embeddings within this discourse structure, and both anaphora and presuppositional resolution involve searching for an antecedent along a pre-defined search path. For a presupposition introduced in the second conjunct of a conjunction, this search would first check in the first conjunct, and then in the discourse context to find a suitable antecedent (if it doesn't find one, that may result in accommodation, on which more below). By and large, the predictions are quite similar to those of [Heim's \(1982\)](#) approach, though there are some crucial differences, some of which we will turn to below.

3.1.2 Other approaches

While dynamic approaches enjoyed a relatively dominant position in the literature throughout the 1980's and 1990's, there also are alternative approaches that capture the special status of presupposed information in different ways, namely via adding a third truth-value to the logic they work with (using systems based on [Kleene, 1952](#)),

or by assuming a supervaluation-based framework (van Fraassen, 1968, 1971). The initial proposals pre-dated the dynamic ones, of course, and were attempts to formalize Strawson's observation that sentences whose presuppositions are not met are neither true nor false. Recent years have seen various revivals of variations of these approaches, and the differences in predictions between them and the dynamic ones turn out to be more subtle than it might initially seem (examples from the recent literature include Beaver and Krahmer, 2001; Fox, 2008; George, 2008a,b). For reasons of space, I cannot go into a more fine-grained discussion of these approaches. See Beaver and Geurts (2012) for a review. (Some further aspects of this are also discussed in Schwarz (this volume c)).

One of the most influential recent developments in this area has emerged from work by Philippe Schlenker (Schlenker, 2008a,b,c, 2009, 2010a,b). In its latest form, this line of work has become a compromise of sorts of the types of accounts considered so far, by proposing a non-dynamic recasting of a theory that is very much in the spirit of Stalnaker and Heim. However, Schlenker's theory of 'Local Contexts' improves on the dynamic approaches in several ways. First, it avoids a problem of explanatory adequacy that had been acknowledged in the literature for some time. In short, the formal setup of context change semantics does not require the context change potential for conjunction discussed above (parallel concerns arise with other connectives). Based on the formalism, an alternative entry for *and* would be just as possible that reverses the update procedure. Schlenker remedies this by defining a general notion of local context that integrates the left-to-right orientation that comes with the linearization of linguistic structure, deriving (almost entirely) the same results as Heim's theory, but without having to stipulate anything further about the lexical entries for connectives (which are understood as in classical logic). Secondly, unlike Stalnaker's original approach, Schlenker's theory is versatile enough to apply the notion of local context to non-propositional nodes, which allows him to capture presupposition projection with quantifiers. In theoretical terms, this theory makes do with a classical semantics (i.e., without a third truth-value). Presupposed and asserted content are both represented in these classical terms, but presupposed content introduces additional pragmatic requirements. In particular, it has to be entailed by its local context. In its simplest form, a local context roughly consists of the pre-utterance context and all parts of the sentence that precede the presuppositional expression.

An important aspect of this type of theory is that it opens up the possibility of considering the basic nature of presuppositional requirements (to be established in the discourse context) and the role of the incremental unfolding of spoken language separately. While the basic version of local contexts in Schlenker (2009) formally requires any possible continuation of the sentence to be felicitous, the incremental aspect can be weakened by demoting it to a processing preference. This switch can be implemented by changing the definition of local context so as to include the actual continuation of the sentence, thus making it in principle possible to support a presupposition by information introduced later in the same sentence. A modular account along these lines is investigated experimentally by Chemla and Schlenker (2012), who argue that such violations of incrementality are dispreferred in process-

ing terms, but still better than having no support for the presupposition in the context altogether. We'll discuss these issues further below.

In summary, there is a rich and extensive theoretical literature on presuppositions, and many central notions are contentious to this day. From an empirical perspective, various proposals make predictions for intricate cases that differ in subtle but interesting ways. One of the important lines of experimental work thus consists of attempts to collect systematic evidence for which predictions are correct. Rather than first outlining the various theoretical intricacies in further details on their own, I review specific issues and related experimental work, both from the prior literature and the chapters in this volume, in the following section.

4 Experimental Approaches

In turning to experimental investigations of presuppositional phenomena and their relation to theoretical proposals, it is prudent to start out by acknowledging that presupposition theories put forward within philosophy and formal semantics do not generally commit themselves to making any specific claims about the actual cognitive processes involved in interpreting presuppositions (though there are some exceptions, perhaps most notably DRT). Nonetheless, it seems clear that everybody's shared ultimate goal is to advance our understanding of how the minds of human beings deal with language. But we have to be careful that in doing so, we do not mistake abstract, theoretical characterizations as making immediate claims about mental processes. When the evaluation of predictions about contextual acceptability or the presence or absence of certain inferences is concerned, this may not seem to be an issue at first sight. After all, even the most abstract theories in this area claim to model actual people's understanding of the linguistic expressions they analyze. However, even at that level, it's clear that judgment data need not correspond directly to the theoretical constructs that the theory in question make predictions about. Take an example from syntax: as has been evident right from the start of modern linguistics, not all structures that most accounts would want to see as grammatically legitimate are judged as acceptable (the classical example of course are multiple center-embedded clauses), and there likely are examples of the reverse case as well. In the realm of presuppositions, a parallel point has been made by von Stechow (2004), who argues that speakers' judgments about truth-values (or lack there-of) for sentences containing non-referring definites should not be expected to be in a one-to-one correspondence with our theoretical notions of truth-values and infelicity. In short, even in simple judgment tasks, people may include a variety of considerations that are not directly related to the theoretical dimensions of the experimental manipulation. Obviously, parallel considerations apply *a fortiori* for investigations of aspects of cognitive processes that do not directly involve conscious decisions by subjects, such as timing measures for processes involved in linguistic comprehension.

While these considerations are important to keep in mind, they should not hold us back from setting out to pursue experimental tests of predictions from non-cognitive theories. We will generally need some linking assumptions about how the theory could possibly be amended so as to make specific predictions for experimental settings. But in many cases, these may be fairly straightforward and simple, at least at the outset of the enterprise. In lack of other, more cognitively real, explanations of the same type of phenomena, theoretical proposals constitute the starting place for asking questions about the actual cognitive processes involved. As actual results are evaluated and interpreted, it needs to be clear that what is tested is the combination of the theoretical claims and the linking assumptions, which in turn means that any evidence against a specific proposal could be due to either one of them being wrong. But that is the nature of experimental investigations, and no particular issues arise for the area of interest here, as far as I can tell. As long as new results lead to new testable hypotheses, there's progress.

As both this introduction and the volume as a whole are very much tied to theoretical questions about presuppositions and related processing perspectives, my overview of experimental work in this area below is organized thematically. Rather than discussing one paper at a time, I sketch some key issues and consider how existing experimental work from the literature and in this volume relates to it.

4.1 Infelicity & Accommodation

The intuition that provided the starting point for the study of presupposition is that utterances of sentences containing a presupposition trigger are infelicitous when the presupposition does not hold. This goes back, of course, to Strawson's observation about the definite description *The king of France*. While that basic intuition may seem robust in certain cases, it is less clear in others. To the extent that this property is fundamental for the notion of presuppositionality, it therefore is important to systematically assess the extent to which these judgments are indeed generally shared by speakers and to understand the factors that give rise to variation in judgments. Detailed discussion of this issue has focussed largely on definite descriptions. It was already observed by Strawson (1964) himself that not all definites seem to give rise to infelicity due to the inability to judge a sentence as true or false. He suggested that presuppositions of definites are primarily present when they are topical, based on examples such as the following, which most people would judge as plain false, as opposed to infelicitous, in standard present day circumstances:

- (11) The exhibition was visited yesterday by the king of France.

Reinhart (1981) fleshed this view out further. Lasersohn (1993) and von Stechow (2004) present a different perspective and argue that definites with presupposition failure give rise to intuitions of plain falsity when they are (actually, in Lasersohn's case, and in principle, in von Stechow's case) falsifiable if one temporarily assumed that the existence presupposition was met. Such a view can be illustrated by von

Fintel's observation that the relevant cases are essentially equivalent to *even if*-conditionals (*Even if there is a king of France, he was not at the exhibition yesterday!*). Another recent proposal is that of Schoubye (2010), who argues that plain false-judgments arise when the sentence in question can be construed as being a 'consonant response' (a technical notion spelled out in detail by Schoubye) to a Question Under Discussion (Roberts, 1996). This has the promise of wider empirical coverage, e.g., to explain the apparent role of focus on truth-value judgments.

While Schoubye (2010) reviews a much larger set of data, it is not based on systematic evidence from a wide range of speakers. However, two recent papers set out to address the issue experimentally: Abrusán and Szendrői (2013) and Schwarz (2013). Abrusán and Szendrői (2013) report a truth-value judgment study investigating the effects of topicality and verifiability (actual and in principle) on speakers' willingness to judge sentences with non-referential definites as plain false. The non-existence of individuals with the relevant property was based on world-knowledge, and fillers ensured that subjects indeed were aware of, say, the fact that France does not have a king. The specific version of the task was a forced choice truth-value judgment with an additional option of 'can't say'. In addition to affirmative sentences, they also included negated variants of each condition. Interestingly, they found that subjects were generally quite willing to judge the affirmative versions as 'false', without any significant differences between conditions. However, in the negated versions, they found significant increases of 'true' judgments for both the topicality and verifiability manipulations, which they argue supports the view that these factors affect speakers' disposition to assign a truth-value rather than being unable to do so. However, as the authors note themselves, once negation is introduced, there is another possibility, namely that of local accommodation. The differences due to the experimental manipulations could then just as well be seen as modulating the availability of a local accommodation interpretation. A further point to note in connection with their interpretation is that the proposals in the literature (especially by Lasersohn and von Fintel) explicitly limit their explanation to cases where sentences with non-referring definites are judged false, rather than infelicitous, by construing a more general notion of pragmatic rejection. It is therefore not clear that one would want to invoke their mechanism to account for 'true' judgments. With these cautionary remarks in place, it nonetheless is clear that Abrusán and Szendrői's (2013) study constitutes a welcome and much needed first step towards investigating truth-value judgments for presuppositional sentences systematically.

Schwarz (2013) takes a different approach to the same issue: in an attempt to avoid the notoriously difficulties in having subjects differentiate between false and infelicitous judgments (witness the results for affirmative sentences by Abrusán and Szendrői (2013) just reviewed), the experiments there involve a truth-value judgment task without a third option, and with reaction times, rather than judgment choices as the dependent variable.⁸ The idea is that if subjects are presented with sentences containing non-referring definites and are only given 'true' and 'false' as answer options, they will opt for 'false'. But if they arrive at the 'false' judgment in

⁸ For an earlier study along similar lines looking at asserted vs. presupposed content introduced by *only*, see Kim (2007).

a different way in cases where it's based on presupposition failure, rather than plain falsity of the literal truth-conditional content, this may be reflected in differences in reaction time. The results reported in Schwarz (2013) indeed suggest that there are such differences. In particular, two experiments find interactions between indefinite and definite sentences that vary whether the nominal restrictor or the main predicate are false relative to a visually displayed context. As the sentences are equivalent, apart from the presuppositional status of the information introduced by the definite, these results thus support the view that rejections based on presuppositional content take longer than rejections based on asserted content. Note, however, that they leave open whether the 'false' judgments for the presuppositional cases correspond to spontaneous 'false' judgment or are merely chosen as the best available option when subjects would rather decline to judge the sentence in the first place. Either way, this approach provides an alternative methodological avenue for assessing judgment behavior with measures that are not directly based on subjects conscious choices.

In addition to cases where presuppositional sentences are rejected (in one form or another) because they are inconsistent with the context, there are cases where a presupposition is consistent with the context though not entailed by it. In such situations, it is quite common for hearers to quietly accept the presupposition, even though it in fact is introducing new information. Following Lewis (1979), such cases are commonly referred to as presupposition accommodation. In its original conception, it is seen as a repair strategy, which hearers utilize to rescue an otherwise infelicitous discourse. They do so by simply adjusting the common ground so that it entails the presupposition, and then proceed to interpret the sentence in light of this adjusted context in the standard way. Numerous interesting issues arise once an attempt is made to spell out the details involved in this process. For recent discussion, see Beaver (2001), Simons (2003), von Stechow (2008), and Beaver and Zeevat (2012). An important issue to come to terms with is that accommodation often proceeds very smoothly and is quite common for certain presuppositional expressions (for corpus results, see Spina, 2002), which seems at odds with the notion of a repair strategy. Another important question concerns the variation in accommodability between triggers, which remains poorly understood in theoretical terms.

A fair amount of experimental work has been carried out on related phenomena with definite descriptions, especially ones involving so-called bridging, where a definite has not been introduced explicitly but directly relates back to something else in the context. In an early study, Haviland and Clark (1974) compared contexts that required a bridging inference (e.g., mentioning picnic supplies) with ones where some entity (e.g., beer) was mentioned explicitly, and found longer reading times on a subsequent presentation of a definite (e.g., *the beer*). O'Brien et al. (1988) showed, however, that prior mention of a referent is not necessary if the context is sufficiently specific: the definite *the knife* was read more slowly when the antecedent was more general (*a weapon*) than when it directly matched the noun phrase (*a knife*), but only when the context involved a general verb such as *assault*, and not when it involved *stab*, which is more closely associated with knives. Burkhardt (2005) (and subsequent work) used ERP-studies to identify neural correlates of bridging by looking

at definites such as *the conductor* in contexts with an explicit antecedent, a bridging antecedent (*a concert*), and no antecedent. Intriguingly, the bridged cases display neural hallmarks of both new and old information in the form of an reduced N400 effect, followed by a P600 effect.

Another approach to accommodation that could be seen as directly relating to the issue of domain restriction is that of Evans (2005), who manipulated the context to vary whether or not a unique individual of the right kind would likely be involved in the described setting:

- (12) a. Juan drove up to the busy tollbooths...
 b. Juan looked at the busy tollbooths...
 (13) ...The toll-taker was rude.

In a fill-in-the-blank task, subjects had to provide the determiner in the target sentence, and chose the definite more frequently in the first context. Rather than merely adding some missing information, this accommodation effect can be seen in light of the assumptions about the domain of interpretation that speakers make based on contextual information.

A final set of studies varies the plausibility of accommodation based on variation of the noun phrase occurring in the definite. Frazier (2006) used passive context sentence (*My order was taken*) followed by a plausible or implausible definite or indefinite (*a/the waiter/busboy*) in a reading time study, and only found effects of plausibility, not of definiteness. Using a similar approach but a different task, namely a stops-making-sense variant of self-paced reading, Singh et al. (2013) do find an interaction of definiteness and plausibility in the frequency of stops-making sense judgments. It remains to be seen to what extent these frequency results can be used to shed light on the issue of what processing costs, if any, might be associated with accommodation, but the addition of systematic evidence for the role of plausibility in accommodation is an important addition to our understanding in this area.⁹

While the literature has very much focused on definite descriptions in investigating accommodation, some studies have looked at other presupposition triggers as well. Schwarz (2007) reports a questionnaire study using ambiguous German sentences with *auch* ('also'), and finds increases in syntactically dispreferred interpretations when those ensure that the presupposition of *auch* is met. This can be interpreted as avoiding accommodation, and is in line with suggestions in the theoretical literature that *also/too* cannot be accommodated Kripke (1991, 2009). Chemla and Schlenker (2012) also utilize *too* (or rather its French variant *aussi*) and their design takes advantage of the difficulty of accommodating an antecedent for *too*. Interestingly, however, Singh et al. (2013) look at *too* in their stops-making-sense task as well, and their results are very similar to those they found for definites: not only do presuppositionality and plausibility interact, but for plausible contexts, subjects

⁹ Direct evidence for processing costs of accommodation has been hard to come by. Perhaps the most convincing result in this regard comes from the accommodation study by Tiemann et al. (2011), which finds longer reading times on critical words in neutral contexts as compared to both verifying and falsifying contexts.

tend to accept the sentences at comparably rates (essentially at ceiling level), even though that requires accommodation for *too*. (See below for discussion of further differences between triggers.)

Yet another important issue involving accommodation from a processing perspective is to what extent decisions in the comprehension process tend to avoid or minimize accommodation. Crain and Steedman's (1985) study discussed above is an early example of a proposal where parsing decisions are influenced by the desire to avoid accommodation, and subsequent work, in particular within the visual world eye-tracking paradigm, has found support for this view from different angles (for an example, see Chambers et al., 2002). Tiemann et al. (this volume) take this view even further by suggesting that for certain triggers (in their case, *again*) whose presupposition does not crucially contribute to the compositional interpretation of their sentence, accommodation may be avoided by ignoring the presupposition altogether. Their version of a *minimize accommodation* principle thus goes so far as to see accommodation as a truly last resort that is avoided whenever possible.¹⁰

4.2 Online Processing

In studying different aspects of meaning in terms of their processing properties, one central question concerns the timing of the availability of a given type of meaning. Much of the experimental literature on scalar implicatures focuses on this aspect, with evidence based on reaction times, reading times, and eye movement data that suggest that scalar implicatures only become available with a delay relative to literally encoded content (but see references above for evidence for immediate availability of implicatures). These results are of great interest for understanding the construction of the overall conveyed meaning in actual online processing as they inform theories about the relationship between different aspects of meaning. The dominant line of interpretation based on implicature-delay effects is that pragmatic enrichment along Gricean lines incurs extra processing cost, which is reflected in the reported delays.

With respect to presuppositions, similar questions arise, and information about the timing of the availability of presupposed content is crucial both for a theory of presuppositions as well as a processing model for them. For example, different theoretical perspectives suggest different temporal orderings of presupposed and asserted content. If we assume that presuppositions are conventionally encoded and constitute conditions on context updates, as on dynamic approaches to presupposition, we would expect that they will be checked immediately, possibly even before the asserted content is computed. From the perspective of pragmatic accounts of presuppositions, on the other hand, which see presuppositions as inferences that arise via pragmatic reasoning in a way at least broadly parallel to scalar implicatures, we might expect delays that are comparable to the results for implicatures in the lit-

¹⁰ For yet another recent study in this area that only came to my attention after writing this chapter, see Domaneschi et al. (2013).

erature. Note, however, that some caution is in order in interpreting any results in this regard. First of all, more needs to be said about how the various theoretical approaches can be translated into corresponding processing hypotheses. Furthermore, while the presence of delays would indeed be problematic for conventional and dynamic accounts (supplemented with appropriate linking assumptions to derive processing predictions), the absence of a delay will not necessarily be evidence against pragmatic accounts. There is ample evidence for rapid availability of various types of pragmatic information (largely from work within the visual world paradigm), so such an outcome could just as well be seen as falling into this category. Nonetheless, insights into the time-course of presupposition interpretation in processing will be crucial for a processing model of different types of meaning, and various studies have begun to shed light onto this issue.

Overall, there is mounting evidence that presuppositions are available rapidly during online processing, much of it using paradigms based on reading times. In two self-paced reading studies on German *auch* and its English correlate *also*, Schwarz (2007) finds increases in reading time for the clause containing the presupposition trigger when it was not supported by the (intra-sentential) context. This delay is attributed to the infelicity of the sentence (assuming that *also* resists accommodation), which in turn can only give rise to reading time effects if the presupposition is indeed available and evaluated relative to the context. Tiemann et al. (2011) expand this general approach to several other presupposition triggers and narrow down the time-window during which the presupposition is available by using word-by-word self-paced reading. One of their experiments indeed finds delays on the presupposition trigger itself, relative to non-presuppositional controls. Furthermore, they find immediate effects on ‘critical words’, which contribute the information needed to determine that a given presupposition is not supported by the context. Using the same general approach of contextual manipulations of felicity but using eye tracking during reading, Schwarz and Tiemann (2012) look at German *wieder* (‘again’) and find delays in early processing measures, such as first fixation duration and regression proportions, on the verb following *wieder* (at least when *wieder* is not in the scope of negation; see below for effects of embedding under negation). Finally, in this volume, Tiemann et al. (this volume) use word-by-word self-paced reading to look at *wieder* in both supporting and neutral contexts, and again find reading time increases at the critical word for the latter. They also present a basic processing model for presuppositions, which includes a proposal for the steps the processor goes through when a presupposition is not supported by the context (see the discussion on accommodation above).

While there have been a number of reading studies on the topic, researchers only recently have turned to the visual world paradigm to investigate the time course of presupposition interpretation at an even more fine-grained level. Indeed, apart from a couple of earlier related studies by Craig Chambers and colleagues (see Chambers and Juan (2005) on *another* and Chambers and Juan (2008) on *return*.), the group of papers using this methodology in the present volume constitutes the first major step towards systematically investigating standard presupposition triggers in comparison with asserted content. They look at English *also* in comparison with the asserted

part of *only*. Romoli et al. (this volume) (see also Romoli et al., 2013) employ a paradigm building on that used by Kim et al. (2009) to investigate focus alternatives in the interpretation of *only*. The linguistic stimuli consisted of a context sentence establishing one individual as having two types of objects, followed by a target sentence that either did or did not include *also* or *only* associating with the subject and a new or old noun in predicate position respectively. They find shifts in eye movements already 300ms prior to the onset of the noun in the critical *also* condition (roughly 500ms after the onset of *also*), indicating that the presupposition of *also* is utilized in determining the referent before further disambiguating information is introduced.

In the second contribution to this volume on this topic, Schwarz (this volume), results from two visual world experiments with a similar approach are reported. In the first experiment, the time course of interpreting *also* associating with an object noun phrase was investigated in visual contexts where its presupposition either did or did not disambiguate the referent during an otherwise ambiguous time window. A shift in fixations towards the target referent was observed in the disambiguating condition as early as 300ms after the onset of *also*, suggesting that the presupposition introduced by *also* is immediately available and utilized in identifying the referent. In a second experiment, the interpretation of stressed *also*, which associated with the subject of the sentence, was compared to the exclusivity asserted by *only*. While *also* again gave rise to an essentially immediate shift in fixations towards the target in the critical condition (starting at 300ms after the onset of *also*), the exclusive inference introduced by *only* did not give rise to a parallel shift until 700ms after its onset. But in contrast to Romoli et al.'s (this volume) findings, this information did yield a significant effect during the otherwise ambiguous time window, in line with Kim et al.'s (2009) findings, who found even more rapid integration of the information introduced by *only*. One difference between the studies is that the ones yielding online effects involved association of *only* with an object, whereas Romoli and colleagues used stimuli where it associated with the subject. Further work is needed to fully understand the factors affecting the ease of interpreting *only*. As far as the presuppositional contribution of *also* is concerned, the results from these studies argue against a delay in availability for presupposed material, and thus may be most naturally compatible with accounts that assume presupposed content is encoded conventionally. But as noted above, it is also possible that we are looking at rapid pragmatic effects, so the results do not settle the question about the nature of presupposed content per se. Nonetheless, they provide the most direct and time-sensitive evidence yet that presupposed information is available and utilized as soon as the presupposition trigger is introduced.

The third study in this volume that looks at *also* using the visual world paradigm, Kim (this volume), takes a different angle, in that it investigates the effects of discourse structure on the choice of the information that is taken to be supporting the presupposition. This is done by presenting multi-sentence discourses, which provide various possible antecedents for *also* in the final target sentence. In two initial comprehension studies, Kim asked subjects to choose one of several descriptions of what the presupposition of *also* conveyed, which indicates how they resolve its

presupposition in the discourse. While there was a general preference for linearly local antecedents (where *also* was understood relative to the immediately preceding sentence), a structurally (but not linearly) local interpretation also became available when the discourse structure was manipulated. In a visual world eye tracking experiment, Kim also found a preference for local interpretation, and she argues that the results provide more evidence that discourse structural, as opposed to linear, locality plays a key role in resolving the presupposition of *also*. The eye movement results for the condition that involves a structurally local antecedent furthermore add to the evidence of the two studies above that the presupposition of *also* is available immediately in online processing.

In closing the discussion of the time-course of presupposition interpretation in online processing, it is worth noting that there is an interesting tension between the results from reading and visual world studies on the one hand and truth-value judgment studies on the other. As mentioned above, both Kim (2007) and Schwarz (2013) find delays in falsifying sentences based on presupposed content, relative to controls based on asserted content. Taken on their own, these results could be seen as suggesting that presupposed content is not readily available in processing. However, that is incompatible with the results considered in this section. It therefore seems that the delays in the judgment studies must be due to the role that presupposed content plays in the verification procedure. This is, of course, entirely in line with the standard view that presuppositions represent backgrounded information, which is taken for granted. Delays in verification might then be due to a reluctance to challenge information expressed in this way, rather than a delay in availability of the information per se, since there seem to be no delays in utilizing this type of information, e.g., in identifying a referent in a visual display. To flesh out this perspective, more work is needed, which ideally would directly investigate these types of tasks in comparison.

4.3 Types of Presupposition Triggers

Various considerations have been brought forth in the theoretical literature to argue for distinctions between different classes of presupposition triggers. For example, Karttunen (1971) already noted that factive verbs seem to vary in how strongly they give rise to inferences based on global presupposition projection. Taking an example from Jayez et al. (this volume) for illustration, (14a) does not necessarily give rise to the inference that Paul missed the point, in contrast to (14b)

- (14) If Paul {(a) realizes / (b) regrets} he has missed the point, he will probably reformulate his objection.

Another proposal for a distinction, which Amaral and Cummings (this volume) take as their starting point, was made by Zeevat (1992). It differentiates between resolution and lexical triggers. The former are crucially anaphoric in that they directly relate back to entities (or events) in the discourse context (examples include

too and *again*). The latter consists of cases where the presupposition is a requirement that comes with the asserted component of the trigger (examples include *stop* and *win*; see Amaral and Cummings, *this volume*, for more detailed discussion). More recently, Abusch (2002, 2010) has proposed a distinction between ‘hard’ and ‘soft’ triggers, based on the possibility of accommodation in the antecedents of conditionals (see Jayez et al., *this volume*, for further illustration). Yet another difference between triggers commonly acknowledged in the literature concerns the extent to which accommodation is possible (for review, see Beaver and Zeevat, 2012). For example, pronouns and *too* are generally found to be hard to accommodate, whereas factives and verbs like *stop* accommodate easily (quantitative support for such differences comes from Spenader, 2002).

At least some of these differences have been used to construct theoretical proposals that accord a different status to the assumed sub-types. For example, Romoli (to appear) argues that soft presupposition triggers really should be understood as a type of scalar implicature, building on the proposal by Abusch (2002, 2010) that soft triggers crucially involve reasoning about alternatives (see also Chemla, 2009a). Whatever the verdict on what the best approach to capturing the differences between types of presupposition triggers, a more thorough understanding of the actual empirical differences will be needed to flesh out the theoretical picture. This includes direct comparisons between particular pairs of triggers, detailed investigations of the properties of individual triggers, as well as cross-linguistic comparisons between (roughly) equivalent triggers.

While various initial efforts in this direction have been made and reported at conferences (Smith and Hall, 2011; Amaral et al., 2011; Xue and Onea, 2011; Jayez and van Tiel, 2011; Velleman et al., 2011; Cummins et al., 2013), much still remains to be discovered and to be documented in the peer-reviewed literature. Three of the papers in the present volume contribute to this topic, both with new experimental results and detailed perspectives on the emerging body of empirical results more generally. Destruel et al. (*this volume*) investigate the exhaustive inference of *it*-clefts in detail by revisiting previous results from Hungarian and German and reporting new data on English and French. They argue that while much of the previous literature has argued about the source of exhaustive inferences of clefts, i.e., whether they are semantic or pragmatic, the key difference between clefts and exclusives (e.g., statements with *only*) lies in the status of the inference. In particular, they argue that with clefts, it is not part of the main assertion, or at-issue content of the utterance, whereas it is with exclusives. Their discussion also makes a substantial methodological contribution by evaluating the test they employ, which involves choosing between various continuations of a given discourse. These differ in whether the preceding utterance is affirmed or denied (by starting with *yes* or *no*), and furthermore, whether a following statement contradicting the exclusive inference is introduced by *and* or *but* (*Yes, and ...* vs. *Yes, but ...*). The availability of *yes, but ...* is argued to be indicative of the status of the inference, in contrast with standard cancellation tests for implicatures, which are indicative of the source of the inference. For clefts, *yes, but ...* continuations are preferred over *no, and ...* ones, whereas the reverse holds for exclusives.

Amaral and Cummings (this volume) use a similar technique in investigating a variety of Spanish presupposition triggers, building on previous work on English (Cummins et al., 2013). Based on Zeevat's (1992) distinction between lexical and resolution triggers, they find differences between examples from both classes of triggers with respect to the acceptability of *yes, but ...* continuations and *no, because ...* continuations. Lexical triggers, such as *lamentar* ('regret'), and *dejar de* ('stop'), among others, yielded significantly higher acceptance rates for *no, because ...* continuations, whereas no such difference was found for resolution triggers such as *también* ('too') or *otra vez* ('again'). These results mirror those that the authors previously found for English and seem to support the distinction posited by Zeevat. Several interesting questions arise when comparing these findings with those for clefts by Destruel and colleagues. First, the existence presupposition of clefts also is one that is entailed by the asserted content of the triggering construction, which would seem to put clefts on par with the lexical triggers considered by Amaral and Cummins. Nonetheless, Destruel and colleagues find a strong preference for *yes, but ...* continuations over *no, and ...* continuations, in contrast with Amaral and Cummins' findings for lexical triggers. Secondly, Destruel and colleagues' claim that the availability of *yes, but ...* continuations is indicative of non-at-issueness may have to be qualified, as the presuppositions of lexical triggers presumably still count as not being at-issue (note that Velleman et al., 2011, also find different patterns for clefts and *too* on the one hand and *find out* and *know* on the other). Further work will be needed to resolve these tensions, e.g., by refining the theoretical perspective on the continuation task in general, or by investigating possible task differences between these studies in particular.

Jayez et al. (this volume) also is concerned with the issue of differences between types of triggers. It uses constructions modeled after Abusch's (2010) test for the weak vs. strong distinction, with presupposition triggers in the antecedent of conditionals and a context sentence that explicitly suspends the global interpretation of the presupposition. Looking at French *aussi* ('too'), *regretter* ('regret') and clefts, they present evidence that the distinction is not entirely robust, as it seems to interact with certain contextual factors. Instead, they argue their results to be consistent with a three-way distinction between presupposition triggers, in line with Jayez (2013). These intriguing findings open up the way towards further investigations, ideally including a broader comparison of the various methods used in the studies discussed here, as well as methods that can shed light on the online processing of the relevant inferences.

4.4 Projection

Presupposition projection, that is the phenomenon that presuppositions introduced in many embedding environments are interpreted outside of that environment, constitutes one of the central theoretical challenges in presupposition theory, and much of the literature has focused on attempts to capture it. Three major approaches have

mostly dominated the picture. Dynamic semantics and Discourse Representation Theory (DRT) constitute different variants of accounts that model the evolving information in discourse dynamically. More recently, Schlenker's (2009) theory of Local Contexts has revived a non-dynamic perspective that nonetheless is conceptually quite close to Stalnaker's original view of contexts and empirically almost equivalent to Heim's dynamic semantics.

Each of the three theories successfully accounts for a large part of the projection data, but their predictions differ in subtle ways. Assessing which prediction is correct in specific cases is a difficult empirical task, and a large part of the experimental work in this area aims precisely to settle specific points of disagreement in the literature. For reasons of space, I cannot review the details of the projection mechanisms of each theory in detail here, but I will briefly sketch some of their key properties (for an accessible overview, see Schlenker, 2011a,b). As discussed briefly above, dynamic semantics sees the meanings of sentences in terms of their context change potentials, and presuppositions are seen as restrictions on admissible contexts. Projection phenomena are dealt with in terms of the formulation of the embedding operators and connectives. To take the simplest example, the contribution of the second conjunct in a conjunction is evaluated relative to a context derived from the context for the entire sentence by updating it with the first conjunct. This accounts for the fact that *John is married and he is bringing his wife to the party.* does not presuppose that John is married, but *John is in town and he is bringing his wife to the party.* does. DRT also models the way presuppositions interact with the previous discourse context, but unlike dynamic semantics, it does so in a representational way. Discourse structure is modeled in hierarchically structured representations, and connectives introduce structures that are associated with a search path (from local to global contexts) for presuppositional antecedents. If no antecedent is found, accommodation is attempted along the search path in the reverse order. Finally, the Local Contexts theory takes a classical, non-dynamic semantics but defines a notion of Local Context that mimics the dynamic effects. In particular, it considers all possible continuations of the linguistic material preceding a presupposition trigger and requires all of them to be presuppositionally acceptable. While this version of the theory assumes a strict role for incrementality, it allows more flexibility than traditional accounts in that incrementality can be seen as a processing bias that can in principle be violated (this becomes crucial for work on symmetry vs. incrementality below).

Much of the experimental work on projection has focused on the question of what exactly the presupposition in a given embedded context is. For example, there is disagreement in the theoretical literature on whether a presupposition trigger in the consequent of a conditional gives rise to a conditional or non-conditional presupposition for the overall sentence. Both types of interpretations appear to be attested, but theories differ in terms of which one they see as the basic one. Romoli et al. (2011) provide a first experimental exploration of this topic using a covered box picture matching task (Huang et al., 2013) and argue their results to favor accounts that predict a conditional presupposition as the basic one (they also shed light on the factor of whether the presupposition intuitively can be seen as dependent on the

content of the antecedent). Another line of work has been concerned with presupposition triggers in quantified sentences and the readings that they give rise to. Chemla (2009b) reports results from several judgment studies and argues that quantifiers vary in terms of the strength of the presupposition (e.g., whether it is universal, existential, or somewhere in-between), in a way that is not predicted by any of the main theories on the market.

Another line of experimental work on projection has been concerned with the role of incrementality. Dynamic accounts, at least as they are standardly construed, assume that presuppositions have to be supported in their context by material that precedes the trigger. More recent modular accounts, on the other hand, have opened up the possibility that incrementality can be seen as a mere processing factor (for some more discussion of these accounts and further references, see Schwarz, *this volumeb*, , *this volume*). Chemla and Schlenker (2012) home in on this prediction and test presupposition triggers in conditionals, disjunctions, and *unless*-sentences in configurations where the presupposition trigger appears either in the linearly first or second clause. In an inference judgment task, they find that subjects more strongly endorse inferences corresponding to a conditional inference, compared to a non-conditional one, regardless of where the presupposition trigger appears. They interpret this as support for a symmetric theory of presupposition satisfaction, where material introduced later on in the sentence in principle can provide support for an earlier presupposition. Such cases are still going to be considered as dispreferred on the grounds of a processing preference for incremental presuppositional support, but this preference is not hard-wired into the projection mechanism.¹¹

Schwarz (*this volumeb*) further investigates this topic by looking at presuppositions introduced in the antecedent of conditionals. Unlike Chemla and Schlenker, who varied placement of the presupposition trigger by putting it either in the antecedent or the consequent, the studies reported here reverse the order of the clauses by creating *if*-clause initial and final variants. They employ a covered box picture matching task, with a variation in whether the consequent of the conditional is true or false of the target picture. This should make a difference on a symmetric account, but not on a dynamic account. Furthermore, the target picture is varied in whether or not it meets the presuppositions. The results for the *if*-clause initial conditions suggest a strong role for incrementality, but the *if*-clause final versions are more in line with the predictions of a symmetric account. However, a possibility remains that a dynamic theory that takes into account linear order in its update procedure might be compatible with the results after all. Further work will be needed to tease apart the more subtle differences in predictions between such modified accounts.

Another important topic involving projection concerns the availability of so-called local interpretations, where presuppositions in the scope of an operator that they would normally escape are interpreted relative to the operator. An early example from the literature on definite descriptions is the following:

- (15) The king of France is not bald - because there is no king of France!

¹¹ For a very recent contribution to this topic looking at disjunction, see Hirsch and Hackl (2013)

By and large, the consensus in the theoretical literature has been that local interpretations are dispreferred. But there had not been any systematic evidence supporting that assessment until very recently, when Chemla and Bott (2013) used a truth value judgment task with sentences such as (16) and measured reaction times for subjects' responses.

(16) Zoologists don't realize that elephants are reptiles.

The factive verb *realize* presupposes the truth of its complement clause, and on its global interpretation, this presupposition prevails even in the context of negation. However, a local interpretation would have that inference negated, as if it were introduced as part of the asserted content. In the latter case, the sentence should be judged true, whereas on the former, it should be judged false. Both types of responses are given by subjects (with only a slight bias towards 'false'-responses), but the 'true' responses take significantly longer than 'false' responses. Chemla and Bott interpret this as evidence for traditional, semantic accounts that take local accommodation to be a last resort repair strategy, and evidence against pragmatic accounts à la Schlenker (2008a), which assume that the local reading corresponds to a literal semantic reading, while the global reading requires additional pragmatic inferences.

Romoli and Schwarz (this volume) utilize a different task to investigate the speed of local interpretations of the presupposition introduced by *stop* under negation. Using a covered box picture matching task, their experiment compares cases where the overt picture supports the presupposition with ones where it doesn't. Their design allows them to not only look at acceptance rates for each case, but also to compare reaction times for target picture choices in both conditions. This avoids a possible confound in the study by Chemla and Bott, who compare reaction times for true vs. false responses. Acceptance rates were much lower for target pictures corresponding to the local interpretation. Furthermore, response times were slower for local target acceptances than for global ones, in line with the findings by Chemla and Bott (2013).

A final set of studies to be mentioned in this discussion is that reported in Schwarz and Tiemann (2013b,a). In several reading time studies using eye tracking, embedding of presupposition triggers is found to modulate processing effects of presuppositional acceptability. In one study, immediate eye movement effects on the critical word are found when the contexts was inconsistent with the presupposition, but only when the trigger (German *wieder*, 'again') was outside of the scope of negation. No effects of context emerged when it was embedded under negation, and follow-up studies suggest that this is not due to a general availability of local interpretations. In a second set of studies, presuppositional support for *wieder* in the consequent of conditionals is introduced in varying locations, namely in the antecedent or in a context sentence. Furthermore, embedding under negation was another factor, as in the previous experiment. The results from this study suggest that the hierarchical distance in terms of the projection search path assumed by DRT directly affects reading times on the critical region. This is unexpected under purely semantic accounts (such as dynamic semantics). It will be interesting to relate Kim's (this volume) contribution to the present volume to these results, as her

study also involves different resolution options for the presupposition of *also*, but at the level of discourse structure. It seems worth considering seeing the two results in a unified way, though this might require a unified discourse structural perspective on both intra- and inter-sentential relations between clauses. This constitutes yet another area ripe for further in-depth investigations.

4.5 Relation to Other Aspects of Meaning

From the overall theoretical perspective laid out in the initial sections of this introduction as well as much of the experimental work discussed here, it is clear that our understanding of presuppositions crucially takes place in relation to other aspects of meaning. From a theoretical perspective, key questions are where to draw the lines between different types of meaning and how they interact with one another. Experimentally, the best angle of understanding the processing properties of one type of meaning often employs contrasts with another type of meaning. While I have adopted a traditional division between central aspects of meaning that are more or less generally accepted in the literature, much recent work has been concerned with re-drawing the boundaries or turning towards more fine-grained distinctions based on specific properties.

For example, as already mentioned above, certain pragmatic approaches to presuppositions raise the possibility that (at least certain) presuppositions are much closer to implicatures than previously thought. And some proposals, such as Romoli (to appear) and Chemla (2009a), go as far as seeing (certain) presuppositions as theoretically equivalent to implicatures. The contribution by Romoli and Schwarz (this volume) attempts to investigate this possibility experimentally. As already discussed in the previous section, their experiments look at *stop* under negation. But in another condition, they also look at the strong scalar item *always* under negation. In downward entailing contexts (which include negation), strong scalar items give rise to indirect scalar implicatures (Chierchia, 2004). For example, in saying that *John didn't always go to the movies this week*, the implicature arises that he sometimes went. By presenting such sentences with target pictures that either were or were not compatible with the implicature, the experiment allowed for a direct comparison of indirect scalar implicatures and the presupposition of *stop* under negation. If the latter was equivalent to implicatures, we might expect patterns on par with prior results in the literature, where the interpretation involving an additional inference involves longer reaction times. Interestingly, the results from this experiment are not straightforwardly reconcilable with any of the traditional perspectives. While presuppositions and indirect scalar implicatures are found to pattern alike, the reaction time pattern is exactly the opposite of that reported for (direct) scalar implicatures in the literature, in that responses involving the additional inference were faster than ones that didn't. While the result for presuppositions is in line with the previous finding by Chemla and Bott (2013), the result for indirect scalars is surprising. The

chapter explores possible explanations for this pattern, and also sketches the path forward for further research to elucidate this puzzling empirical situation.

An important recent theoretical contribution towards the issue of classifying different aspects of meaning is put forward by [Tonhauser et al. \(2013\)](#). They compare a variety of expressions and constructions which project out of embedded environments, including various types of presupposition triggers as well as conventional implicatures in English and Guaraní, and argue for the need for a unified theory of projection. Interestingly, they present a typology of projective meaning that cuts across some of the traditional boundaries, e.g., by grouping together certain presupposition triggers with conventional implicatures based on some of the features of their behavior. There have only been a small number of experimental investigations of conventional implicatures that relate to this discussion. In the theory of [Potts \(2005\)](#), conventional implicatures are argued to differ from presuppositions in that they project more generally, and furthermore in that they always wind up conveying speaker-oriented information. However, [Amaral et al. \(2008\)](#) show that non-speaker oriented interpretations are more prevalent than expected on that type of account, and [Harris and Potts \(2009b\)](#) and [Harris and Potts \(2009a\)](#) investigate the conditions under which such readings become available, using both experimental and corpus methodologies. More recently, [Syrett et al. \(2013\)](#) investigate conventional implicatures and presuppositions by looking at both truth value judgments and reaction times. They find an interesting effect of linguistic context, in that the contribution of sentence final appositives (which are assumed to contribute a conventional implicature) can become part of the at-issue content, in contrast with sentence initial or medial ones. Further experimental and cross-linguistic investigations are in order to assess the nature and variation in types of projective content in natural language more thoroughly.

4.6 Acquisition

While most of the work in this volume reports investigations involving comprehension by adults, the questions and perspectives presented there of course can also be considered from the angle of language acquisition. While there are several related lines of work that involve presuppositional aspects of meaning, a full-fledged investigation of presuppositions and their various properties in their own right is largely yet to be carried out. As with the earlier adult literature, much of the existing work focuses on definite descriptions, and more narrowly on those involving restrictive relative clauses ([Hamburger and Crain, 1982](#), starting with) or other post-nominal modifiers, such as prepositional phrases ([Trueswell et al., 1999](#); [Hurewitz et al., 2000](#)), specifically in connection with the contextual needs for restriction in order to satisfy the presuppositions of the definite. More recently, [Syrett et al. \(2010\)](#) investigated definites containing gradable adjectives and find evidence for 3-year-olds' understanding of the existence and uniqueness presuppositions of the definite article, as well as their ability to shift their contextual assumptions appropriately

when accommodation is needed. In contrast with presuppositions, the acquisition of scalar implicatures has received quite a lot of attention in the literature over the last decade or so. Most of the findings here focus on non-adult-like behavior in children, who tend to accept literal interpretations (lacking the scalar implicature) much more generally than adults (Noveck, 2000; Papafragou and Musolino, 2002; Huang and Snedeker, 2009), though it is not necessarily clear to what extent such results show that children are unable to compute scalar implicatures in the first place (Katsos and Bishop, 2011).

One related area that has been investigated quite extensively is that of children's comprehension of attitude predicates, such as *think* and *know* (for references, see Dudley et al., this volume). As some of these (e.g., *know*) come with a factive presupposition, a crucial question is to what extent children are sensitive to this aspect of meaning and the corresponding differences between such verbs. Dudley et al. (this volume) addresses this question head on by testing children's interpretation of *think* and *know* both in unembedded context and in the scope of negation. They had children find hidden toys in one of two boxes, utilizing cues provided by a puppet, which were relayed to the children by means of an attitude report. Their results have important consequences for the theoretical options considered in the literature for explaining the acquisition of attitude verbs in general, and also show that at least some of the 3-year olds in their study have an exquisite understanding of the factive component of *know*, including its presuppositional property of projection out of the scope of negation.

While these initial steps towards understanding the acquisition of presuppositional content constitute important progress, it is clear that the various other theoretical issues concerning presuppositions that were discussed above merit more detailed investigation from the perspective of acquisition as well. Given the existing methodologies and findings from the literature on implicatures, as well as the emerging body of adult studies, the door should now be wide open for researchers to plow ahead and extend the empirical domain of study for presuppositions even further in this direction.

5 Conclusion & Outlook

As should be clear from the various pointers throughout the previous section, we have begun to learn a good bit about presuppositions in language comprehension, but the field is still in its initial stages and much work remains to be done. Some of the key claims based on existing results include the following:

- Perception of presuppositional infelicity is affected by various contextual factors.
- Rejecting statements based on unmet presuppositions takes longer than rejecting them based on literal content.
- Accommodation can be mediated by prior context (e.g., through bridging), and is affected by plausibility.

- Some presupposition triggers resist accommodation, but this resistance may not be as strong as previously thought in the theoretical literature.
- Parsing decisions are affected by a desire to avoid infelicity or accommodation.
- Presuppositions are rapidly available in online comprehension.
- Processing of presupposition resolution is sensitive to the location of presuppositional support as well as discourse structure.
- Global presupposition interpretations are preferred over and faster than local ones.
- Presupposition triggers vary in their projection behavior and in available continuations that deny the presupposition (*yes, but...* vs. *yes, and...*).
- The incremental component of presupposition evaluation may be a mere processing preference.
- Presuppositions (of certain triggers) and other types of meaning share crucial properties, and more fine-grained typologies of types of meaning may be needed.
- Children as young as three years can display quite detailed knowledge about presuppositions, but there is substantial variation between individuals.

These should, of course, by no means be regarded as final truths about presupposition comprehension, but rather are subject to revision, and furthermore give rise to numerous further questions. Perhaps amongst the most pressing are the following:

- What exactly are the factors that may yield genuine false judgments in light of presuppositional infelicity?
- Does accommodation involve processing costs, and if so, does it do so in general or only in specific circumstances?
- What classes of presupposition triggers are there, and what are the differences between them? Or are more fine-grained typologies of meaning that cut across traditional boundaries called for?
- What affects whether a given presupposition trigger allows accommodation?
- To what extent is accommodation a last resort repair that is to be avoided, and to what extent is it a default form of enrichment?
- How do effects based on the location of presupposition resolution relate to processing of anaphora resolution (e.g., for pronouns)?
- Why are rejections based on presuppositions so slow when presuppositional content seems to be available online so rapidly?
- How general is the evidence for symmetric presupposition projection, e.g., in terms of types of triggers and embedding constructions involved?
- What is the exact nature of presuppositions introduced in other embedding environments, such as attitude verbs?
- What is the role of incrementality in presupposition comprehension, and how does it interact with hierarchical linguistic structures?
- How much do young children know about presuppositions and their projection behavior, and how do they acquire such knowledge?

Many other specific questions of course arise as we consider additional concrete theoretical assumptions and build more detailed processing models for different aspects of meaning. Given the growing body of work in this area and ongoing research

projects both by authors contributing to this volume as well as other researchers, the coming years promise to yield work addressing these questions head-on.

As a final note, there obviously is much room for empirical extensions of research in this area, in various directions. First, given the obvious differences between triggers, the issues laid out above should be studied carefully by considering a broad range of triggers. Second, it is desirable to address one and the same question from various methodological angles to assess the generality of findings. Furthermore, the range of experimental methods utilized to investigate presuppositional phenomena is still relatively limited, mostly to behavioral studies and eye tracking. While some studies using neuro-imaging techniques exist (mostly on definites; see discussion and references in section 4.1), a more extensive use of such methods would substantially enrich research in this area. Finally, most of the work reported here is focused on language comprehension in healthy adults. As already mentioned at the end of the last section, extensions of these approaches to the study of children and their acquisition of knowledge about presuppositions would strongly enhance the overall enterprise. Similarly, consideration of individuals with language-related disorders would seem to open up new angles of understanding, specifically with regard to the question of which aspects of meaning are narrowly based on linguistic knowledge, and which crucially involve domain-general resources.

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