Pragmatic Development

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Abstract

Every token of *language* a child receives as input is also a token of *language use*: someone using language for some or other purpose. In this chapter we discuss the developmental interactions between formal properties of language and principles of language use, or pragmatics. We discuss three avenues of research. How do pragmatic capacities (quantity implicatures and presuppositions) develop? What can we learn about children's pragmatic expectations from what sometimes look like grammatical errors (quantifier spreading, scope relations)? How can children leverage their pragmatic knowledge for learning more language (pragmatic bootstrapping, subset problem). The overarching theme is that grammatical development and pragmatic development are intertwined in ways that make studying their interaction especially fruitful.

1 Introduction

Pragmatics is a tricky concept to pin down. Across the cognitive sciences, the term is used in different and sometimes incompatible ways. It refers to a branch of linguistics concerned with formalizing language use ("formal pragmatics") (e.g. Gazdar 1979). It is used as an umbrella term for the inferential processes that allow speakers and listeners to communicate efficiently using language (e.g. Goodman & Frank 2016). For some, it refers broadly to communicative social interaction and would encompass any goal-directed communicative behavior (e.g. Sperber & Wilson 1986). In this chapter, we will use the term "pragmatics" to talk about the use of language in context: the processes that allow speakers to use language to convey more than what is explicitly stated, and allow listeners to infer such meaning based on background knowledge and situational cues.

Even so, this definition is too broad to satisfyingly tackle in one chapter. So instead of aiming for completeness, we present an opinionated survey of those aspects of language use that have clear interactions with grammar, and in turn, connect to a set of core questions within generative linguistics. Because of this, we will not be covering many things that are part of pragmatics or very relevant for its development.[1] What we do discuss are three major avenues in which developmental linguistics has approached pragmatics.

First, naturally, pragmatic abilities are often the explanandum: the core phenomena to be explained. These endeavors are successful if they can map out and explain when, how, and why children acquire the relevant capacity. Ideally, the developmental trajectory of pragmatic competences should map onto our adult theories, and the quality of this mapping should provide support for or evidence against those theories. We will focus on two case studies: implicatures and presuppositions.

Second, pragmatics often serves as the *explanans*: the explanation for something that might not initially seem pragmatic at all. It turns out that for many linguistic capacities, children's still-developing pragmatic ability is the missing piece that explains otherwise recalcitrant patterns. The basic insight in such work is that no linguistic phenomenon can be explored without pragmatics: context is an ever-present aspect of any linguistic test that children encounter. Critical case studies here are the phenomenon of quantifier spreading and development of scope relations.

Finally, a third way to explore pragmatics is to examine how pragmatic capacities *aid* children's language acquisition. If learners assume that others around them are pragmatics-compliant, that gives them critical

[1] For instance, we will not discuss how sensitivity to others' communicative goals and mental states develop or pragmatic theories of word learning, which do not connect to language structure straightforwardly. We also won't discuss at length work that aims to show that some previously proposed phenomenon disappears under pragmatically "better" conditions, except when it also comes with a generalizable and predictive theory of what makes conditions better or worse.

information to restrict their hypotheses about the grammars that generated the utterances. Such expectations can help explain how children assign meanings to a variety of expressions, from common nouns, to attitude verbs and logical terms.

A note of caution before we head off. There is considerable variability in how well some of our target domains have been studied. Some of the work we discuss results from decades of exploration, while others are single studies hot off the press, whose conclusions are more likely to be subject to revision. While we tried to mark these distinctions, we urge the reader to consult the source materials whenever in doubt.

2 Pragmatics as the explanandum

2.1 Quantity implicatures

Sentences are used to convey not just what they literally mean, but also to provide premises for additional inferences that involve background knowledge and discourse context. A listener of (1), who happens to know that all of Andy's sisters live in California, might infer upon hearing the sentence that Andy is visiting the West Coast.

(1) Andy had dinner with some of her sisters last night.

This is an inference that depends on a listener's private knowledge; even the *speaker* of (1) might not know where Andy's sisters live. People make myriad such inferences in the course of everyday conversation, but it is hard to provide a systematic account of how they work. On the other hand, there are general, highly predictable patterns of inference that are tied to the speaker's choice of one linguistic form over another. Going back to our example in (1), irrespective of what the listener knows about Andy's family, they are likely to infer that *some* here implies "some but not all", and thus, that Andy didn't have dinner with *all* of her sisters.

Grice (1975) provided the classic account for this type of generalized inference, known as a 'quantity implicature'. Grice argued that conversation is a cooperative activity governed by rational expectations, what he called Maxims. Listeners assume that speakers are trying to be truthful (Maxim of Quality), informative (Maxim of Quantity), relevant (Maxim of Relation), and efficient (Maxim of Manner). Though the literal meaning of (1) is compatible with Andy having had dinner with all of her sisters — since *all* entails *some* — a speaker who believed this and adhered to the Maxim of Quantity would have chosen the logically stronger

and more informative sentence with *all*. So the choice of the weaker and under-informative variant with *some* leads to an inference to "not all", via reasoning over a stronger alternative the speaker could have said, but didn't.

Quantity implicatures pose a potential challenge for the learner: how do they distinguish them from hard-wired meaning that is part of an expression's lexical entry? As we saw, in some contexts, *some* can mean "some but not all." Likewise, the disjunctive operator *or* can take on a stronger, exclusive "XOR" interpretation, just as the modal *might* can mean "might but not must". The list goes on. So why shouldn't children start out assuming these stronger meanings, or at least treat these words as ambiguous in their encoded meanings? Yet, surprisingly, the developmental literature suggests that children do not make such mistakes. If anything, they seem not to always access the stronger meanings.

Noveck (2001) was the first to systematically test children's understanding of quantity implicatures (see also: Paris 1973; Braine & Rumain 1981). He looked at how kids interpret the modal *might* in situations where *must* would be more appropriate. Child and adult participants were shown clear evidence for some proposition, e.g., that a parrot was certain to be inside the box. They then heard a sentence like (2) and were asked if they agree.

(2) There might be a parrot in the box.

Adults typically said no, but 7-year-olds overwhelmingly agreed. Noveck saw this as evidence that children initially overlook the quantity implicatures that adults automatically compute. As he put it, "children are more logical than adults" (p. 165).

Subsequent research has aimed at pinpointing exactly why children compute fewer implicatures than adults. Doing this will require us to be a bit more precise about how quantity implicatures arise, and here we will present the Neo-Gricean formalization of Grice's insights (Gazdar, 1979; Horn, 1984; Sauerland, 2004). We can restate the Gricean Maxim of Quantity as mandating that a speaker asserts a sentence ϕ only when they believe that ϕ is true and relevant, and furthermore that for all sentences ψ that asymmetrically entail ϕ, ψ is not both true and relevant. This ensures that the speaker always utters the strongest pertinent statement they believe. Thus, a listener hearing the sentence (1), uttered in response to a background question like *Who did Andy have dinner with last night?*, will conclude that it's not the case both that (i) the speaker believes the logically stronger "dinner with all" is true, and that (ii) "dinner with all" is relevant.

Notice that this alone won't get us to the inference that a speaker who utters ϕ believes that the stronger ψ

is false. The quantity implicature derived above is also compatible with the speaker simply being *ignorant* as to whether Andy had dinner with all or just some of her sisters. To get to the stronger inference — the scalar or exhaustivity inference — we need an additional premise that the speaker has information about the truth of the stronger statement. Amended with this additional premise (the "epistemic step"), the stronger, "not all" inference can be drawn from the speaker's choice of *some*.

A final ingredient in this implicature calculation algorithm is having the right alternatives. If any stronger alternative could be plugged in, we would make bad predictions. For instance in (1), if the listener reasoned over an alternative with *some but not all*, which also is stronger than plain *some*, they would conclude the opposite: that Andy had dinner with all of her sisters. This is because after eliminating the *some but not all* alternative, Andy having dinner with all of her sisters would be the only meaning compatible with the utterance. The Neo-Gricean solution to this problem is to stipulate a restriction on the alternatives. Quantity is constrained by "formal alternatives" specified by the grammar. A common view holds that certain vocabulary items form "Horn scales," as in (3), with scalar alternatives arising from replacing an item with a scale-mate (e.g., Horn 1972; Sauerland 2004).

(3) <all, most, many, some>
<and, or>
<n,...,5,4,3,2,1>
<hot, warm>

Having laid out more concretely what computing a scalar implicature entails, let us enumerate the reasoning steps where children could in principle diverge from adults:

1. Gricean norms of conversation: expect speakers to provide sufficient information, adhering to conversational maxims.

2. Generating alternatives to S: find the scalar alternatives and generate stronger sentences the speaker could have said but chose not to.

3. Reasoning about the speaker's epistemic state: assess whether the speaker considered a stronger alternative relevant and whether they are opinionated about it.

4. Negating the alternatives: derive a strengthened meaning by eliminating stronger, relevant alternatives.

If children's issue is with conversational norms (in 1), we should expect a broad uniformity in failure to compute implicatures. Two pieces of evidence suggest a finer grained pattern, implying that children do have some Quantity expectations.

The first piece of evidence is that children's performance shifts across different tasks. Chierchia et al. (2001) looked at preschoolers' interpretation of *or* in positive sentences, where adults typically strengthen the disjunction to have an exclusive meaning (e.g., interpreting "Every boy chose a skateboard or a bike" as implying that "not both skateboard and bike"). Like Noveck, they found that children often failed to derive this strengthened meaning. But things changed when the task was modified. When children watched two puppets make competing true statements — one using a stronger, more informative sentence with *and* ("Every farmer cleaned a horse and a rabbit"), and the other using a weaker sentence with *or* ("Every farmer cleaned a horse or a rabbit"), they overwhelmingly rewarded the puppet who used the stronger statement. Because there is no obvious reason why the Maxim of Quantity should selectively apply in one of the two tasks, we have to look elsewhere to explain children's differential behavior. Converging results have been found with *some* and *all* (Foppolo et al., 2012) and with modals (Ozturk & Papafragou, 2015).

The second piece of evidence is another type of variability, not based on task, but on the scalar items involved (Papafragou & Musolino, 2003; Huang & Snedeker, 2009). In one study, Papafragou & Musolino (2003) tested Greek-speaking 5-year-olds on three kinds of scalar contrasts: *oli* ('all') vs. *meriki* ('some'), *tris* ('three') vs. *dio* ('two'), and *teliono* ('finish') vs. *arxizo* ('start'). Participants heard a sentence with the weaker term (some, two, start) in a context where the stronger alternative was true (all, three, finish), and had to evaluate sentence acceptability. Adults reliably rejected the weaker statement. Children, however, did so selectively, only with numerals (*tris* vs. *dio*). If exact readings of numerals arise via implicature (*three* meaning exactly three; cf. Huang et al., 2012), then this suggests that children can compute strengthened meanings when the conditions are right.

Findings like these have led to a growing consensus that children's difficulties lie either in generating alternatives (2) or in reasoning about which alternatives are relevant (3). On the most straightforward version of such an account, children simply fail to identify or retrieve the scalar terms that need to be substituted into the sentence to form alternatives. That is, they just don't access the alternative with *all* upon hearing a sentence with *some*. While there have been precursors to this idea (Chierchia et al., 2001; Reinhart, 2006; Guasti et al., 2005), Barner et al. (2011) put it directly to the test. They measured how children strengthen sentence meanings, manipulating two critical dimensions. The first dimension was the nature of the scale: either a context-independent (Horn) scale (*some* vs. *all*) or a context-dependent conjunctive scale (*dog and*

cat vs. *dog, cat, and cow*). The second dimension was the 'evidentiary basis' of the strengthening inference. In one condition, children needed to strengthen based on pragmatic information via a scalar implicature as in previous studies. This was contrasted with another condition, where strengthening was not pragmatic, but grammatically enforced using the particle *only*. Such sentences (e.g. "Only some of the animals are sleeping") involve the same processes as implicature calculation (generating and negating alternatives), but the motivation for strengthening is the meaning of the particle itself, not reasoning over the speaker's epistemic state. Two key patterns emerged from this test. First, children did better when the alternatives involved context-specific scales than conventionalized Horn scales. Second, their performance did not depend on whether the strengthening was grammatically required (*only*) or derived pragmatically (scalar implicatures). Barner et al. (2011) interprets this as showing that the bottleneck comes *before* the strengthening process. In particular, it is in finding the right (lexical) scale-mates and generating the alternatives to negate (in 2).

More recent work has raised the possibility that problem may not be in generating alternatives per se, but in deciding when an alternative is relevant (in 3). There are multiple ways of caching out the role of relevance in scalar implicatures; here we only focus on one option. This version starts from the observation that during conversation, interlocutors can disregard alternatives that do not contribute to their communicative goals (Roberts, 1996/2012). Take (4), for example. Here, the interlocutor's main concern is whether Andy had dinner with any of her sisters, not how many. As a result, the same sentence that normally triggers a "some but not all" inference (see (1) above) is much more compatible with the possibility that all of Andy's sisters were there.

(4) A: Did Andy manage to have dinner with some of her sisters last night?
B: Yeah, she did have dinner with some of her sisters last night.

On this account, when the *some* vs. *all* contrast is not relevant to the conversation, the *all*-variant can get filtered out from the set of alternatives. Is it possible that children, instead of failing to generate alternatives, actually over-filter them based on relevance considerations? Findings from Skordos & Papafragou (2016) are in line with this possibility. They found that 5-year-olds were more likely to compute implicatures and reject under-informative statements like "Some of the blickets have shovels" when the prior context made quantity relevant — i.e. when the conversation was explicitly about how many blickets had shovels. Notably, this is not just about the contextual salience of the lexical item *all*. When they made the *all*-alternative salient, it did help, but it wasn't necessary. As long as quantity was clearly at issue, children succeeded in computing the

"not all" implicature.

To sum up, children seem to entertain a smaller set of alternatives than adults when computing quantity implicatures. This is due to some combination of failing to access the lexical items required for strengthening, and over-filtering logically stronger alternatives based on a non-adult construal of what is relevant.

More recently, a new research project has emerged that builds on the exploration of children's under-strengthening. This project *leverages* the fact that children consider fewer alternatives in order to explain cases where they are less tolerant than adults in their interpretations. There is a long-standing observation in the implicature literature that remained largely unaddressed until recently: some children interpret sentences with *or* conjunctively, rejecting disjunctive statements when only one disjunct is true (Paris, 1973; Braine & Rumain, 1981; Chierchia et al., 2004; Singh et al., 2016). Thus, children often think that the sentence in (5) is true only when the girl possesses both types of fruits.

(5) The girl has an apple or an orange.

Singh et al. (2016) argue that this is a case of over-strengthening, which arises because fail to consider the stronger *and*-alternative but nevertheless strengthen. Unlike adults, who negate the *and*-alternative to derive the standard XOR inference, children compute implicatures while considering only the individual disjuncts as alternatives. Since neither disjunct can be negated without affirming the other, children take a different route: they first strengthen each disjunct, generating alternatives like in (6-a)-(6-b), and then negate these 'pre-strengthened' alternatives.

(6) The girl has an apple or an orange.

   a. The girl has only an apple.

   b. The girl has only an orange.

Negating both (6-a) and (6-b) yields the inference that the girl must have both an apple and an orange (not only an apple; not only an orange).This pattern of over-strengthening has been replicated with disjunction (Tieu et al., 2017) and extended to modals (Staniszewski et al., 2023). Nevertheless it is still an open question whether this 'over-strengthening' behavior reflects a genuine developmental phenomenon or if it can be explained away as a task effect (see Skordos et al. 2020a).

Quantity implicatures have been among the most active topics in language development research, and this section has been a bird's-eye view of the critical issues. There has been considerable progress on the

starting puzzle that mobilized the field: why do children seem to compute fewer implicatures than adults? This progress has allowed the field to expand to a novel set of questions. Beyond the over-strengthening case study we discussed, interesting new directions include explorations of ignorance inferences (Hochstein et al., 2016), free-choice (Tieu et al., 2016) and distributive inferences (Denić & Chemla, 2020).

2.2 Presuppositions

Generally, when we think of sentence meaning, we think of what the sentence is used to assert: content a speaker wishes to put forth and expects the listener to deliberate and evaluate for truth. But sentences can also contain meaning that a speaker wishes to take for granted and expects the listener to just go along with. Such meanings, the 'presuppositions' of a sentence, can be distinguished from truth-conditional meaning in two key respects. First, as already indicated, the presupposed information is not presented as new or debatable; it is packaged as background information that has already been accepted. This can be tested using the "Hey, wait a minute" diagnostic (von Fintel, 2008; Shanon, 1976). Take the exchange in (7). A's utterance here conveys two pieces of information: (i) that Andy has been to a Beyoncé concert before, and (ii) that Andy is planning to go to one now. But because the "Hey wait a minute" test selectively targets presuppositions, only the first inference—the prior concert-going—can be challenged that way.

(7) A: Andy is going to a Beyonce concert again.

a. Hey, wait a minute! I had no idea that she went to a Beyonce concert before.

b. #Hey, wait a minute! I had no idea that she was going to do that.

Second, presuppositions, unlike ordinary entailments, tend to persist when embedded under entailment-canceling operators. In (8-b)-(8-d), the sentence in (8-a) is embedded under different operators (negation, conditionals, modals). The resulting sentences no longer entail that Andy plans to attend a Beyoncé concert, but they still entail that Andy has attended one before.

(8) a. Andy is going to a Beyonce concert again.

b. Andy isn't going to a Beyonce concert again.

c. Maybe Andy is going to a Beyonce concert again.

d. It's unlikely that Andy is going to a Beyonce concert again.

But what exactly is this presuppositional component of meaning? Why do some expressions 'trigger' them

(e.g. *again* in (8))? What principles guide their usage, and are these principles the same across different presupposition triggers?

One influential view takes the distinction between asserted and presupposed content to be about how they affect the conversational "common ground" — the body of information that all conversation participants accept as true (Stalnaker, 1974; Karttunen, 1974). The asserted content of an appropriately used sentence adds new information to the common ground, whereas its presupposed content must already be part of it. On the simplest version of this view, we might expect that a sentence like (7) is appropriate only in circumstances where the listener already knew about Andy's prior concert-going, but did not know about the future plans. But this is not the case: (7) can certainly be used when both the asserted and the presupposed content is new information to the listener. To handle such cases, the 'common ground' view allows for a process of post-hoc adjusting of the common ground: *accommodation*. Even if the listener previously knew nothing about Andy's concert-going history, they can infer what the speaker intends and tacitly adjust their beliefs to retroactively make the presupposition part of the common ground, before evaluating the asserted content.

But semantic theories have continued to wrestle with the question: If presuppositions aren't always *pre*-supposed, how can we know that they impose any requirement on the common ground in the first place? An alternative view would be to imagine accommodation to be the only mechanism underlying presuppositional meaning. Presuppositions don't have to be common ground already; rather, they signal content that the speaker expects the listener to add to the common ground tacitly and without fuss (Atlas, 2005; Simons, 2006).

Developmental data could provide crucial insight into these issues. Do children start out by treating presuppositions as a special class of meaning? Or do they slowly learn the dynamics of how information gets backgrounded? As of now, we do not have a full answer to these questions, as our understanding of how presuppositions develop is fairly limited. There have been two persistent challenges. First, presuppositional expressions are a massively heterogeneous class. Many different linguistic forms carry presuppositions, but they vary in ways that are both theoretically meaningful and incidental. This makes it hard to pinpoint what is driving developmental patterns. Take the additive particle *too* and the attitude verb *know*: both introduce presuppositions, and furthermore, differ in how strictly they require the presupposed information to be established background knowledge prior to utterance. If children acquire *know* later than *too*, is that because of these differences in presuppositional meaning? Or is it because *know* happens to be an attitude verb, which may be independently harder to acquire?

The second challenge is methodological: it is inherently difficult to test for presuppositional knowledge.

If we explicitly draw attention to the presupposition, we risk turning it into at-issue content, undermining its status as assumed background information. But if we provide strong contextual support for the presupposition, we can't tell whether children inferred the presupposition from the linguistic form or just relied on this contextual support. This dilemma is clear in prior work on presuppositions. Take as an example Harris (1975), which examined the factive presupposition of words like *know*. In a "truth-questioning" task, 5-to-11-year-olds heard sentence-question pairs like (9). Since *know* presupposes the truth of its complement, children were expected to give an affirmative answer to the question, but many struggled even in later grade school years.

(9) a. Sentence: The teacher didn't know that Tim was absent.

b. Question: Was Tim absent?

But the test itself may be to blame. The factive verb *know* implies that Tim's absence is already accepted as old information. However, immediately questioning that information paradoxically suggests it is not to be taken for granted after all. To maintain a coherent discourse, children might feel compelled to treat the presupposition as if it in fact was not a presupposition.

Contrast this with Schulz (2003), who tested children's understanding of the factive verb *forget* in contexts where the truth of its complement was explicitly supported. Even 4-year-olds performed well, but this setup introduced a different issue. Once the complement's truth is made clear in context, the task cannot distinguish between children who are adult-like and children who just answer based on what has been independently established, but do not actually know that *forget* is factive.

The fragmented nature of past investigations, along with the challenges in interpreting their results, makes it difficult to draw general conclusions about presupposition acquisition. Instead of attempting a full synthesis, here we focus on two types of expressions, additives and definite descriptions. This pairing allows us to highlight the heterogeneity of presuppositional expressions and their divergent developmental trajectories.

Additives (e.g. *too*, *again*) presuppose the truth of a salient alternative proposition to the prejacent. For instance, "X did P too/also" presupposes that someone other than X also did P, while "X did P again" suggests X had done P before. Across languages, additives appear in children's naturalistic speech as early as age two, and from the get-go seem to be adult-like (Aravind, 2018; Dudley, 2017; Höhle et al., 2009; Jordens, 2012; Matsuoka et al., 2006). Comprehension experiments have also shown that 2-year-olds distinguish different additive particles based on their particular presuppositions (Berger & Pouscoulous, 2014).

Definites presuppose existence and uniqueness; a definite description of the form 'the NP' implies there is exactly one relevant individual in the set denoted by NP. Like additives, definites emerge in children's speech in toddlerhood, but they show a different trajectory. Children up to age six frequently misuse *the* in contexts where uniqueness isn't met, opting for definites when adults would prefer indefinites (Brown, 1973; Maratsos, 1976; Karmiloff-Smith, 1979; Wexler, 2003; Schaeffer & Matthewson, 2005). For instance, Maratsos (1976) presented preschoolers with a story about a woman with multiple children, both boys and girls. They were told that one of the children was making a lot of noise, and asked, "Who was laughing and giggling like that?". Children responded "the boy"/"the girl" about 40% of the time, despite no unique referent having been established in the story. Since then, this 'overuse' of definites have been explored using different methodologies and given a range of explanations (e.g. Karmiloff-Smith 1979; Schafer & de Villiers 2000; Wexler 2003; Munn et al. 2006; Modyanova & Wexler 2007; van Hout et al. 2010).

Why would children struggle with definites for years, but have no analogous trouble with additives? A natural place to look is the divergent presuppositional properties of the two triggers. The presuppositions triggered by additives generally resist accommodation (Tonhauser et al. 2013; see also Kripke 2009; Beaver & Zeevat 2007). Uttering "Dana is having dinner in New York, too" out of the blue is odd, even if it is obviously true that someone else is dining there. Definites, however, have no such issue. There is nothing hard or unnatural in inferring the existence of a unique rental car from a sentence like: "The car that I rented broke down". It might be that these trigger types are fundamentally different, and only additives come with "strong contextual felicity" requirements on the common ground, wherein their presupposition has to be established mutual belief prior to utterance (Tonhauser, 2015).

In a set of experiments, Aravind et al. (2023) explored whether children think presuppositions need to have common ground status prior to utterance, and whether this expectation differs for additives (*too*) and definites (*the*). Preschoolers and adults saw third-party communicative situations where a protagonist talked to someone off-screen, and participants had to figure out who the addressee was from what was said. In some cases, the protagonist's utterance contained presuppositions. If participants expect speakers to presuppose only what is common ground, upon hearing a presuppositional sentence, they should infer that the addressee is someone who already knows the presupposed information. Both adults and children acted according to this expectation, irrespective of the trigger that was used. What did participants do when they were forced to accommodate? In one critical condition (that used the readily accommodable trigger *the*), the more knowledgeable addressee was familiar with both the presupposed content *and* the asserted content, while the less knowledgeable addressee knew neither. When adults were put in this bind, they assumed the addressee

was the less knowledgeable addressee, likely recognizing that novel presuppositions can be accommodated, whereas redundant asserted content cannot be easily rescued. But 4- and 5-year-olds showed no such preference, only reaching adult-like behavior by age 6. Younger children thus seem to treat all presuppositions as tied to strong contextual felicity conditions: they have to be common ground prior to utterance.

So, if children treat additives and definites as being tied to the same common ground requirements, what explains their apparent divergent developmental trajectories? Why, in particular, do children frequently use *the* even when its presuppositions are not common ground? One classic idea is that children initially have a non-adult semantics for *the*, where it presupposes existence, but not uniqueness/maximality (Wexler, 2003; Modyanova & Wexler, 2007; Modyanova, 2009). Another possibility is that children's overuse of definites is due to a miscoordination about what is common ground. In naturalistic conversation, interlocutors must infer what is known and accepted by others, and such inferences are inherently fallible. Children, being less skilled at reasoning about others' epistemic states, may over- or under-estimate what their conversational partners know, leading to corresponding overuse or underuse of presuppositional expressions. To differentiate these possibilities, future work could examine whether overuse is specific to the definite article or if it generalizes to other triggers.

Beyond understanding when presuppositional expressions *can* be used, there is another challenge the learner faces: figuring out when they *must* be used. Amongst a set of competing alternatives that add the same new information to the common ground speakers ought to use the one that has the strongest presupposition (Heim, 1991). On the assumption that cooperative speakers abide by this rule of 'Maximize Presupposition' or 'MP', the use of the presuppositionally weaker variant licenses the inference — an anti-presupposition — that the presuppositionally stronger sentence is not usable in the context. Thus, the (a)-sentences in (10)-(12) all compete with the (b)-sentences to trigger the respective anti-presuppositions in (c).

(10) a. A woman that attended the party is a linguist.
b. Competitor: The woman that attended the party is a linguist.
c. Anti-presupposition: It's not the case that there is only one woman that attended the party.

(11) a. All of her children are college graduates.
b. Competitor: Both of her children are college graduates.
c. Anti-presupposition: She has more than two children.

(12) a. Dana believes that it is raining.

b. Competitor: Dana knows that it is raining.

c. Anti-presupposition: It is not raining.

As the examples above already suggest, competition based on MP involves alternatives obtained by replacing one or more lexical items with a scale-mate, much like in implicature calculation (e.g. *the, a, both, all, know, believe*). But here, the scale-mates differ in presuppositional strength.

Do children respect MP and derive anti-presuppositional inferences? To our knowledge, Wexler (2003) is the first to discus the development of MP. He makes a case that MP is place in child grammar early on based on patterns of errors in children's article use. Children might over-use the definite, but they never over-use contextually equivalent indefinites. Wexler argued that this pattern demonstrates that children prefer to maximize presuppositions.

Evidence from comprehension studies is mixed. Yatsushiro (2008) found that German-speaking 6-year-olds failed to compute the anti-presupposition of *jeder* ('every'), which competes with *der* ('the') and signals non-uniqueness. Legendre et al. (2010) tested 30-month-old French learners' comprehension of personal pronouns, building on the claim that 1st and 2nd pronouns encode person features as presuppositions, whereas the 3rd person meaning arises via competition with the 1st/2nd pronouns (Sauerland, 2008). Legendre et al. found that toddlers had more difficulties comprehending 3rd-person pronouns than 1st/2nd, and saw this result as supporting the idea that anti-presuppositions emerge later than presuppositions.

Aravind (2018) examined preschoolers' sensitivity to MP in two competition environments: <*both, all*> and <*another, a*>. Children showed no preference for *both* over *all* in situations where the duality presupposition of *both* was met. In contrast, they were adult-like in preferring *another* over *a* when the additive presupposition of *another* was met. What explains this asymmetry? One option is that the difference lies in how the presuppositions are (re)verified. The duality presupposition of *both* requires digging into the weeds of shared belief: is it common ground that the domain consists of two entities? On the other hand, *another* is anaphoric and as such, its presupposition can find justification by looking at the conversational record. A sentence like "I ate another apple" requires the prior discourse to have a mention of a previous apple.

There are many further aspects of the development of presupposition that we have not discussed. For instance, we have not touched upon the work on the development of presupposition projection (see Zehr et al. 2016 and Chen et al. 2022 for presupposition projection from quantifiers and conditionals, respectively). Yet other developmental questions — e.g. how do children identify some piece of conveyed content as presuppositional in the first place — remain almost entirely unexplored. In short, many questions are open

for inquiry.

3 Pragmatics as the explanans

A common strategy for 'explaining away' theoretically inconvenient data is by questioning whether the study was pragmatically felicitous. This move often leads to methodological contributions, but fails to advance the theoretical landscape (see, e.g., Bar-Hillel 1971). In some cases though, this strategy is augmented with a non-ad hoc theory of pragmatics that makes new and generalizable predictions. The result is a substantive contribution to our understanding of pragmatics and its development. Here, we discuss two such cases.

3.1 Quantifier spreading

Universal quantifiers like *all* and *every* start appearing in children's spontaneous speech around age 2. By age 4, children show clear sensitivity to some of their key logical properties. For instance, they seem to understand that *every* is downward-entailing in its restrictor and upward-entailing in its nuclear scope (Gualmini et al., 2001; Notley et al., 2012). Despite this, a substantial body of developmental research shows that even at age 6, they still misinterpret universal quantifiers in characteristic ways, in a phenomenon known as "quantifier spreading" (e.g., Inhelder & Piaget 1958; Donaldson & Lloyd 1974; Freeman et al. 1982; Philip & Takahashi 1991; Philip 1995; Crain et al. 1996; Kang 2001; Drozd 2001; Brooks & Sekerina 2005/2006; Drozd & Loosbroek 2006; Philip 2011; Aravind et al. 2017, Skordos et al. 2020b, inter alia).

In a typical quantifier spreading experiment, children hear a universally quantified sentence like (13), and have to evaluate its truth against a scenario. In the critical conditions (e.g. Figure 1), the scenario makes the universal statement true, but there is an extraneous individual that belongs to the set denoted in the restrictor (in this case an elephant).

(13) Every girl is riding an elephant.

Adults judge sentences like (13) as true in this situation, but children often judge them false, and point to the extra elephant as justification. This error was already documented by Inhelder and Piaget (1958) and later by Donaldson and Lloyd (1974). Nevertheless, it wasn't until the 1990s that researchers began to connect this error to children's interpretation of universal quantifiers. Philip and Aurelio (1991) (see also Roeper & de Villiers 1993; Philip 1995) suggested that children initially treat *every* as quantifying over events or

Figure 1: Sample quantifier-spreading scenario from Skordos et al., 2020

situations (e.g., like the adverb *always*) rather than over individuals in their restrictor. From this perspective, a sentence like "Every girl is riding an elephant" is true only if every event is a girl-riding-elephant event.

But a purely semantic explanation of quantifier spreading is difficult to reconcile with the above discussed findings that imply that children *do* grasp the logical properties of *every*. Adults, too, have been shown to make similar errors under cognitive load (Bott & Schlotterbeck 2018; Brooks & Sekerina 2005/2006), suggesting that this is not merely an issue of immature syntax or semantics.

The event-quantification account was therefore more or less abandoned in favor of pragmatic accounts that assume children have the right semantics of *every*, but differ from adults in how they construe the task. So, what about the task could mislead them? One influential pragmatic theory comes from Crain et al. (1996), who argue that the standard quantifier spreading paradigm violates a core principle of conversation they dub 'Plausible Dissent'. What they propose is that for 'Yes' to be a felicitous answer to a Yes/No question, an outcome other than the actual one has to be entertainable at some point over the course of the trial. In typical quantifier-spreading setting, this condition may never be met because the children are only presented with a single picture representing the true outcome. Crain et al. argue that children in such cases reinterpret the question to one where they can answer "no". The question they converge on is one that also asks whether every elephant is ridden by a girl. Their own study tested the role of Plausible Dissent in quantifier spreading errors by creating contexts where alternative outcomes were explicitly considered — e.g., scenarios where girls could have ridden either elephants or dinosaurs, but ultimately they all chose elephants. Under these conditions, children were more likely to accept the universal statement, leading Crain et al. to conclude that quantifier spreading isn't a grammatical error but the result of skewed pragmatics.

A more recent extension by Skordos et al. (2020b) takes this approach a step further by making the number

of elephant-riding girls explicitly the question under discussion (QUD). Prior to the test trials, children saw scenarios where "Every girl is riding an elephant" was clearly false., e.g., there were three girls and four elephants, but only two girls were riding the elephants. When later presented with the classic extra-elephant scene, children made fewer spreading errors. This suggests that providing contrastive contexts beforehand helps to clarify the intended interpretation of the sentence.

There have been other pragmatic approaches. Drozd & Loosbroek (2006) and Philip (2011) suggest that the near-perfect one-to-one correspondence in the relevant scenarios lead children to infer the presence of an extra girl who is supposed to be riding an elephant but is missing from the pictured scene. According to this view, the domain of quantification isn't the three pictured girls, but rather the four *intended* riders. After all, we can truthfully say "Every jockey is not on a horse" when one horse in a lineup lacks a rider (Philip, 2011). Studies that manipulate the salience of the quantified noun phrase (Drozd & Loosbroek, 2006) or highlight the extra object visually (Philip, 2011) both found reductions in quantifier spreading errors.

Notice that these pragmatic explanations are not easily disentangled. Manipulating the QUD has an effect on the inferred quantifier domain while shifting the domain influences the inferred QUD. Still, the success of these contextual interventions strongly suggests that quantifier spreading is tied to experimental design, not to children's underlying semantic representations.

But the question remains: why do these experimental setups trigger quantifier spreading errors in the first place? Why, when shown an extra-elephant scene like Figure 1 and asked "Is Every girl is riding an elephant?", do children assume that every elephant is relevant? And why do adults, except under cognitive load, avoid making similar assumptions?

While the jury is still out on this question, our hunch — in line with recent work by Kiss & Zétényi (2017) — is that it has to do with the peculiarities of experimental communication. Even in so-called 'neutral' experimental contexts, a communicative dynamic is at play, namely the one between the experimenter and the participant (Brody et al., 2023). Each time a test item is presented, participants naturally ask themselves, "Why did the experimenter show me this picture and ask this question?" An adult, familiar with the norms of laboratory experiments, is likely to infer the true goal of the experimenter: to test their understanding of *every*. But a child, less attuned to these experimental conventions, may infer a different, yet equally plausible, goal: that the experimenter is trying to draw attention to the missing girl. Indeed, Kiss & Zétényi (2017) found that when children are presented with naturalistic photos, "rich in accidental detail," and not purpose-made schematized drawings, they make much fewer errors.

3.2 Scope relations

Pragmatics has also been used to explain children's behavior when assigning scope to quantificational expressions. Here, we examine two phenomena that were initially seen as evidence for children's syntactic or semantic delays, but have since been insightfully reinterpreted as challenges related to conversational dynamics.

The first phenomenon is what has been termed 'scope isomorphism'. A series of studies, beginning with Julien Musolino's seminal work 1998, has shown that preschoolers interpret sentences containing a quantifier and negation more restrictively than adults (see also Musolino et al. 2000; Musolino & Lidz 2003). Consider (14).

(14) Every horse didn't jump over the fence.

For English-speaking adults, (14) is ambiguous. Under the surface scope reading, it means that every horse failed to jump over the fence. Under the inverse scope reading, it means that not every horse jumped over the fence, though a subset may have. However, many 4- and 5-year-olds seem to access only the first interpretation.

In Musolino's (1998) experiments, children evaluated (14) as a description of a story in which two horses jumped over the fence but a third one did not. This scenario renders (14) true on the inverse-scope reading, but false on the surface scope reading. Adults, when faced with an ambiguous sentence that is true under one interpretation and false under another, typically choose the interpretation that makes the sentence true, and that is exactly what Musolino found. In contrast, children consistently rejected the sentence, suggesting that they either lack access to the inverse scope reading or fail to use truth to disambiguate scope. Musolino endorsed the first option, claiming that at this developmental stage children are unable to access the 'more complex' inverse scope readings of scopally ambiguous sentences. In what way is the inverse scope reading more complex? In English, the standard analysis for deriving the *Not* $>$ *All* interpretation for (14) involves reconstructing the universal quantifier to a position below negation at LF, where negation can c-command the quantifier. In contrast, the *All* $>$ *Not* interpretation in this sentence is more straightforward, as the higher-scoping element (the universal quantifier) already c-commands the lower-scoping element (negation).

Gualmini et al. (2008) takes the other route to explain the results, proposing that failure is only in disambiguating the scope relations based on which would make the sentence true. Their argument builds on a well-established assumption, that people interpret an assertively used sentence in relation to an explicit or

implicit Question Under Discussion (QUD) (Groenendijk & Stokhof, 1984; Roberts, 1996/2012). Gualmini et al. argue that children's preference for the surface scope reading isn't about an inability to compute inverse scope. Instead, it happens because, in many cases, the inverse scope reading fails to provide a useful or relevant answer to the most readily inferred QUD.

To test this, they designed an experiment where children heard sentences like (15-a) and (15-b) in the context of a story like (15).

(15) A troll is delivering four pizzas but loses two along the way because he's in too much of a rush.

a. Some pizzas were not delivered.

b. Some pizzas were not lost.

The story naturally raises a question: "Did the troll deliver all the pizzas?" With sentence (15-a), both the surface and inverse scope readings provide informative answers. On the surface scope reading (Some pizzas ended up failing to get delivered), the sentence is true, and under the inverse scope reading (It's not the case that any pizzas got delivered), the sentence is false. In contrast, with sentence (16-b), only the inverse scope reading (No pizza got lost) is relevant to the QUD, and it is false in the scenario. The surface scope reading (Some pizzas failed to get lost), while technically true, is irrelevant to the question about whether the pizzas were delivered.

If children's difficulty with inverse scope was due to a general limitation in deriving inverse scope, they should accept both sentences at roughly the same rate, since in both cases, the surface scope interpretation renders the sentence true. However, if relevance to the QUD is driving their interpretive choices, they should reject (15-b), signaling that they access the relevant but false inverse scope reading. Gualmini et al.'s results support the latter prediction: children accepted (15-b) less than half the time, while overwhelmingly accepting (15-a).

The second case study involves children's interpretation of sentences with *only*. On standard accounts, *only* is a focus-sensitive operator: it requires a F(ocus)-marked constituent in the sentence to associate with (here notated in small caps). *Only* conveys that while the prejacent (i.e. the unmodified statement without *only*) is true, its alternatives — which are generated by replacing the F-marked constituent with other expressions of the same type — are false (Rooth, 1985,9). For instance, the F-marking on the subject in (16) evokes alternatives of the form 'X is holding a bucket' (e.g. "A koala is holding a bucket", "A crocodile is holding a bucket"). The sentence on the whole asserts that the kangaroo and nothing besides the kangaroo is holding a

bucket; so it would be false if, say, a koala was also holding a bucket.

(16) Only A KANGAROO is holding a bucket.

The acquisition of *only* has been a major topic of interest since Crain et al. (1994), who found that young English-speaking children frequently assign non-adult interpretations to sentences with pre-subject *only*. In their study, children judged a sentence like in (16) as true in a scenario where a kangaroo was holding a bucket, but there was also a koala holding both a bucket and a shell.

Is it possible that children just ignore *only*, treating (16) as equivalent to the true sentence, "The kangaroo is holding a bucket"? This has been suggested (e.g. Paterson et al. 2003), but does not fully explain the child data. In the same study, Crain et al. also found that children interpreted sentences like (17) as false in the same scenario, correctly pointing out that the koala is also holding a shell.

(17) The koala is only holding A BUCKET.

Crain et al. (1994) and later Zhou & Crain (2010) argue that child grammars do not have pre-subject *only*, which the authors analyze as a determiner-quantifier that takes the subject NP as its restrictor (Rooth 1985; see also Wagner 2006). In contrast, when *only* appears elsewhere, e.g. the VP, they take it to be a propositional operator with sentential scope. They propose that children, unlike adults, treat all instances of *only*, irrespective of where it appears in the sentence, as a sentential adverb, and as such, not restricted to associating with the subject. The result is that children sometimes interpret (16) on par with (17).

Hackl et al. (2015) and Sugawara (2016) have given an alternative pragmatic explanation for this phenomenon. They note that sentences with *only* are incongruent relative to the broad 'What happened?' question that is commonly posed during an experiment. At the root of the incongruence is a requirement, Question Answer Congruence (QAC), which demands that in the answer to a *wh*-question, F-marking must fall on the constituent corresponding to the *wh*-phrase. Since the associate of *only* must bear focus, in order to satisfy QAC, that constituent must correspond to the *wh*-phrase in the preceding question. So a pre-subject *only* sentence is well-formed relative to a subject *wh*-question, as in (18). Correspondingly a VP *only* is well-formed relative to an object *wh*-question (19). The reverse — as illustrated by the (b)-sentences — are incongruent.

(18) Who is holding a bucket?

a. Only A KANGAROO is holding a bucket.

b. #A kangaroo is only holding A BUCKET.

(19) What is a kangaroo holding?

a. A kangaroo is only holding A BUCKET.

b. #Only A KANGAROO is holding a bucket.

Hackl et al. (2015) and Sugawara (2016) suggest that under QAC-compliant circumstances, children will have no issues with *only*. To test this, they modified Crain et al.'s experimental paradigm, replacing broad questions with targeted *wh*-questions and manipulating whether the response with *only* was congruent (as in the (a)-answers) or incongruent (as in the (b)-answers). They found that when QAC was satisfied, children correctly interpreted sentences with pre-subject *only* over 70% of the time. This speaks against there being a grammatical deficit. More strikingly, when QAC was violated, children misinterpreted VP-*only* sentences in ways that mirrored the previously-reported errors with pre-subject *only*: they misconstrued the associate of VP-*only* to be the subject.

While this is evidence for children's competence with *only* and a sensitivity to QAC, it does not explain why children originally failed. Hackl et al. (2016) and Sugawara (2016) propose that the source of children's difficulties lie in accommodating the right sort of question that would make an answer QAC-compliant. If so, then the previously observed asymmetry between subject-*only* and VP-*only* could be viewed instead as asymmetry in how readily children accommodate different types of sub-questions. This shift in perspective raises broader developmental questions, echoing those in the study of quantifier scope: Why do children differ from adults in the types of questions they accommodate? And what makes some questions easier to accommodate than others?

4 Pragmatics as a tool for learning

Every piece of linguistic data a child gets exposed to is encountered in the context of someone *using* language. Arguably, children's aim in these situations is to figure out what people are trying to accomplish when they say something. It might initially seem that doing so requires children to first know the semantically hard-wired meanings and then use pragmatics to enrich those meanings. But on a second look, this clearly cannot be the case. Just consider word learning. A child who needs to map a word to a meaning by definition lacks the hard-wired meaning. On the other hand, they do have access to the context. In many cases, they might even be able to infer the full meaning conveyed by an utterance, even when they don't understand what the

individual parts mean. They might then use this contextual information to decode the hard-wired meaning. Pragmatics is trivially a tool for learning in this sense of the word. There is by now a wealth of evidence that even infants—long before they can speak—are remarkably sensitive to the goals and intentions of people around them (Baldwin, 1991; Bloom, 2002; Csibra et al., 2003; Woodward, 1998; Southgate et al., 2010; Brody et al., 2022). Using these social-cognitive skills, infants engage in various communicative exchanges: soliciting information, making requests, and interpreting others' actions and utterances (see Harris & Lane 2014 and Brody & Csibra 2025 for reviews). Taking such communicative skills for granted, we can ask a new variant of the guiding question of this chapter: how does grammar interact with pragmatic abilities in the process of *learning*?

In a series of papers, Valentine Hacquard and colleagues have argued that pragmatics plays a key role in learning attitude verb meanings, when paired with syntax (Hacquard, 2014; Dudley et al., 2017; Hacquard & Lidz, 2019; Hacquard, 2023; Hacquard & Lidz, 2022). Syntactically, attitude verbs reliably combine with sentential complements, and both children and adults seem sensitive to this cue (Gleitman, 1990; Gillette et al., 1999; Gleitman et al., 2005). This syntactic property is semantically motivated: attitude verbs express beliefs, desires, or other mental states about a proposition, which get expressed by a sentential complement. But syntax alone cannot differentiate *within* the class of attitude verbs. After all, attitude verbs with similar syntactic distributions can have crucial meaning differences. For example, *think* and *hope* both take *that*-clause complements, but they express very different attitudes, with *think* describing a belief and *hope* conveying a desire.

Hacquard and colleagues point to one type of pragmatic evidence that could help: the varying discourse moves that these attitude verbs can support. Different attitude verbs can be used to make different indirect speech acts. "I think it's time for bed" can serve to indirectly assert that it's time for bed, while "I want you to go to bed" can carry the force of an imperative (Go to bed!). If children can detect these indirect speech acts — recognizing, for instance, when a speaker is making a request — they might use this information to cluster attitude verbs by meaning, even when their syntactic distributions overlap.

Another line of research suggests that pragmatics could play a critical role in helping children avoid the "subset problem" in logical vocabulary acquisition (Rasin & Aravind, 2020). The subset problem refers to the challenge of settling on the right meaning for a logically stronger expression, when situations that make the stronger meaning true will also render true any logically weaker meaning. For example, how should a child map *every* to a strong, universal meaning when contexts that make *every* true will also make the weaker existential *some* true by entailment? This challenge had previously led researchers to propose learning biases

that push learners toward stronger meanings (Crain et al., 1994; Piantadosi et al., 2016). What Rasin & Aravind (2020) propose instead is that pragmatic evidence, systematically available in the input, could help rule out logically weaker meanings. Specifically, there are instances where assigning *every* an existential meaning would lead to an odd utterance that violates pragmatic constraints, such as the Gricean Maxim of Quantity or principles that rule out trivial assertions and questions (Stalnaker, 1978,9). A child who has pragmatic expectations — for speakers not to produce odd utterances — can use this to avoid the subset problem.

Analogous claims has been made for how learners acquire the force of modal expressions (Dieuleveut et al., 2022). Modals present a challenge akin to that of quantifiers: whenever a sentence with a necessity modal (i.e., a universal modal) is true, a corresponding sentence with a possibility modal (i.e., an existential modal) is also true. How, then, does a learner determine that a given modal conveys necessity rather than possibility? Dieuleveut et al. (2022) argue that the conversational contexts in which modals are used provide informative cues about their force. For instance, in the case of epistemic modals, contexts that explicitly highlight salient evidence in favor of the prejacent may bias interpretations toward necessity.

One can imagine further ways in which formal pragmatic information can be exploited in learning words. For instance, children, who understand how Focus is expressed in their language can use this information to infer when a word contrasts in meaning with another (Szendrői et al., 2018; Ip et al., 2022). This is because (free) Focus presupposes the presence of a contextually salient, contrastive alternative. In a recent study, Brody et al. (2024) have argued that such expectations might even explain the Mutual Exclusivity effect, an effect previously thought to be a word learning bias.

In typical Mutual Exclusivity studies, children are shown a novel object (e.g., a vacuum tube) and a familiar one (e.g., a car), and hear a novel label (e.g. *dax*). In such situations children reliably take the novel word to refer to the novel object (Markman & Wachtel 1988 et seq). Decades of research in developmental psychology has taken this effect to reveal children's biased expectations about word meanings or speaker intent (Markman & Wachtel, 1988; Diesendruck & Markson, 2001; Markson & Bloom, 1997; Halberda, 2003; Frank et al., 2009; Lewis et al., 2020).

Brody et al. (2024) reinterpret Mutual Exclusivity as driven by Focus. Their starting observation is that in cases of referential ambiguity, F-marking the critical NP is the most natural way of referring to an object. If so, the reason children may expect a new word to refer to an unnamed object in experimental setups may be that the target prompt explicitly communicates the presence of a contrasting alternative (the noun corresponding to the familiar object). Consistent with this hypothesis, they found that when a novel noun was focused

(expressed via prosodic prominence), 2-year-olds treated it as referring to a new object. Crucially, without focus, children thought it referred to the object that they knew the name for. This raises the possibility that what looks like a bias for mutual exclusivity may actually reflect sensitivity to the presuppositions of Focus—a form of "presuppositional bootstrapping" in early word learning.

5 Conclusion

In this chapter, we surveyed the progress on three major areas in the study of pragmatic development.

Adult pragmatic competences have developmental roots. Studying these roots can shed light not only on the processes that result in adult-like abilities, but also provide data that illuminate the structure of the competences themselves. We saw that the developmental trajectories of implicatures and presuppositions bear on theoretical debates, by supporting and clarifying distinctions made by theories of the adult state.

Children are a special population, and as with most special populations, developing valid measures of linguistic competence is far from straightforward. Our adult pragmatic capacities are so automatic and effortless, and our ability to recover from imperfect communicative exchanges so seamless, that it is hard to notice when unintended hoops are placed in front of a participant who has less experience in doing the same. Acknowledging this has been both experimentally and theoretically productive. When armed with sufficiently precise theories of the different components — syntax, semantics and pragmatics — it is possible to disentangle what is responsible for what. This, in turn, helps to identify what children have mastered and where they go awry.

In many cases, it is hard to give principled explanations for how children learn what they do from the information available to them. At first glance, it seems that all they have to go on are the sentences they hear and the contexts in which those sentences occur. The theorist's last resort in many of these cases is to stipulate some internal bias. We discussed a few successful attempts at replacing such biases with systematic pragmatic theories. These start from the insight that the formal properties of sentences are not independent from, but interact with, the context of language use.[2] It turns out that children know many of these interactions, and seem to have access to a treasure trove of information helping them connect words to meanings. This literature is quite recent. How far this knowledge can take children, and what its limits are, are exciting future questions.

[2] Just as syntactic bootstrapping started from positing syntax and semantics interactions (Gleitman, 1990).

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