I want to thank the speakers for inviting me to be part of this symposium. These were three great papers, and I learned a lot from them and from thinking about them. I knew that quantifiers were complex, and I knew about the phenomena under investigation, I think some very interesting things pop out when you juxtapose these three talks together.

So when we put this symposium together, one of the first things that really jumped out at us is that all three papers are really about ambiguity, and I think at some point we considered subtitling it...
A Case Study in the Development of Ambiguity Resolution

“a case study in the development of ambiguity resolution.” Dealing appropriately with ambiguity is of course a key feature in any competent language user, since of course language is absolutely rife with ambiguity. Here are some of the more famous examples.
Can you pass the remote?

Kids Make Nutritious Snacks.

Sally saw the man with the telescope.

Buffalo buffalo buffalo buffalo buffalo buffalo buffalo.
And so in our symposium we have three different ambiguities, but all of them involving quantifiers, and two of them even involving the same quantifier, “every”. And so our case study. Now, when we see non-adult-like behavior, there are roughly two broad possible explanations: either the child is unable to represent one or other of the possible meanings of the ambiguous construction, or the child is unable to choose between them appropriately. So we went into this case study with the idea that the three phenomena under consideration would give us three different windows into how children come to represent both possible meanings and choose between them, and altogether some coherent whole would emerge. [PAUSE] In fact, the only general conclusion I’ve been able to draw is that there is no general conclusion to draw, that these three ambiguities and their developmental trajectories are strikingly different. There are three striking and puzzling differences that I will discuss, each of which I think points the direction to profitable future research in language development and the structure of language. But I think that additionally the fact that these three phrenomena are so different itself points to a general conclusion, which I will return to at the end of my talk. First, I’ll review the three phenomena.
Three Ambiguities

Scalar Implicature (Shetreet et al.)

"Some of the sheep are sleeping"
Just so we’re clear, this image on the left is meant to represent one person, let’s call him
Bob, who walks all the dogs but at different times.
Three Ambiguities

Quantifier Scope (Feiman & Snedeker)

“Every boy climbed a tree”
Three Ambiguities

Scalar Implicature (Shetreet et al.)
“Some of the sheep are sleeping”

Simultaneous/Sequential (Novogrodsky & Roeper)
“Who walked every dog?”

Quantifier Scope (Feiman & Snedeker)
“Every boy climbed a tree”

During Development
Three Ambiguities

Scalar Implicature (Shetreet et al.)

“Some of the sheep are sleeping”

Simultaneous/Sequential (Novogrodsky & Roeper)

“Who walked every dog?”

Quantifier Scope (Feiman & Snedeker)

“Every boy climbed a tree”

During Development

• Adults prefer *only some*
• Children prefer *non-zero*
• Until 7-9 y.o.

(Horn, 1989; Noveck, 2001)
Three Ambiguities

Scalar Implicature (Shetreet et al.)

“Some of the sheep are sleeping”

Quantifier Scope (Feiman & Snedeker)

“Every boy climbed a tree”

Simultaneous/Sequential (Novogrodsky & Roeper)

“Who walked every dog?”

During Development

• Adults prefer only some
• Children prefer non-zero
  • Until 7-9 y.o.
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• Adults prefer both(!)
• Children split
  • Until >7 y.o.
    (Novogrodsky & Roeper, today)
<table>
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<tr>
<td>Quantifier Scope (Feiman &amp; Snedeker)</td>
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<td>• Kids (4-7) prefer distributive</td>
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<tr>
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**[PAUSE]** So here is the first puzzle
Puzzles in Comparing the Phenomena

Puzzle #1: Scope ambiguity resolution does not develop?
Here I have regraphed Roman’s data, and you can see a nice bias towards the distributive reading in every condition that he ran. Maybe if we looked at sufficiently younger kids, we’d see something, but so far we don’t, and in any case it would be a developmental change happening early relative to the others discussed in this symposium. [PAUSE] And it’s not like there are no changes in children’s interpretation of quantifier scope.
Puzzles in Comparing the Phenomena

Puzzle #1:
Scope ambiguity resolution does not develop?

cf “Every boy did not climb a tree.”
Children: “All boys are such that they did not climb any tree.”
Adults: “At least one boy did not climb any tree.”
(e.g., Mussolino, Crain, & Thornton, 2000)

Famously, the scope of “every” interacts with the scope of negation,
[READ & EXPLAIN]
Puzzles in Comparing the Phenomena

Puzzle #1: Scope ambiguity resolution does not develop?

“Every boy climbed a tree”

So you might think that perhaps it’s actually computationally easier to assign the distributive meaning to “every boy climbed a tree”. That means that every boy is such that they climbed a tree, whereas the other reading is that there is a tree such that every boy climbed it. The order of arguments is reversed, maybe that’s what makes it hard, and nothing additional need be said. Unfortunately for this hypothesis, not all quantifiers work this way.
“All” has the exact opposite bias, with “All of the boys climbed a tree” generally being interpreted collectively, with one tree that all the boys climbed. And there is some evidence that this is true in children as well.
So this was a study from Brooks and colleagues. Children were presented with sentences like “All of the flowers are in a vase”. They chose the appropriate picture out of three options: a “collective” option, in which all the flowers are in the same vase, a “distributive” picture, in which each flower is in its own vase, and an “exhaustive” picture in which all flowers have vases -- notice how there are extra vases in the “collective” and “distributive” pictures. [PAUSE] Focusing on the collective and distributive interpretations
You can see that at every age, participants were slightly more likely to choose the collective reading than the distributive reading. The effect does get stronger with age. Part of that is certainly noise, but part of it is that children really like the exhaustive picture.
There is a long, storied literature trying to work out what this is. From our perspective, what is important is that these data do NOT support the hypothesis that children have a strong distributive bias for universal quantifiers from the get–go.
So that was the first puzzle. There is a second one that actually jumps out of the illustrations I used for the each/every study and the scope ambiguity study. Focusing just on them...
There is a striking resemblance between the pictures on the left and the pictures on the right.
And, in fact, both Roman and Rama initially used the term “distributive” to discuss the reading on the left and the term “collective” to discuss the reading on the right. After discussion, we settled on
“sequential” and “simultaneous” to describe the two readings of “who walked every dog” and to restrict
“distributive” and “collective” to the scope ambiguities, just in order to keep the two phenomena distinct. Because they are distinct. The “sequential” reading of “who walked every dog” distributes over EVENTS which are temporally distinct, whereas the distributive reading of “every boy climbed a tree” distributes over BOYS, and there need be no temporal distinction (though, there could be). Also, the quantifier scope ambiguity is a structural ambiguity; what’s going on with the sequential/simultaneous ambiguity is less clear.
To see that, let’s look at “every boy climbed a tree”. As we’ve seen before, the distributive reading is
[CLICK & READ] whereas the collective reading is [CLICK & READ]. In contrast, let’s look at “Sally walked every dog”. Here, as long as we restrict ourselves to the standard logical terms, both the sequential and the simultaneous reading are [CLICK & READ]. Now, maybe that’s just a limitation of the formal logic we’re using here, and maybe a better formal logic would show a deep relationship between “sequential” and “distributive” on the one hand and “simultaneous” and “collective” on the other. But keep in mind that if you go down that road, you’re stuck trying to explain why in sentences like “Sally walked every dog”, adults have no strong preference or perhaps a weak preference for the “simultaneous” reading, whereas for sentences like “every boy climbed a tree” both adults and children strongly prefer the “distributive” reading. And that is the second puzzle.
Puzzles in Comparing the Phenomena

Puzzle #1:
Scope ambiguity resolution does not develop?

Puzzle #2:
  a. “Distributive” ≠ “Sequential”
  b. Every biased towards “distributive” in subject position
     but (slightly) towards “sequential” in object position?

[PAUSE] I promised one more puzzle. This one has to do with scalar implicature.
Scalar implicature is usually analyzed like this. Let’s say someone says “Some of the sheep are sleeping.” This just literally means that a non-zero number of sheep are sleeping.
Scalar Implicature (Shetreet et al.)

“Some of the sheep are sleeping”

Steps in derivation

Next, you check to see if there are any appropriate implicatures. First,
Scalar Implicature (Shetreet et al.)

“Some of the sheep are sleeping”

Steps in derivation
1. Is there a more informative alternative? 
   (e.g., all of the sheep are sleeping)

You consider any more informative statements the speaker could have made, such as “all of the sheep are sleeping.” I’ll spell out what is meant by “more informative” for those of you not that familiar with the scalar implicature literature.
Think through the range of situations in which you can use “some”. That includes the range of situations in which you can use “all”, because “all” entails “some”. If all of the sheep are sleeping, it must be the case that some of the sheep are sleeping. But the reverse is not true, since if some of the sheep are sleeping, perhaps not all of them are. Thus, the sentence involving “all” is more restricted, is true in a smaller range of possible worlds, than is the sentence involving “some”. That is what it means for it to be more informative.
Scalar Implicature (Shetreet et al.)

“Some of the sheep are sleeping”

Steps in derivation
1. Is there a more informative alternative?
   (e.g., all of the sheep are sleeping)
2. Assume that alternative is not true iff:
   a. The speaker knows whether it is true.
   b. If it were true, the speaker would say so.

Next, rule out that stronger alternative statement if the speaker knows whether the stronger statement is true and the speaker would have said so were it true.

So when we think about why children are less likely than adults to calculate scalar implicatures, this analysis highlights two places where the problem could be.
Scalar Implicature (Shetreet et al.)

“Some of the sheep are sleeping”

Steps in derivation
1. Is there a more informative alternative?
   (e.g., all of the sheep are sleeping)
2. Assume that alternative is not true iff:
   a. The speaker knows whether it is true.
   b. If it were true, the speaker would say so.

They could have a problem with Step 1, with identifying the alternative utterance. David Barner and his collaborators have probably been the most active in exploring this possibility.
Steps in derivation
1. Is there a more informative alternative? (e.g., all of the sheep are sleeping)
2. Assume that alternative is not true iff:
   a. The speaker knows whether it is true.
   b. If it were true, the speaker would say so.

Scalar Implicature (Shetreet et al.)

“Some of the sheep are sleeping”

Another possibility is that children have difficulty with what are essentially the theory-of-mind aspects of the problem, identifying the speaker’s knowledge and intentions. Which, given children’s difficulty with social cognition, is not impossible.
Einat argued for yet a different possibility, which is that children actually succeed at the derivation but fail in the application, that children have difficulty making use of this enriched meaning. [PAUSE] The puzzle appears as soon as we think through the relationship between “each” and “every”.

Steps in derivation
1. Is there a more informative alternative?
   (e.g., all of the sheep are sleeping)
2. Assume that alternative is not true iff:
   a. The speaker knows whether it is true.
   b. If it were true, the speaker would say so.
Here’s the puzzle: Each and every contrast in much the same way some and all do. They are closely related words, but “each” has the narrower range of meanings -- it refers to sequential events whereas every refers to simultaneous OR sequential events -- and thus ‘each’ more informative. So if we were to apply the logic of scalar implicature to each and every, we should find that adults strongly prefer the simultaneous reading of “every”. Why? Because if the speaker knows that the event was sequential, and if the speaker wants to be informative, she should use the more specific term “each”; since she didn’t, by implicature the event was not sequential -- that is, simultaneous.

[PAUSE] However, the only participants showing that behavior in either of Rama’s experiments is the 6yos.
Here are those data re-graphed [PAUSE] You can see it’s only the 6yos that show a strong preference for “simultaneous”.
Puzzles in Comparing the Phenomena

Puzzle #1:
Scope ambiguity resolution does not develop?

Puzzle #2:
b. Every biased towards “distributive” but not “sequential”

Puzzle #3:
Why is there no every/each scalar implicature?

And that is the third puzzle. [PAUSE]. Each of these I think are worthy topics for future study, particular Puzzle #3, if for no other reason than to make sure we don’t over-fit our theories of pragmatics to scalar implicatures on “some” and “all”, which has been the focus of much of the work lately. [PAUSE]
More broadly, we have looked at three different ambiguities involving quantifiers, and they don’t seem to have all that much in common. The developmental trajectories are different. The structure of the inference is different. The plausible explanations for how the ambiguities are resolved by adults have little in common. Is that disappointing? Did we just end up with a bad case study?
A Case Study in the Development of Ambiguity Resolution.

I don’t think we did. I actually think this is a very informative case study, and very representative of pragmatics in general.
A Case Study in the Development of Pragmatics.

Pragmatics as always been a negative category -- it’s whatever syntax and semantics don’t explain. Maybe all of pragmatics reduces to the operation of a few very general principles, like those of Relevance Theory or Gricean Theory, but maybe it doesn’t. Maybe there are many different mechanisms for enriching the literal meaning of an utterance or for choosing between two possible meanings of an utterance.

This is something I’ve been considering for a while -- and I don’t think I’m unique in this. The trigger for me was a project I did a few years ago with Steve Pinker, in which we were investigating the role of domain-general social cognition in pragmatics. We reasoned that, given that there is a fair amount of individual variation in social cognition abilities — some people are better at reading others, and some are not so good — then if social cognition drives pragmatics, we should see correlated variation in pragmatic abilities. We tested a number of different types of pragmatic inferences, and surprisingly we saw hardly any relationship between social cognition and these inferences. [PAUSE] Relevant to this talk, though, we saw little correlation between the different pragmatics tasks. Closely-related tasks did correlate. So scalar implicature correlated with contrast implicature (that’s the Julie Sedivy implicatures, for those of you who know that work). And different politeness implicatures correlated with one another -- that’s the inference that “Can you pass the salt” is not meant to be taken literally. But politeness implicatures did not correlate with scalar implicatures and contrast implicatures. And none of them correlated with pronoun interpretation. And so on.

I think the future of pragmatics research is going to look a lot more like this, that we may be moving beyond big framework theories. If so, then this symposium provides a very good case study in the development of pragmatics.
A Case Study in the Development of Pragmatics.

Thank You!