

# Presuppositions vs. Scalar Implicatures in Acquisition

Cory Bill, Jacopo Romoli, Florian Schwarz and Stephen Crain\*

## 1 Introduction

Scalar implicatures, (1b) or (2b), and presuppositions, (3b), are two central types of inferences that we draw from sentences. Traditionally, these inferences are considered to be very different from each other: scalar implicatures are standardly treated as arising from reasoning about the speaker's intentions (Grice 1975; and much subsequent work), while presuppositions are typically analysed as appropriateness conditions to be satisfied in the conversational context (Stalnaker 1974, Karttunen 1974, Heim 1982; among others). Recently however, several theorists have argued that at least some presuppositions should be brought closer to implicatures and have proposed theories of presuppositions based on mechanisms that have traditionally been associated with implicatures (Simons 2001, Abusch 2002, 2010, Chemla 2010, Romoli 2014). Throughout the rest of this paper, these theories will be referred to as the 'Presupposition as Implicature' approach.

- (1) a. Some of the giraffes have scarves  
b.  $\rightsquigarrow$  Not all of the giraffes have scarves
- (2) a. Not all of the giraffes have scarves  
b.  $\rightsquigarrow$  Some of the giraffes have scarves
- (3) a. The bear didn't win the race  
b.  $\rightsquigarrow$  The bear participated in the race

The Presupposition as Implicature approach predicts that, everything being equal, certain presuppositions and scalar implicatures should behave uniformly. This prediction has been investigated in adult sentence processing studies by Chemla and Bott (2013), and Romoli and Schwarz (2014), with their results at least *prima facie* challenging the predictions made by this approach.

Following the logic of these previous studies, the present study tested the predictions of the Presupposition as Implicature approach by comparing the way adults and children interpret scalar implicatures and presuppositions. The main finding was that presuppositions and scalar implicatures evoked different patterns of behavior from children and adults. This finding represents a further challenge to the Presupposition as Implicature approach, favouring instead the more traditional perspective on these kinds of inferences.

The paper is organised as follows. Section 1.1 compares the traditional approach on presuppositions and implicatures to the Presupposition as Implicature approach. Section 2 outlines the method we used to investigate the possibility that presuppositions are scalar implicatures. Section 3 reports the results of this investigation, and finally, Section 4 discusses how the findings of the present study bear on these different accounts of presuppositions and scalar implicatures.

### 1.1 Presuppositions and Scalar Implicatures

The traditional conception of presuppositions and scalar implicatures contends that these inferences are fundamentally different, in contrast to the Presupposition as Implicature approach. In the following two Sections, we will give a brief sketch of how presuppositions and scalar implicatures are analysed within these different perspectives. First, we will present the traditional perspective that scalar implicatures and presuppositions are generated by distinct mechanisms. Then we will turn to the Presupposition as Implicature accounts, and show how they attempt to tie these inferences together.

---

\*For helpful feedback and discussion, we would like to thank Emmanuel Chemla, Gennaro Chierchia, Alexandre Cremers, Kelly Rombough, Raj Singh, Jesse Snedeker, Ayaka Sugawara, Rosalind Thornton, Lyn Tieu, the audiences at the CUNY2014 and PLC38 conferences, and the members of the CCD Language Acquisition Group at Macquarie University. We would also like to thank Dorothy Ahn for images used in the experimental stimuli.

### 1.1.1 The Traditional Perspective on Presuppositions and Scalar Implicatures

The standard way of analysing presuppositions is as definedness conditions on the conversational context that contains the sentence expressing the presupposition. The gist of the idea is that a sentence like (4a), repeated from above, is only felicitous in a context in which the presupposition in (4b) is already assumed in the common ground (Stalnaker 1974, Karttunen 1974, Heim 1982, 1983; see also Beaver and Geurts 2012 for an introduction to presuppositions.)

- (4) a. The bear didn't win the race.  
b. The bear participated in the race.

According to this perspective, presuppositions are necessarily associated with sentences containing presupposition triggers. In order to reconcile this with cases of apparent suspension of presuppositions, as in (5), this approach assumes an extra mechanism, through which the presupposition is 'accommodated' locally in the scope of negation (Heim 1983; see also von Stechow 2008). This gives rise to the meaning paraphrased in (6), which is compatible with the continuation of (5), in which Bear didn't participate in the race.

- (5) The bear didn't win the race ... he didn't even participate!  
(6) It's not true that (the bear participated and won)

In contrast to presuppositions, scalar implicatures are analysed differently. The traditional approach to scalar implicatures goes back to Grice (1975) and Horn (1972). On this approach, the source of scalar implicatures can be understood as involving principles that are invoked when we interact with each other in conversations. In particular, the inference (7b) that is drawn from the statement in (7a) arises from the hearer's reasoning about what the speaker did and did not say.

- (7) a. Some of the giraffes have a scarf  
b. Not all of the giraffes have a scarf

In brief, the hearer will note that the speaker said (7a), rather than the more informative sentence (8). Assuming that (8) is relevant to the purposes of the conversation, and that speakers are committed to conveying the most informative relevant information at their disposal, the hearer infers that the speaker's reason for not saying (8) is that the speaker believes (8) to be false. Therefore, the hearer derives the inference (7b). This type of scalar implicature will be referred to in this paper as a 'direct scalar implicature' (DSI) (cf., Chierchia 2004).

- (8) All of the giraffes have a scarf

A parallel line of reasoning, can be used to derive (9b) from (9a). The hearer reasons that the speaker said (9a), rather than the relevant and more informative (10). Therefore, the hearer infers that (10) is false (= (9b)). This type of scalar implicature will be referred to as an 'indirect scalar implicature' (ISI).

- (9) a. Not all of the giraffes have a scarf  
b. Some of the giraffes have a scarf  
(10) Not some (=none) of the giraffes have a scarf

This brief reconstruction of presuppositions and scalar implicatures, while quite general and glossing over many intricacies, will suffice for our purposes. We now turn to the more recent accounts of these inferences from the Presupposition as Implicature approach.

### 1.1.2 Presuppositions as Scalar Implicatures

Presupposition as Implicature accounts generally attempt to bring presuppositions and scalar implicatures closer together. In particular, some of the accounts within this general approach treat certain presuppositions, such as the presupposition associated with the verb 'win' (11b), as scalar implicatures of a sort (Simons 2001, Abusch 2002, 2010, Chemla 2010, Romoli 2012, 2014).

- (11) a. The bear won the race  
 b.  $\rightsquigarrow$ The bear participated in the race

The main argument for this recent approach comes from identified differences between the presuppositions associated with certain verbs like ‘win’ and the presuppositions associated with other expressions. These differences arise in the ease with which the different kinds of presuppositions can be suspended, and their behavior in quantificational sentences (see Abusch 2010 and Romoli 2014 for discussion).

The basic idea is that the inference (12b) is derived from (12a) as a scalar implicature, following the same line of reasoning as the previous example. That is, the speaker said (12a) rather than the relevant and more informative sentence (13). Therefore, the hearer infers that the speaker believes the latter to be false, deriving the presuppositional inference in (12b).

- (12) a. Bear didn’t win the race  
 b. Bear participated in the race  
 (13) Bear didn’t participate in the race

If this approach is correct, then the presuppositions of triggers like that associated with the verb *win* are essentially scalar implicatures. Therefore, it predicts that, everything being equal, both kinds of inferences are expected to behave uniformly with respect to behavioral measures relating to their role in overall interpretation.

## 1.2 Previous Research

There has been a considerable amount of work done on children’s acquisition of DSIs. This literature has displayed a great variability in regards to the specific rates at which adults and children base their responses on SIs.<sup>1</sup> However, one consistent pattern throughout this literature is that children are less likely than adults to generate SIs. (Noveck 2001, Papafragou and Musolino 2003, Huang and Snedeker 2009, Foppolo et al. 2012, among many others).

The acquisition of ISIs has been subject to fewer empirical investigations. However, the work that has been done appears to display a similar pattern, with children being more likely than adults to give responses based on the literal meaning of the target sentences (Musolino and Lidz 2006, Katsos et al. 2011).

As for presuppositions, although there has been quite a bit of work done on children’s understanding of certain presuppositions (e.g., presuppositions associated with negation, definite descriptions etc.), there is little, if any, previous work on children’s understanding of the kinds of presuppositions we are interested in (i.e., soft-presuppositional triggers, like the verb ‘win’). However, if the Presupposition as Implicature approach is right, we would expect participants to engage with these presuppositions in the same way as they engage with scalar implicatures. If so, we would expect children to be less likely than adults to generate these presuppositions.

## 2 Method

### 2.1 Participants

Twenty monolingual English-speaking adults, and 30 monolingual English-speaking children, split into two age-groups (22 4–5 year olds, 16 7 year olds), participated in the study. Only those participants who passed at least 3 out of the 4 controls related to each of the 3 critical conditions (outlined

<sup>1</sup>We remain neutral here as to the source of this different behavior. While it is commonly attributed to children’s inability to generate SIs, it could also be due to a higher tolerance to pragmatic infringements (Katsos and Bishop 2011: a.k.a ‘Pragmatic Tolerance Hypothesis’), or to variation in the type of judgments (e.g., with regards to assessing informativity vs. truth). Although these are interesting questions, for our purposes it is not necessary to find their answers, so in the interest of terminological consistency we may occasionally describe certain responses as being indicative or not of ‘SI-generation’, even though we are aware of the noted criticisms and ongoing discussion in this area.

below) were included in the analysis. We report the data from the 16 4–5 year olds (4;01–5;05,  $M=4;06$ ), 14 7 year olds (7;00–7;12,  $M=7;04$ ), and 20 adults who met these requirements.

## 2.2 Materials

As shown in Figure 1, each trial consisted of three pictures, namely a context picture and two test pictures. One of the test pictures was visible, and the other was covered. These pictures were pasted onto a large cardboard poster, which was then laminated. The whole poster was 600mm x 450mm in size, with each individual picture measuring 297mm x 210mm. The context picture was positioned at the middle top of the poster. The visible test picture was placed at the bottom left of the poster, and the covered test picture was placed on the bottom right of the poster.<sup>2</sup>

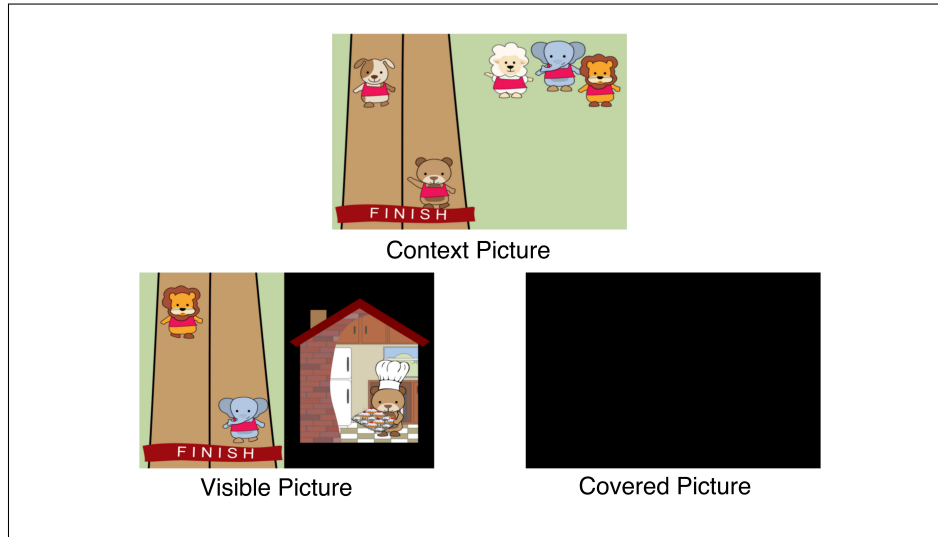


Figure 1: Example trial - Presupposition condition.

Throughout the training trials the covered picture was revealed to the participants at the end of each trial. However, the participants were not shown the covered picture throughout the rest of the experiment, in order to ensure that participants' judgments would not be influenced by any interpretation options suggested by the covered picture.<sup>3</sup>

## 2.3 Procedure

The task was a variant of the 'Covered Box' paradigm used in Huang et al. 2013 to investigate similar phenomena. In each trial, the participant was presented with a short description of the context picture. This was done to 'set the scene' and make the use of negation felicitous. This short description was followed by a test sentence that purportedly described only one of the two test pictures (visible or covered). The participant's task was to judge which of the two test pictures was described by the test sentence, and then to provide a short justification for their decision.<sup>4</sup> An audio

<sup>2</sup>The covered test picture consisted of a black piece of laminated paper stuck to the poster by tabs of fabric hook and loop fastener ('Velcro').

<sup>3</sup>In fact, unbeknown to participants, for the non-training part of the session, there was no actual picture underneath the 'Covered Picture'.

<sup>4</sup>This paradigm is quite similar to the Truth Value Judgment Task paradigm (Crain and Thornton 1998), however, it arguably differs in a couple of important ways. First, by presenting the option of the 'unknown' interpretation, participants are encouraged to actively consider alternative interpretations, which might better suit the test sentence. Second, by requiring participants to choose between two pictures, rather than judging the 'truth-value' of a sentence, the possibility of participants accepting the test sentences out of politeness or confusion is reduced.

recorder was used to record these judgements and related justifications.

In total, the study compared 3 different linguistic contexts corresponding to the three inferences under investigation (DSI, ISI, or P). Each of these contexts was tested on 4 critical trials and 4 control trials. The critical trials tested whether participants were generating the relevant inferences from the test sentences. The control trials tested participants general capacity to understand the test sentences.

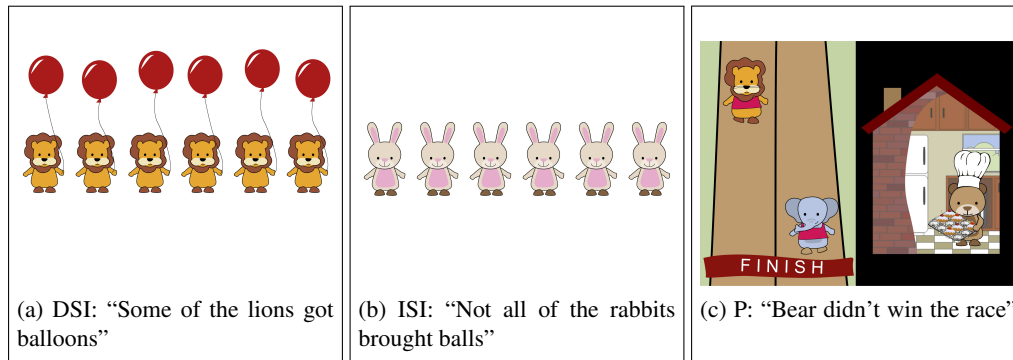


Figure 2: Examples of the visible test pictures and test sentences for each condition.

As illustrated in Figure 2, the visible test pictures in the critical trials, while consistent with the literal meaning of the test sentence, were incompatible with the additional inference of interest (e.g., picture (b) is incompatible with the implicature that some of the rabbits brought balls). Therefore, selection of the covered picture was interpreted as evidence of the associated inference being generated.

The control trials were designed so that participants were required to select the visible picture twice, and the covered picture twice. In the latter case, the picture was incompatible with the literal meaning (e.g., by using a sentence such as *Some rabbits brought balls* with the picture in (b)). In the former case, the images were compatible both with the literal meaning and the additional inference. Note that these overt picture controls were only presented after all the critical trials for that condition had been presented. This was done to ensure that participants were not exposed to a picture suggesting an interpretation consistent with the relevant inference until after they had given all their judgments for the relevant critical trials. The trials (critical and control) for each of the conditions (DSI, ISI, P) were presented separately in their own sub-parts of the overall experimental session. The order in which the three conditions were presented was counterbalanced, and the trials in each condition were presented in a pseudo-random order.

**Trial Outline** Each individual trial followed the same steps, as outlined below:<sup>5</sup>

1. The participant (with the help of the experimenter, if required) identified the different animals in the picture, (to ensure familiarity).
2. The experimenter presented a short preamble introducing the animals and the setting (e.g., "Today a group of penguins and a group of rabbits went to the park.>").
3. The experimenter gave a short description of the context picture (e.g., "All of the penguins brought balls.>").
4. The experimenter presented the test sentence (e.g., "But not all of the rabbits brought balls.>"). The test sentence was presented a second time (e.g., "So remember, not all of the rabbits brought balls.>")., to ensure that the participant heard it accurately.

<sup>5</sup>The examples presented are from one of the trials in the ISI condition. The visible picture for this trial is shown in Figure 2(b).

5. The participant was asked to identify which of the test pictures (visible or covered) the test sentence was referring to (e.g., “Which group of rabbits do you think I’m talking about?”).
6. Finally, the participant was asked to give a justification for their judgement (e.g., “Why do you think I’m talking about that picture?”).

### 3 Results

Using logistic regression mixed effect models, the analysis revealed significant interactions between inference type and age group. Due to space limitations, we only report detailed statistics for comparisons between the group of 4–5 year olds and the group of adults.<sup>6</sup> Table 1 lists estimated  $\beta$ 's, standard errors, Wald's  $z$  and  $p$ -values from the *lmer*-output.

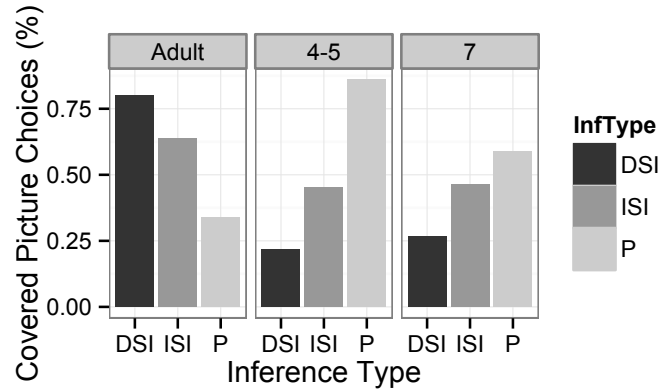


Figure 3: Results for adults and children across all conditions.

		$\beta$	$SE$	Wald's $z$	$p <$
Interactions:	P vs. DSI	-8.09	0.84	-9.62	.001
	P vs. ISI	-5.03	0.73	-6.94	.001
	DSI vs. ISI	-3.05	0.69	-4.40	.001
<b>Post-hoc Comparisons:</b>					
4/5:	P vs. DSI	4.68	0.66	7.10	.001
	P vs. ISI	3.02	0.58	5.19	.001
	DSI vs. ISI	1.66	0.49	3.36	.001
Adults:	P vs. DSI	3.40	0.52	6.53	.001
	P vs. ISI	2.01	0.43	4.66	.001
	DSI vs. ISI	-1.39	0.49	-2.85	.01
P	Adults vs. 4/5	3.86	0.84	4.62	.001
DSI	Adults vs. 4/5	4.23	0.84	5.06	.001
ISI	Adults vs. 4/5	1.18	0.77	1.53	0.15

Table 1: Interactions and Post-hoc Comparisons for Covered-Box Choice proportions, comparing 4–5 year olds and Adults.

As can be seen in Table 1, there were significant  $2 \times 2$  interactions ( $p < 0.001$ ) for adults versus

<sup>6</sup>The general pattern of results for 7-year olds had a somewhat intermediate status numerically speaking, but was largely parallel to those for 4–5 year olds in terms of statistical significance.

4–5 year olds on all pairs of factor levels: P vs. ISI, P vs. DSI, and DSI vs. ISI comparisons. As can be seen in Figure 3, the P vs. ISI interaction was driven by adults being significantly more likely to produce an inference interpretation in the ISI condition than in the P condition. In contrast, children were significantly more likely to generate an inference interpretation in the P condition, compared to the ISI condition. The same pattern produced the interaction in the DSI vs. P comparison. The final interaction between the ISI and DSI conditions was caused by adults being significantly more likely to produce an inference interpretation for DSIs, compared to ISIs, while children were significantly more likely to generate an inference interpretation in the ISI condition. In addition to these interactions, a significant difference was found between the two age groups of children in regards to their generation of inference interpretations in the P condition. As can be seen in Figure 3, the 4–5 year olds were significantly more likely than the 7 year olds to generate an inference interpretation in the P condition.

Group	Condition	Example Justification
Child(4–5&7)	DSI	Visible: “Because they got balloons” Covered: “Because this group of lions all have balloons”
Adult	DSI	Visible: “Because they have balloons” Covered: “Because all of the lions have balloons”
Child(4–5&7)	ISI	Visible: “Because they don’t have balls” Covered: “Because there, none of them have balls”
Adult	ISI	Visible: “Because they don’t have balls with them” Covered: “Because in that picture, none of them brought balls”
Child(4–5)	P	Visible: “Because the bear is baking cookies” Covered: “Because the bear isn’t in the race”
Child(7)	P	Visible: “Because the bear’s not in it” Covered: “Because there is no bear in the second race”
Adults	P	Visible: “Because he wasn’t in the race, so he couldn’t have won it” Covered: “Because the bear wasn’t even racing”

Table 2: Example justifications produced by participants for both ‘visible’ and ‘covered’ test picture judgements. Justifications are responses to the visible picture.

In addition to providing critical picture judgements, participants also provided justifications for their decisions. Some examples of these justifications are provided in Table 2. In the DSI and ISI conditions, the judgements for both groups of children (4–5 year olds and 7 year olds) were very similar (see Figure 3), therefore, only one example justification has been provided for the child groups in those conditions.

## 4 Discussion

The strongest prediction that might be derived from a Presupposition as Implicature approach is that participants’ responses would be parallel across all three conditions (DSI, ISI, and P). A weaker and arguably more plausible prediction, motivated by the observation that the ISI and P conditions (but not the DSI condition) include negation in the test sentences, is that the ISI and P conditions would pattern together. In any case, neither of these predictions were borne out in the present study. In fact, there was a significant difference between the scalar implicature and P conditions across all three age groups.

On the other hand, the present findings are more in line with a more traditional perspective

of how these inferences are generated. The traditional perspective treats DSI/ISIs and Ps as two different classes of inferences, based on distinct mechanisms and therefore is compatible with an asymmetry in participants' responses to them. In particular, this perspective treats the basic meaning of sentences containing a scalar term as not containing the inference, with the scalar implicature derived on top of this basic meaning through an extra process (e.g., Gricean enrichment (Grice 1975)). On the other hand, in the case of Ps, the traditional perspective views the associated inference as a part of the basic meaning, which can only be 'cancelled' through some extra process (e.g., local accommodation (Heim 1983)). If we label the basic meaning of these sentences the 'Base Meaning', and the meaning produced through some extra process (whether Gricean enrichment or local accommodation) as the 'Derived Meaning', then Table 3 displays the state of the relevant inferences at these two levels for the DSI/ISI and P sentences (according to the traditional account).

	<b>Base Meaning (Child)</b>	<b>Derived Meaning (Adult)</b>
<b>DSI/ISI</b>	[-inference]	[+inference]
<b>P</b>	[+inference]	[-inference]

Table 3: An interpretation of our results from the traditional perspective.

As indicated in Table 3, the traditional perspective on the ISI and P inferences could account for the cross-over interaction which we found in the the DSI/ISI and P conditions between adults and children, by proposing that across conditions children tend to access the base meaning of these sentences, whereas, adults tend to access the derived meaning. This explanation is, on the other hand, not available for the Presupposition as Implicature approach, at least in its simplest form.<sup>7</sup>

#### 4.1 Previous Processing Results

In the P condition, we found a significant difference between the responses given by adults versus children, with children being more likely than adults to provide an inference interpretation of the sentence. This result appears to link in nicely with recent results from the literature on how presuppositions are processed in studies of adult sentence comprehension (Chemla and Bott 2013, Romoli and Schwarz 2014). These studies found that although adults could access both a 'literal interpretation' (without the associated inference) and an 'inference interpretation' (the literal interpretation, plus the associated inference), the literal interpretation was more costly (took longer to perform response action) than the inference interpretation. Given this apparent extra difficulty attached to the literal interpretations of P sentences, we might expect children to be less proficient than adults at accessing this interpretation. And as mentioned, this expectation would appear to be borne out in our results, as children were significantly less likely than adults to generate literal interpretations in the P condition.

#### 4.2 A note on ISI vs. DSI

The interaction effect that we found between the DSI and ISI conditions when comparing adults versus children is not predicted by any of the current theoretical accounts of scalar implicature that we are aware of. If this result is robust we may need to start treating these inferences differently in the theory. However, due to the fact that it is an interaction (rather than a simple effect), any attempt to provide such an explanation would be unable to appeal to something 'simple', like the presence of negation, to separate them theoretically.

Having said that, perhaps we should not be too quick to see these as separate phenomena, as, at least in the adult sentence processing literature, there have been conflicting results produced by

<sup>7</sup>It is of course conceivable to adapt the Presupposition as Implicature approach in a way that can account for our results. However, as Chemla and Bott (2013) point out, this would take further theoretical development and 'the burden of the proof' would then be to show that these development are independently justified. On the other hand, the results seem to fit easily into the traditional perspective on these inferences.



(at least) two recent reaction-time studies (Romoli and Schwarz 2014, Cremers and Chemla 2013), which looked at whether adults process these inferences differently. Romoli and Schwarz (2014) found that when adults were presented with ISI sentences, they were faster at rejecting sentences based on an inference interpretation than a literal interpretation (Bott and Noveck (2004), Chemla and Bott (2014) and others found the opposite pattern for DSIs). In contrast, Cremers and Chemla (2013) found no difference in the reaction times between their ISI and DSI conditions. Therefore, the question of whether DSIs and ISIs should be treated as the same or different phenomena is subject to ongoing debate, and would likely benefit from further work.

### 4.3 Conclusion

We set out to test the claims of the Presupposition as Implicature approach, as they pertained to direct scalar implicatures, indirect scalar implicatures, and presuppositions. This approach was set against the claims of the more traditional perspective on how these inferences are generated. Our results appear to favour the more traditional perspective, which posits presuppositions as being derived via different mechanisms from scalar implicatures. Additionally, the results of the present study seem to be consistent with recent work on adult processing of presuppositions. Finally, these results provide important input to the ongoing discussion of whether direct and indirect scalar implicatures should be treated as theoretically equivalent. Further research on these inferences (perhaps using language processing measures like reaction time or eye tracking) may help to unravel the factors that contributed to the differences that were observed between the different age groups and inference-types.

### References

- Abusch, Dorit. 2002. Lexical alternatives as a source of pragmatic presupposition. In *Semantics and Linguistic Theory (SALT) 12*, ed. B. Jackson, 1–19.
- Abusch, Dorit. 2010. Presupposition triggering from alternatives. *Journal of Semantics* 27:1–44.
- Beaver, David, and Bart Geurts. 2012. Presuppositions. In *Semantics: An International Handbook of Natural Language Meaning volume 3*, ed. C. Maienborn, K. von Stechow, and P. Portner, 91. Berlin: Mouton de Gruyter.
- Bott, Lewis, and Ira Noveck. 2004. Some utterances are underinformative. *Journal of Memory and Language* 51.
- Chemla, Emmanuel. 2010. Similarity: towards a unified account of scalar implicatures, free choice permission and presupposition projection. Unpublished manuscript.
- Chemla, Emmanuel, and Lewis Bott. 2013. Processing presuppositions: Dynamic semantics vs pragmatic enrichment. *Language and Cognitive Processes* 38:241–260.
- Chemla, Emmanuel, and Lewis Bott. 2014. Processing inferences at the semantics/pragmatics frontier: disjunctions and free choice. *Cognition* 130:380–396.
- Chierchia, Gennaro. 2004. Scalar implicatures, polarity phenomena, and the syntax/pragmatics interface. In *Structures and Beyond: The Cartography of Syntactic Structures*, ed. Adriana Belletti, volume 3, 39–103. Oxford: Oxford University Press.
- Crain, Stephen, and Rosalind Thornton. 1998. *Investigations in Universal Grammar: A Guide to Experiments on the Acquisition of Syntax and Semantics*. Cambridge, Massachusetts: The MIT Press.
- Cremers, Alexandre, and Emmanuel Chemla. 2013. Direct and indirect scalar implicatures share the same processing signature. *Manuscript, LSCP-ENS, Paris*.
- Foppolo, Francesca, Maria Teresa Guasti, and Gennaro Chierchia. 2012. Scalar implicatures in child language: Give children a chance. *Language learning and development* 8:365–394.
- Grice, Paul. 1975. Logic and conversation. In *The Logic of Grammar*, D. Davidson and G. Harman (eds), Encino, CA: Dickenson, 64–75.
- Heim, Irene. 1982. *The Semantics of Definite and Indefinite Noun Phrases*. Doctoral dissertation, University of Massachusetts, Amherst.
- Heim, Irene. 1983. On the projection problem for presuppositions. In *Proceedings of WCCFL 2*, ed. Daniel P. Flickinger, 114–125. Stanford University, Stanford, California: CSLI Publications.
- Horn, Lawrence. 1972. *On the Semantic Properties of Logical Operators in English*. Doctoral dissertation, UCLA.

- Huang, Yi Ting, and Jesse Snedeker. 2009. Semantic meaning and pragmatic interpretation in 5-year-olds: Evidence from real-time spoken language comprehension. *Developmental psychology* 45:1723–1739.
- Huang, Yi Ting, Elizabeth Spelke, and Jesse Snedeker. 2013. What exactly do numbers mean? *Language Learning and Development* 9:105–129.
- Karttunen, Lauri. 1974. Presupposition and linguistic context. *Theoretical Linguistics* 1:181–194.
- Katsos, Napoleon, and Dorothy VM Bishop. 2011. Pragmatic tolerance: Implications for the acquisition of informativeness and implicature. *Cognition* 120:67–81.
- Katsos, Napoleon, Clara Andrés Roqueta, Rosa Ana Clemente Estevan, and Chris Cummins. 2011. Are children with specific language impairment competent with the pragmatics and logic of quantification? *Cognition* 119:43–57.
- Musolino, Julien, and Jeffrey Lidz. 2006. Why children aren't universally successful with quantification. *Linguistics* 44:817–852.
- Noveck, Ira. 2001. When children are more logical than adults: experimental investigations of scalar implicatures. *Cognition* 78:165–188.
- Papafragou, Anna, and Julien Musolino. 2003. Scalar implicatures: experiments at the semantics–pragmatics interface. *Cognition* 86:253–282.
- Romoli, Jacopo. 2012. Soft but Strong: Neg-raising, Soft Triggers, and Exhaustification. Doctoral dissertation, Harvard University.
- Romoli, Jacopo. 2014. The presuppositions of soft triggers are obligatory scalar implicatures. *Journal of semantics* 1:1–47.
- Romoli, Jacopo, and Florian Schwarz. 2014. An experimental comparison between presuppositions and indirect scalar implicatures. In *Experimental Perspectives on Presuppositions*, ed. F. Schwarz, Studies in Theoretical Psycholinguistics. Dordrecht: Springer.
- Simons, Mandy. 2001. On the conversational basis of some presuppositions. In *Semantics and Linguistic Theory (SALT) 11*, ed. R. Hastings, B. Jackson, and Z. Zvolenszky, 431–448.
- Stalnaker, Robert. 1974. Pragmatic presuppositions. In *Semantics and Philosophy*, ed. M. Munitz and D. Unger, 197–213. New York University Press.
- von Stechow, Kai. 2008. What is accommodation, again? *Philosophical Perspectives*, 22, *Philosophy of Language* 22:137–170.

Cory Bill  
 Department of Cognitive Science  
 Macquarie University  
 Sydney, NSW 2109  
 cory.bill@students.mq.edu.au

Jacopo Romoli  
 School of Communication  
 University of Ulster  
 Belfast, NIR BT15 1ED  
 jacopo.romoli@gmail.com

Florian Schwarz  
 Department of Linguistics  
 University of Pennsylvania  
 Philadelphia, PA 19104-6305  
 florians@babel.ling.upenn.edu

Stephen Crain  
 Department of Linguistics  
 Macquarie University  
 Sydney, NSW 2109  
 stephen.crain@mq.edu.au