The Processing of Scalar Implicatures

Day 2 - 29/7/2009

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EGG 2009, Poznań

Development of Comprehension of "Or": Evidence for a Sequence of Competencies

MARTIN D. S. BRAINE AND BARBARA RUMAIN

Braine & Rumain (1981)

- Tests the ability of children of various ages to use *or*, as compared with adults.

- Looked at *or* in a variety of contexts, some supporting exclusive readings and other supporting inclusive readings.

- Four separate experiments, each testing a different competency. The relevant experiment for our purposes in the third one.

Braine & Rumain (1981)

- Four boxes, each containing four different toy animals.
- For each box, a puppet (Jane) made a disjunctive statement about the box: "either there's an X or there's a Y in the box"
- There was on box of each pattern: TT, TF, FT and FF.
- Subjects were asked "Is Jane right?"

Braine & Rumain (1981)

TABLE 3

PERCENTAGE OF EACH AGE GROUP SHOWING VARIOUS TRUTH JUDGMENT PATTERNS IN TASK 3

	Age groups			
Response pattern[a]	5–6	7–8	9–10	Adult
YYYN (inclusive disjunction)	18	41	50	32
NYYN (exclusive disjunction)	0	14	9	41
YNNN (conjunction)	32	14	14	9
YPPN $\left.\begin{matrix} \\ \end{matrix}\right\}$ ("partly right") $Y(P^Y_N)N$	$\left.\begin{matrix}18\\23\end{matrix}\right\}41$	$\left.\begin{matrix}14\\5\end{matrix}\right\}19$	$\left.\begin{matrix}14\\0\end{matrix}\right\}14$	$\left.\begin{matrix}0\\9\end{matrix}\right\}9$
Y(YN)N	5	9	0	0
NNNN	5	5	14	9

[a] Y = "yes," i.e., the puppet is right; N = "no," i.e., the puppet is wrong; P = "the puppet is partly right." In each row, the first letter identifies the judgment when both designated animals are in the box; the second and third letters indicate the judgments on the mixed truth forms, i.e., when one animal named is in the box and the other absent; the fourth letter indicates the judgment when neither animal named is in the box. Thus, except for the "partly right" responses, each row indicates a truth table. The fifth row pattern indicates that one of the mixed truth forms was judged "partly right" while the response to the other might be either "yes" or "no." In the sixth row the responses to the mixed truth forms were inconsistent, one "yes" and one "no."

Braine & Rumain (1981)

- Braine &Rumain do not directly discuss Gricean views of *or*, and are not overly concerned with the distinction between exclusive and inclusive *or*.

- However, they do point out that "the data suggests a developmental shift from inclusive to exclusive *or*".

- However, they are not willing to commit to this point.

The Acquisition of Disjunction:
Evidence for a Grammatical View of Scalar Implicatures

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Chierchia et al. (2001)

- Investigates children's knowledge of *or* in downwards and upwards entailing contexts.

- The ultimate goal is to argue for a local/grammatical view of scalar implicatures.

Chierchia et al. (2001)

- Experiment 1: Children were told a story, and then a puppet made a statement about the story. The children were supposed to judge if the puppet was right.

- The puppet's statements had *or* in the restriction of *every*.

- Fifteen children (age from 3;7 to 6;3; mean age: 4;11) participated in the experiment, each child saw 4 trials.

- 11 adults were also tested as controls.

Chierchia et al. (2001)

Story example:

Snow White and four dwarves are at a picnic. Snow White promises a jewel to all the dwarves who will choose healthy food. She reminds them that bananas and strawberries are healthy food. Three of the dwarves want to receive a jewel, so they choose fruit. But they are very hungry, so they choose both a banana and a strawberry. One of the dwarves says he doesn't care about jewels, and he chooses potato chips. Snow White only gives a jewel to the dwarves who have chosen a banana and a strawberry

- Every dwarf who chose a banana or a strawberry received a jewel.

Chierchia et al. (2001)

Experiment 1 results:

	Child	Adult
Correct (true)	91.6%	95.5%
Incorrect (false)	8.4%	4.5%

Chierchia et al. (2001)

- Experiment 2: same design.

- The puppet's statements had *or* in the scope of *every*.

- Fifteen children (age from 3;5 to 6;2; mean age: 5;2) participated in the experiment, each child saw 4 trials.

- 8 adults were also tested as controls.

Chierchia et al. (2001)

Story example:

- Four boys at the summer camp are choosing which toys they want to play with. There are a lot of toys they can choose: some skate-boards, some bikes, a boat and a truck. After considering the possible choices, the four boys take both a skate-board and a bike.

- Every boy chose a skate-board or a bike.

Chierchia et al. (2001)

Experiment 2 results:

	Child	Adult
Correct (false)	50%	100%
Incorrect (false)	50%	0%

Chierchia et al. (2001)

- Experiments 1 and 2 can't determine whether children simply don't know how to do implicatures, or whether implicatures are hard (reference-set theory).

- Experiment 3 – story similar to exp 2.; instead of presenting one sentence, two were presented (by different puppets).

- Both sentences were true, but one is more appropriate. The children had to reward the puppet who "said it better".

- The puppet's statements had *or* in the scope of *every*.

- Fifteen children (age from 3;2 to 6;0; mean age: 4;8) participated in the experiment, each child saw 4 trials. (no adult controls)

Chierchia et al. (2001)

Experiment 3 results:

	Child
Correct (and)	93.3%
Incorrect (or)	6.7%

At the Semantics/Pragmatics Interface in Child Language

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Gualmini et al. (2001)

- Experiment 4: sentence comparison in the restriction of *every*.

- Fifteen children (age from 4;6 to 6;1; mean age: 5;3) participated in the experiment – no adult controls.

Gualmini et al. (2001)

girl$_1$	?	turtle & bunch of flowers	?	bottle of water
girl$_2$	?	turtle & bunch of flowers	?	bottle of water
girl$_3$	?	turtle & bunch of flowers	?	bottle of water
girl$_4$	?	turtle	?	bottle of water
girl$_5$	?	bunch of flowers	?	bottle of water
girl$_6$	?	2 teddy bears		

- Every girl who picked a turtle or a bunch of flowers received a bottle of water.
- Every girl who picked a turtle and a bunch of flowers received a bottle of water.

Scale reversal!

Gualmini et al. (2001)

Experiment 4 results:

	Child
Correct (or)	90.0%
Incorrect (and)	10.0%

Gualmini et al. (2001)

- Conclusion:
  - Children know that *or* is weaker than *and* in positive environments.
  - They know that *and* is weaker than *or* in negative environments.
  - However, they are not capable of calculating the implicature.
  - Since they understand the entailment scales but can't use them, this supports a processing load argument.

When children are more logical than adults: experimental investigations of scalar implicature

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Noveck (2001)

- A series of experiments comparing child behavior to adults with regards to scalar implicatures.

- The first experiment: *might* vs. *must*

- 32 5-year olds (5;1-5;11, 5;5), 20 7-year olds (7;1-8;0, 7;5), 16 9-year olds (9;0-9;5, 9;4), 20 adults

- After a long training procedure, children were shown a box that was covered and were told that `a friend of mine gave me this box and said `all I know is that whatever is inside this box looks like this box (experimenter pointed to the Parrot 1 Bear Box) or this box (experimenter pointed to the Parrot-only Box)"

Noveck (2001)

- After a long training procedure, subjects were shown a box that was covered and were told that `a friend of mine gave me this box and said `all I know is that whatever is inside this box looks like this box (experimenter pointed to the Parrot 1 Bear Box) or this box (experimenter pointed to the Parrot-only Box)"

- Subjects were then asked to judge statements about the box.

Noveck (2001)

Table 2

Percentage of correct responses to modal statements which concerned what was necessarily in the hidden box (i.e. the parrot) and what was possibly in the hidden box (i.e. the bear) in Experiment 1[a]

Presented statements	Is the puppet right?	Age (years) (n)			
		5 (32)	7 (20)	9 (16)	Adults (20)
		Necessary conclusion (parrot)			
Has to be a parrot	Yes	75*	90**	88**	100**
Does not have to be a parrot	No	72*	75*	75*	100**
Might be a parrot	Yes	72*	80**	69	35
Cannot be a parrot	No	66	80**	100**	100**
Total		73**	81**	83**	83**
		Possible conclusion (bear)			
Has to be a bear	No	47	65	88**	100**
Does not have to be a bear	Yes	66	75*	81**	100**
Might be a bear	Yes	53	80**	100**	100**
Cannot be a bear	No	53	80**	100**	100**
Total		55	75**	92**	100**

[a] *$P < 0.05$, **$P < 0.01$.

Noveck (2001)

- Experiment 3:
- Thirty-one 8-year-olds (7;4-8;11, 8;2), 30 10-year-olds (10;0-11;7,10;7), and 15 adult native French speakers.
- Sentences were based on three types of information: factually universal (that elephants have trunks is arguably best represented with the quanti®er All), factually existential (that birds live in cages is arguably best represented with Some), and absurd (that stores are made of bubbles is arguably false with both kinds of quantifiers).
- Participants were told that they were going to be presented a series of statements and that it was their job to simply say whether or not they agree with each.

Noveck (2001)

Table 4
Rates of correct responses to the six types of sentences presented in Experiment 3 [a]

Sentence type	Correct response	Age (years) (*n*)		
		7–8 (31)	10–11 (30)	Adults (15)
Utterances expressed with *All*				
Absurd (false)	No	93	99	99
(e.g. All chairs tell time)				
Appropriate (true)	Yes	91	99	96
(e.g. All elephants have trunks)				
Inappropriate (false)	No	86	99	96
(e.g. All dogs have spots)				
Utterances expressed with *Some*				
Absurd (false)	No	95	99	98
(e.g. Some stores are made of bubbles)				
Appropriate (true)	Yes	84	90	99
(e.g. Some birds live in cages)				
Inappropriate (true though pragmatically infelicitous)	Yes	89	85	41
(e.g. Some giraffes have long necks)				

[a] There were five exemplars of each type. Values are given as percentages.

Noveck (2001)

- Conclusion:
- Children are "more logical" than adults – they use the logical definitions of operators, not the pragmatic definitions.

Scalar implicatures: experiments at the semantics–pragmatics interface

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Papafragou & Musolino (2003)

- Testing children and adult on scalar terms in Greek:
  - *meriki* (some) → not all
  - *dio* (two) → not 3
  - *arxizo* (start) → not finish
- 30 children (4;11-5;11, mean 5;3), 30 adults.
- Experiment 1: Subjects were shown a scenario (acted out with toys), then a puppet made a statement, and had to judge whether the puppet spoke well or not.
- Subjects were then asked to justify their responses.
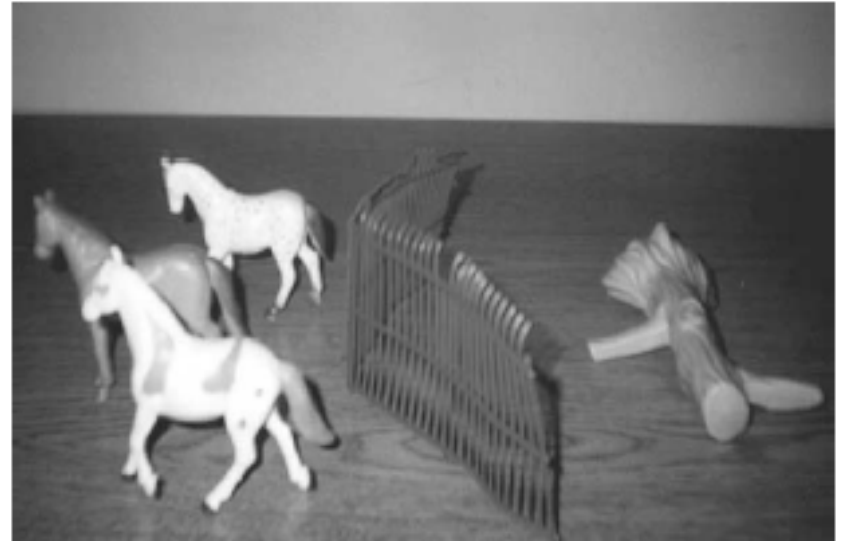
Papafragou & Musolino (2003)

Fig. 1. The horses are about to jump over the fence.

Fig. 2. All of the horses jumped over the fence.

- Merika apo ta aloga pidiksan pano apo to fraxti.
  'Some of the horses jumped over the fence.'

Papafragou & Musolino (2003)

- After each trial, the experimenter gave a control trial, of the same structure but one where the implicature was felicitous.

- The puppet then asked a question designed to elicit the opposite response from the critical trial.

Papafragou & Musolino (2003)

A. Papafragou, J. Musolino / Cognition 86 (2003) 253–282
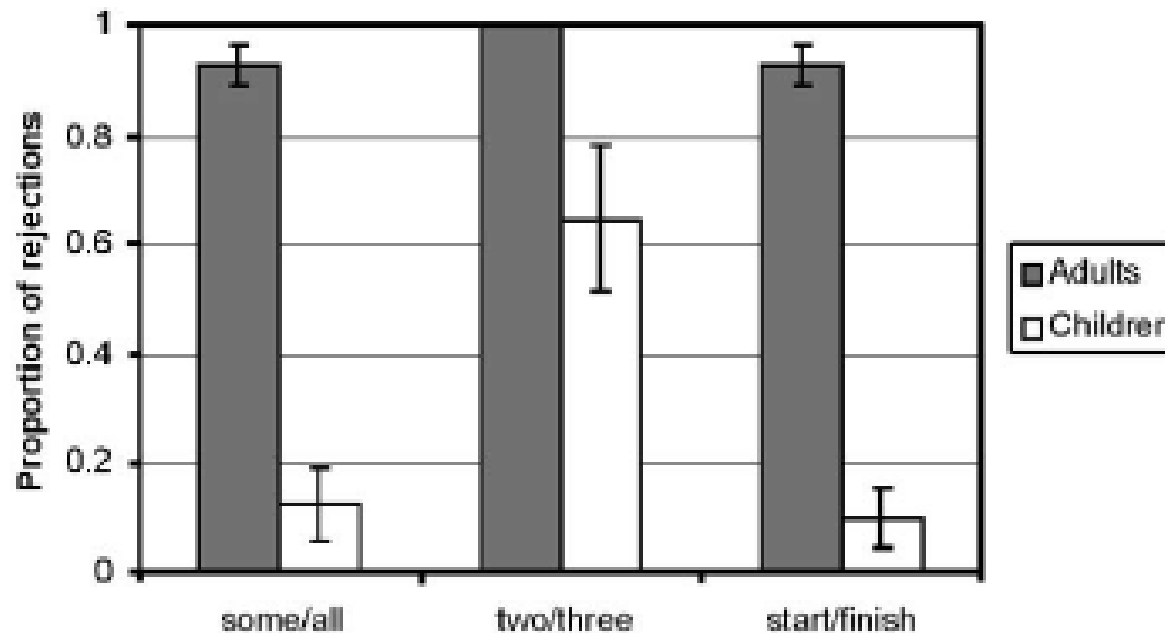
Fig. 3. Subjects' performance on critical trials (experiment 1).

Papafragou & Musolino (2003)

- The problem with this experiment: maybe children can calculate implicatures, but do not understand that implicature violations are bad.

- The second experiment repeated the first, except that:
  - Subjects were trained to detect pragmatic anomaly (they were given warm-up sessions, in which they were warned that the puppet sometimes says "silly things", and asked to improve what the puppet says).
  - The scenarios were modified so that it's clear that the implicature is important.

Papafragou & Musolino (2003)

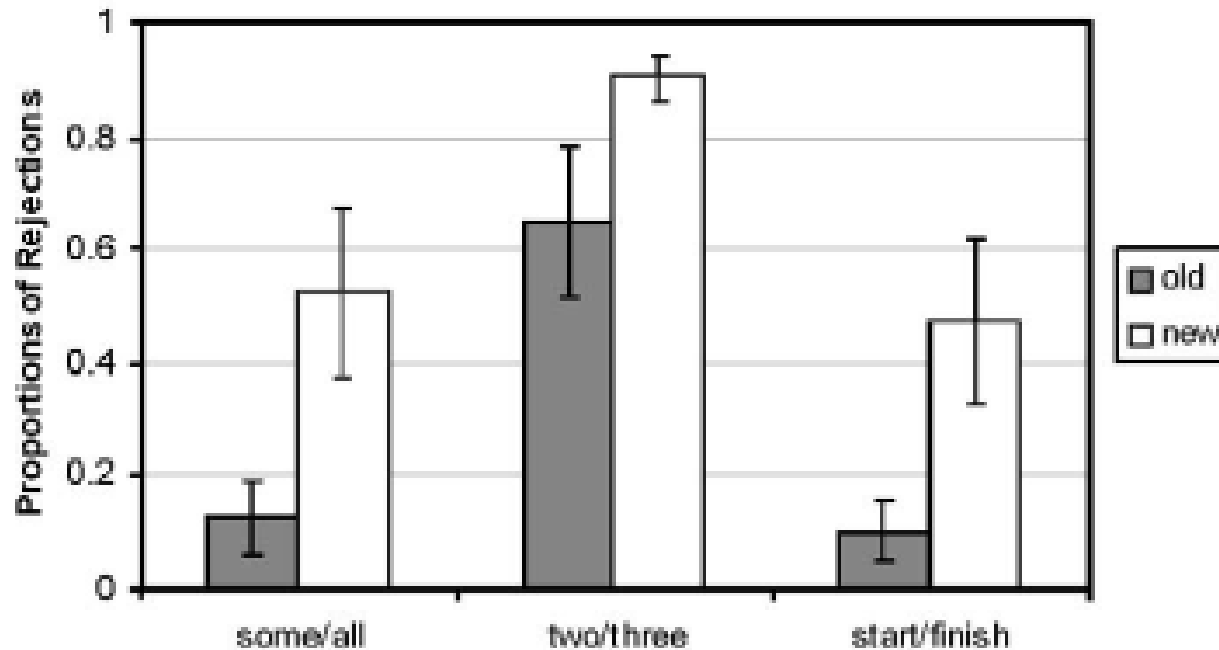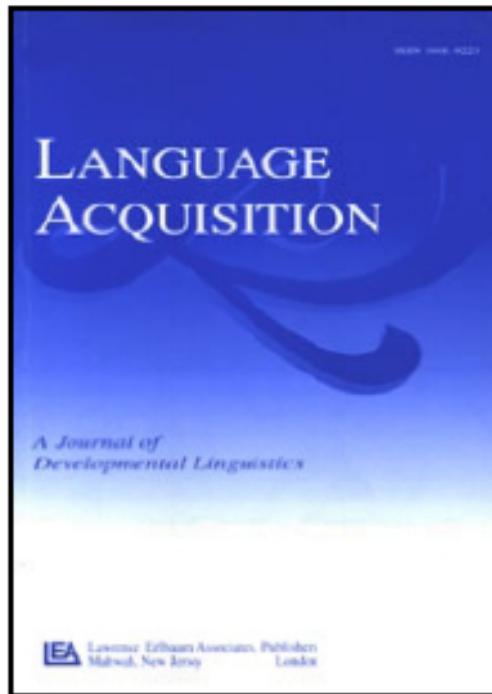A. Papafragou, J. Musolino / Cognition 86 (2003) 253–282

Fig. 4. Children's performance on critical trials (Experiments 1&2).

Papafragou & Musolino (2003)

- Conclusion:

- Children's behavior is different for different implicature triggers.

- Number implicatures are easier than other scalar implicatures.

Language Acquisition

Children's Computation of Implicatures

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Papafragou & Tantalou (2004)

- Testing children reactions to three kinds of implicatures:
  - Quantificational (some → not all)
  - "encyclopedic" (eat the cheese → not eat the sandwich)
  - Ad hoc (wrap the parrot → not wrap the gifts)
- Children were shown a scenario in which an animal was given a task (wrap the gifts), and in which the animal performed only part of the task.
- The animal then reported on what they did ("I wrapped the parrot").
- The children were supposed to reward the animal on task completion.
- 30 children (4;1-6;1, mean 5;3)

Papafragou & Tantalou (2004)

TABLE 1
Proportion of Correct Responses

Condition	Test Trials	Control Trials
Quantifier	77.5	97.5
Encyclopedic	70.0	100.0
Ad hoc	90.0	92.5

TABLE 2
Children's Justifications for Negative Responses on Test Trials

	Conditions		
	Quantificational	Encyclopedic	Ad Hoc
"He didn't do all the ——."[a]	72.0	25.0	11.0
"He only did ——."	—	43.0	17.0
"He didn't do the rest (too)."	—	7.0	19.0
"He didn't do —— [other part] (too)."	—	3.5	25.0
"He didn't do it (right)."	3.0	11.0	14.0
"He did some/a few."	12.5	3.5	—
Other	12.5	7.0	12.5

[a]Some justifications included a full verb rather than *do* ("He didn't clean all of ——," (etc.). We present all justifications schematically here for ease of exposition.

Papafragou & Musolino (2003)

- Conclusion:
- Children's aren't at bad at implicatures as previously thought, especially if there is supporting context.
- It's possible that particularized implicatures are easier than generalized ones.