Universal Quantification in SLI
A Selective Semantic Deficit?

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Rapid auditory processing and SLI

Tallal & Piercy (1973) and much other work:

(1) Specific language impairment/language learning impairment is caused with non-linguistic rapid auditory processing impairment

- correlation of deficits in tasks
- perception improvement with acoustically lengthened speech
- training rapid auditory processing improves language perception

Rapid Auditory Processing Test: Tallal repetition task

Questions to ask

1. Are there other types of SLI than temporal auditory processing deficit (GSLI)?
2. Is SLI (in the majority of cases) a purely auditory/phonological deficit?

Today: focus on the second question

Purely phonological SLI?

Difficulty: A phonological deficit can cause syntactic and semantic deficits via delaying word perception (especially with function words).

For example: agreement (Wexler & Rice):

(2) John eats fish and chips.

The delay of agreement depends on the phonology of a language (cf. Leonard on Italian vs. English)
But: Plural /-s/ vs. agreement /-s/:

(3) a. book - books, miss - misses
b. John books his flights alone. Mary misses her brother.

Selective semantic deficits

A selective semantic deficit:

- recognize the words and morphemes
- understand the sentence structure
- show some evidence of understanding the interpretation
- lack complex/fast semantic processing

Complex Semantic Processing?

What constitues complex semantic processing?
Basically: to be discovered
One suggestion: reference set computation (Reinhart 2006)

- quantifier scope economy
- binding (coreference ban)
- stress shift
- implicatures

Scalar implicatures

A subtype of conversational quantity implicatures: scalar implicatures (Horn 1972)
Based on comparison with a stronger alternative (Sauerland 2004, among others): implicates (5).

(4) The Philharmonic played some Beethoven symphonies this season.

(5) The Philharmonic didn't play all Beethoven symphonies this season.

Similarly, implicates (7):

(6) Kai started his homework.

(7) Kai didn't finish his homework.

Acquisition of Scalar Implicatures

Children around age 5 seem to lack implicatures (Noveck 2001, Papafragou and Musolino 2003).

(8) Did some of the horses jump over the fence?

Adult No, all of them jumped.
Child Yes.

(9) Did Smurf buy a pizza or french fries?

Adult No, he bought both.
Child Yes.

However, Gualmini et al. (2001): Children can compute scalar implicatures if both alternatives are presented

(10) a. I know what happened. Smurf bought pizza or french fries.
b. I know what happened. Smurf bought pizza and french fries.

Adult Processing of Scalar Implicatures

Bott and Noveck (2004), Noveck and Posada (2003), Breheny et al. (in print): Scalar implicatures are hard for adults.
Noveck and Posada (2003): Measuring response time

(11) Some giraffes have necks.

(12) a. Response time for logical responders: 655ms
b. Response time for implicature based responders: 1203ms

Bott and Noveck (2004): Forcing fast responses

(13) Some elephants are mammals.

(14) a. 0.9s response time: 28% protest
b. 3s response time: 44% protest

Scalar implicatures in SLI

Not tested, as far as I know. Only indicative result by Surian et al. (1996), test for Quantity I:

(15) How would you like you tea?

a. With milk.
b. #In a cup.

Acceptance rates:

(16)
a. Autism, 12;11 old: 58%
b. SLI, 11;10 old: 63%
c. Unimpaired, 6;7 old: 58%

Nominal Universal Quantification

Universal quantification in the nominal domain is expressed by words like *every* in English.
At least three stages in the acquisition of universal quantification (cf. Inhelder & Piaget 1959; Philip 1995, Roeper et al. 2004 and others):

- Yes-Stage ($\leq$5 years): no knowledge
- No-Stage (6–7 years): partial knowledge
- Adult Stage ($\geq$8 years): full knowledge

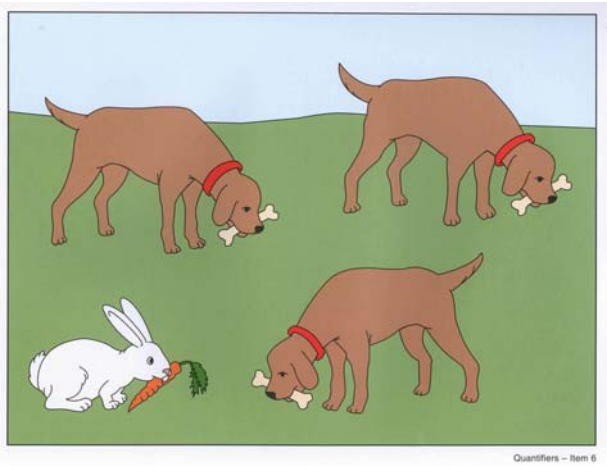
A Yes-Error ($\leq$5 years)

Is every cowboy riding a horse?
Child: Yes.

The Yes-Stage ($\leq$5 years)

- Children respond ‘yes’ to all items with ‘every’
- Hypothesis: Children don’t know the word ‘every’

A No-Error (6–7 years)



Is every dog eating a bone?
Child: No.

The No-Stage (6–7 years)

- No-errors occur only with an extra item (Philip 1995).
- No-errors don't occur with many extra items (Sugisaki and Isobe 2002).

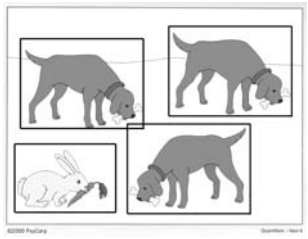
Children know the meaning of 'every'.

Silent Quantification over Situations

Adults often silently quantify over relevant situations:

(17) a. A good father is reading to every child.
b. When teaching, she tries to look at every student.

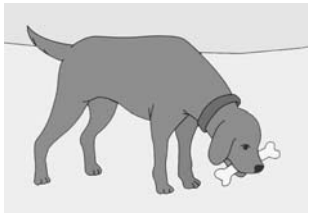
This predicts the ‘no’-error:



Is every dog eating a bone?

Blocking Situation Quantification

Why do adults never give the ‘no’ response?
Situation Quantification is blocked by a presupposition of ‘every’ (the anti-uniqueness presupposition). ‘The’ must be used instead.



#Every dog is eating a bone.
The dog is eating a bone

Children, however, lack this presupposition (Yatsushiro 2005)—they are more logical than adults.
Children in the ‘no’-stage have difficulty with semantic comparison with ‘the’ (cf. Noveck 2001 and others on implicatures).

Section Summary

Three stages of the acquisition of ‘every’:

- Yes-Stage ($\leq$5 years): no lexical entry for ‘every’
- No-Stage (6–7 years): full lexical entry for ‘every’, difficulties with higher semantic processing (comparison with ‘the’)
- Adult Stage ($\geq$8 years): full knowledge

The DELV-Study

Data from the DELV-study (Seymour, de Villiers, and Roeper 2000).

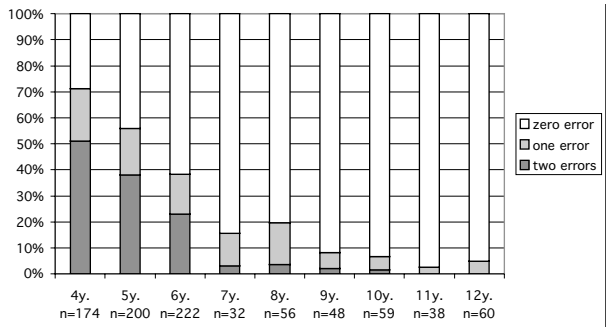
- test of about 1300 children with 301 questions
- 7 questions relevant for the following
- presented in fixed order in a block
- age: 4 to 12 years
- both unimpaired and SLI children
- Mainstream and African American English

The Yes-Stage Data

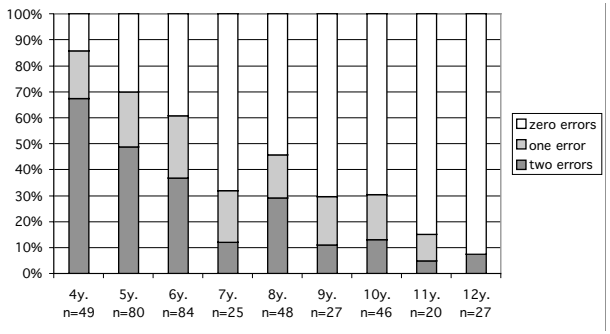
- two relevant items (one below)
- unimpaired children: until 6 years of life
- SLI children: until 7 years of life

Is every cowboy riding a horse? — “Yes.”

Yes-Errors in Unimpaired Children by Age



Yes-Errors in SLI Children by Age

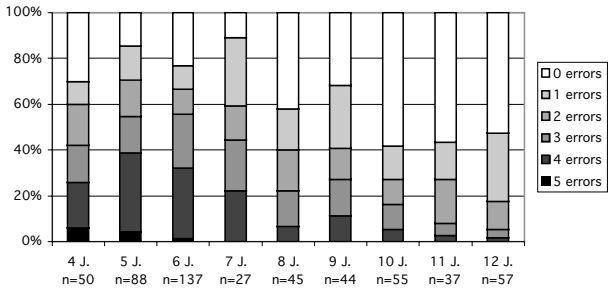


The No-Stage Data

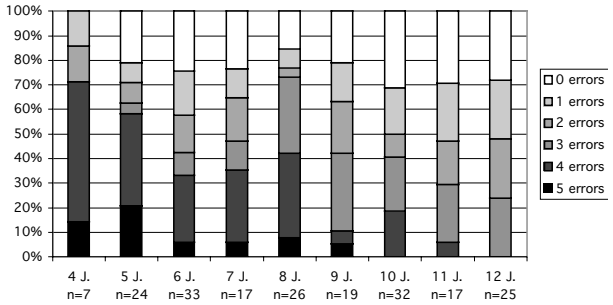
- five relevant items (one below)
- only data from yes-error free children
- unimpaired children: until 8 years of life
- SLI children: frequent even at 12 years of life

Is every father holding a baby? — “No.”

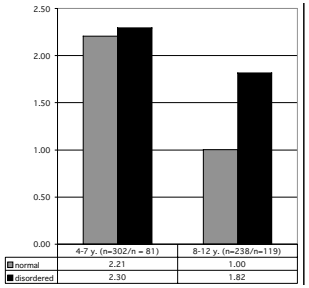
No-Errors in Unimpaired, Yes-Error Free Children by Age



No-Errors in SLI, Yes-Error Free Children by Age



No-Errors Statistics



Statistical significance by t-test

- $p < 10^{-21}$ young vs. old unimpaired
- $p = 0.034$ young vs. old SLI
- $p = 0.653$ unimpaired vs. SLI 4–7 year olds
- $p < 10^{-6}$ unimpaired vs. SLI 8–12 year olds

Section Summary

SLI causes the following delays in the acquisition of ‘every’:

- the yes-stage lasts one year longer in SLI-children
- could be consequence of phonological deficit
- the no-stage last 5 years longer in SLI-children
- cannot be consequence of phonological deficit

Conclusion

- Would an early transplant of auditory cortex prevent SLI?
- No. SLI also causes purely semantic deficits.
- SLI-children might also exhibit selective semantic deficit with question exhaustivity (Strauss 2002, Roeper et al. 2005).

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