Quantifier Processing: Acquisition of Quantification

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Lecture 5 topics:

- Quantifier Spreading
- Strong & weak quantifiers
- Focusing adverbs
- Quantificational anaphora
- Quantifier scope ambiguity
Quantifier Spreading

- Widely observed that children make non-adult errors when evaluating the meaning of statements that contain a universal quantifier.
- Errors appear to be restricted to universal quantifiers (but see section on focusing adverbs).
- Observed from at least 3 years until 7 years.

Quantifier Spreading

Are all of the circles blue?

Child: No, there are two blue squares.

(Inhelder & Piaget, 1959, see Geurts, 2003).
Quantifier Spreading

Are all of the children riding a bike?

Child response: No. No-one is riding that bike.

(e.g., Donaldson & Lloyd, 1974; Philip & Takahashi, 1991).
Are all of the girls holding an umbrella?

Child response: No. The man is holding one too.

(e.g., Philip & Verrips 1994).
Quantifier Spreading

- Error widely attributed to children employing a “symmetrical” reading, where they anticipate one-to-one correspondence between X and Y in statements of the form “Every X is a Y”.
- Essentially same as illicit conversion observed in (adults) syllogistic reading (e.g., Newstead, 1989).
- “All X are Y” is taken to mean that “All Y are X”.
Quantifier Spreading

- Drozd (2001) and Geurts (2003) argue that errors are due to children misconstruing universal quantifiers as “weak”.
- As a consequence, children prone to construing universals as weak quantifiers and consequently often assign non-relational readings.
Strong & Weak Quantifiers.

- Milsark (1977) argued for broad distinction between determiners that encompasses well-known distinction between definite and indefinite expressions.
- “Strong” determiners are inherently relational but “weak” determiners aren’t.
- “Most X are Y” means that most individuals in given set of X’s are Ys.
- This also presuppose that set X is non-empty.
Strong & Weak Quantifiers.

- Milsark (1977) used existential there-sentences as the litmus test of this distinction, based on the argument that because strong determiners already presuppose existence, this will create a tautology that renders sentences unacceptable.

1. There is a boy in the garden.
2. There are some boys in the garden.
3. There are many boys in the garden.
4. #There is the boy in the garden.
5. #There is every boy in the garden.
6. #There are most boys in the garden.
Strong & Weak Quantifiers

- Do children lack “strong” readings?
- Can assess this by examining judgements about the acceptability of quantifiers in there-sentences.
- Recent data collected by Matt Passby at the University of Leicester suggests that children (age 4-7 years) have difficulty rejecting there-sentences that contain “strong” quantifiers.

See also Hsiang-Hua, Miller, & Schmitt (2004)
Strong & Weak Quantifiers

![Bar chart showing mean total critical errors for different school years. The x-axis represents school years from Year 3 to Adult, and the y-axis represents mean total critical errors. The bars are color-coded, with blue for weak and red for strong quantifiers. The chart shows a trend of decreasing errors from Year 3 to Year 6, with a significant drop in errors for the Adult group.](chart.png)
Focusing Adverbs

- Children also produce non-adult responses when evaluating the meaning of sentences containing focus-sensitive particles such as “only”.
- Crain et al. (1996).
  - Children make errors by misinterpreting sentences with preverbal “only” as having the same meaning as sentences with pre-subject “only”.
    - Only the fireman is holding a hose.
    - The fireman is only holding a hose.
  - Children lack knowledge of syntactic restrictions.
Focusing Adverbs

The fireman is holding a hose.

Only the fireman is holding a hose.

The fireman is only holding a hose.

Children primarily make errors by failing to take account of contrast information.

Paterson et al. (2003)
Focusing Adverbs

Pollard & Paterson: The case of “even”.

Only the girl is holding a balloon.

The girl is only holding a balloon.

Even the girl is holding a balloon.

The girl is even holding a balloon.

“Even” is additive focus particle and requires that what is true of contrast set is true for focus set.
Evidently, children (and adults) have difficulty in evaluating meaning of “even”.
Focusing Adverbs

- Crain et al. (1996): Semantic Subset Principle
  - Children initially adopt interpretation of pre-verbal quantifier as ranging over entire VP rather than just the direct object, because former interpretation is truer is narrowest set of circumstances.

The fireman is only holding a hose.

As children encounter situations in which initial hypothesis is incorrect, they acquire evidence for alternative analyses.
Focusing Adverbs

The woman is walking a dog.
The woman is only walking a dog.
The woman is walking only a dog.

Children and adults performance consistent with only ranging over VP.

Thus evidence relating to Semantic Subset Principle remains unclear (but see Musolino, 2006)

Paterson et al. (2006)
Notley et al. (2009)
Quantificational Anaphora

- Research on adults indicates a preference for the subset reading of following ambiguity:
  
  There were six ships on the horizon.
  
  Three ships sank.

- Considerable evidence that children have difficulty in processing anaphora (e.g., Karmiloff-Smith, 1980).

- How do children deal with this ambiguity?
Wijnen, Roeper, & van der Meulen (2004).

Here’s a playground.
It’s great to do all kinds of funny things when you’re out in the playground, like swinging, making a sand castle or climbing on the monkey bars.
There are some kids playing in the sand box. Are two upside down?

- Children very likely (>80%) to say “yes” for picture of 2 kids doing handstands in sand box, compared to when 2 kids are doing handstands outside of box, or 2 adults are doing handstands.
Quantificational Anaphora

Mousoulidou & Paterson

Three cats were on a wall.
Two (other, of the) cats caught a mouse.

Presuppositional Picture

Existential Picture
Quantificational Anaphora

Experiment 1
Children and Adult’s Existential Responses

- Unambiguously Existential: Children 70%, Adults 100%
- Ambiguous: Children 68%, Adults 27%
- Unambiguously Presuppositional: Children 59%, Adults 0%
Quantificational Anaphora

- Clear discrepancy in findings.
- Wijnen et al. (2004) finding good evidence for discourse integration - although >80% responses of this type exceeds normal adult performance.
- Mousoulidou & Paterson find none!
- Clearly further work is needed to clarify children’s capabilities and acquisition of processing strategies.
Quantifier Scope Ambiguity

- Recall ambiguity nature of ambiguity.
  
  “A boy kissed every girl.”

Surface scope interpretation: one boy, many girls.

\[ \exists x \ [ \text{boy}(x) \land \forall y \ [ \text{girl}(y) \rightarrow \text{kissed}(x,y) \] \]

Inverse scope interpretation: many boys, many girls.

\[ \forall x \ [ \text{girl}(x) \land \exists y \ [ \text{boy}(y) \land \text{kissed}(x,y) \] \]

- How do children process this ambiguity?
- How are alternative analyses acquired?
Quantifier Scope Ambiguity

“Donald didn’t’ find two guys.”

1. It is not the case that Donald found two guys.
2. There are two guys Donald didn’t find.

- Adults can assign either reading and respond to pictures appropriately.
- Children have difficulty in reaching inverse scope reading of sentences.

Lidz & Musolino (2003)
Scalar Implicature

- Argued that children produce non-adult patterns of scalar implicature that, unlike adults, tend to be logical in nature (Noveck, 2004; see also Huang & Snedeker, 2009).
  - “Some boys kissed a girl”.
  - In terms of logic, true if “all boys kissed a girl”.
  - However, licences implicature that “not all boys kissed a girl”.
- Whereas 8-10 year olds will accept that “some x” can imply “all x”, adults are more circumspect (Noveck, 2001).
- Considerable evidence that children have difficulty in computing scalar implicature (Feeney et al., 2004; Pouscoulous et al., 2007; Papafragou & Musolino, 2003).
Conclusions

- Considerable evidence that young children assign non-adult interpretations to quantifiers, including:
  - Full understanding of meaning of universal quantifiers and focusing adverbs
  - Distinction between strong & weaker determiners
  - Inverse scope reading of quantifier scope ambiguity
  - Evidence for age differences in processing of scalar implicature.

- Evidently children must acquire semantic representations for quantifiers over considerable period of time.
References

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