Asymmetries in the production and comprehension of (non)factive complements

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Overview

- Background: (Non)factivity and Theory of Mind
- Asymmetry between production and comprehension
- Asymmetry across different comprehension tasks
- Conclusion and open questions
(Non)factivity


- **Propositional**
  
  *He thought he bought a ring.*  
  
  p true or false

- **Factive**
  
  *He forgot that he bought a ring.*  
  
  presupposition: p true

- **Negative-implicative**
  
  *He forgot to buy a ring.*  
  
  entailment: p false

Complex interaction of lexical-semantic, syntactic, and discourse-semantic factors
(Non)factivity

Interpretation of complement clauses requires calculation of dependent event variable, but with different properties (Hegarty, 1992; Schulz, 2002, 2003)

propositional \[ \exists e \in M_E : \text{buy}(A, \text{rose}, e) \text{ think}(A, e) \quad M_E = \text{set of events in A's mental model} \]

neg.-implicative \[ \exists e \in D_E : \neg \text{buy}(A, \text{rose}, e) \text{ forget}(A, e) \quad D_E = \text{set of events in a discourse D} \]

factive \[ \delta e : \text{buy}(A, \text{rose}, e) \text{ A forget that } e \text{ occurred} \quad \delta = \text{discourse binder} \]

Factive complements
Anaphoric expressions, bound to a specific event in the discourse
\[ \mathcal{E} \text{ Event binding triggered by interaction of a tensed complement and a potentially factive (p-factive) matrix predicate like forget} \]
Theory of Mind

Knowledge that while there is a single reality different people may have different representations of that reality

Capacity to attribute mental states to other people
- distinguish between appearance and reality
- discuss contents of other minds
- make behavioral predictions on that basis

Relation between ToM and language

**Linguistic Determinism Hypothesis**
Emergence of false belief understanding rests on the child’s mastery of the semantics and syntax of complementation (de Villiers, 1995, 2000, 2003, 2005; de Villiers & de Villiers, 2000; de Villiers & Pyers, 1997, 2002; Schick, de Villiers, de Villiers & Hoffmeister, 2007)

- Mastery of false complements under communication verbs taking realis complements (e.g., *say*)
- By analogy mastery of false complements embedded by mental verbs (e.g., *think*)
Requirements for factivity

- **Lexical-semantic**
  Production/comprehension of p-factive matrix predicates

- **Syntactic**
  - Production/comprehension of tensed complements of p-factive predicates
  - Recognition of factive comp as barrier to adverbial wh-movement and neg-raising \( (\text{She didn't know that } x \neq \text{She knew that not } x) \)

- **Discourse-semantic**
  - Calculation of dependent event variable as definite description
  - Presupposition and presupposition failure

- **Cognitive**
  Mastery of ToM (false belief)

- The concept of factivity is acquired stepwise
Aim of the talk

Show that the intermediate stages in acquiring the concept of (non)factivity are reflected differently

- ... in production and comprehension
- ... in different comprehension tasks
Production and comprehension

Before mastery:

**Prediction for production (P1.1)**
Stepwise acquisition of components of factive complements: p-factive matrix verbs and tensed complements

**Prediction for comprehension (P1.2)**
Default strategy across different complement types
Production of sentential complements

Method

- Age range: 2;3 to 5;0
- Analysis of all utterances containing the complement-taking matrix verbs *try, want, think, tell, forget, say, remember, hope, and wish*

Schulz (2003)
## Production of sentential complements

<table>
<thead>
<tr>
<th>Production Type</th>
<th>Adam</th>
<th>Abe</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-factive verb + NP</td>
<td>3;3 forget</td>
<td>2;4 forget</td>
</tr>
<tr>
<td></td>
<td>3;7 remember</td>
<td>2;11 remember</td>
</tr>
<tr>
<td>Nonfactive verb + tensed complement</td>
<td>2;11</td>
<td>2;7</td>
</tr>
<tr>
<td></td>
<td><em>I think</em> that go on</td>
<td><em>My mommy</em> said that</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>we make popcorn</em></td>
</tr>
<tr>
<td>P-factive verb + to-infinitive</td>
<td>3;6</td>
<td>3;2</td>
</tr>
<tr>
<td></td>
<td><em>I forgot</em> to make</td>
<td><em>You forgot</em> to put</td>
</tr>
<tr>
<td></td>
<td><em>sailboat</em></td>
<td><em>your name</em></td>
</tr>
<tr>
<td>Factive complement</td>
<td>4;1</td>
<td>3;9</td>
</tr>
<tr>
<td></td>
<td><em>I forgot</em> I gave you</td>
<td><em>I forgot</em> that # I</td>
</tr>
<tr>
<td></td>
<td><em>some dollars</em></td>
<td>didn’t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4;1</td>
<td>4;4</td>
</tr>
<tr>
<td></td>
<td><em>You remember</em> I broke</td>
<td><em>I remember</em> he never</td>
</tr>
<tr>
<td></td>
<td><em>my window</em></td>
<td><em>hurts himself</em></td>
</tr>
</tbody>
</table>

Schulz (2003)
Production of sentential complements study: Summary

- Production of p-factive matrix predicates first with NP, then with nonfinite complements
- Complementizer *that* often absent, independent of the specific complement type
- Production of tensed nonfactive complements precedes production of tensed factive complements

Stepwise acquisition of (non)factive matrix verbs and sentential complements (P1.1 confirmed)
Comprehension of sentential complements

Methods

TVJ task: Assigning truth-values to sentential complements (Abbeduto & Rosenberg, 1985; de Villiers et al., 1997; Scoville & Gordon, 1980; Schulz, 2003)

Mary remembers that the cat is slow.
Test question: Is the cat slow?
Child: Yes.
Comprehension of sentential complements

Methods

Matching a complex sentence to a situation (Léger, 2007)

She knows that she has a cat.
Comprehension of sentential complements study: Summary

- Initial use of the complement-only strategy (COS) between ages 3 and 6: Interpretation of the complement independent of the matrix clause (Harris, 1975; Abbeduto & Rosenberg, 1975; Léger, 2007)

  \[
  \text{She knows that she has a turtle.} = \text{She has a turtle.}
  \]

  \[
  \text{She thinks that she has a turtle.} = \text{She has a turtle.}
  \]

  \[
  \exists e \in D_E: \text{have(}\text{she, turtle, e}) \]

  \[
  D_E = \text{set of events in a discourse } D
  \]

- Correct interpretation of factive, negative-implicative, and propositional complements reported between age 4 (Abbeduto & Rosenberg, 1985; Pérez-Leroux & Schulz, 1999; Schulz, 2003) and ages 6 to 8 (de Villiers et al., 1997; Léger, 2008)

- Before mastery, default strategy across different complement types (P1.2 confirmed)
Production and comprehension

- First occurrences of sentential complements before age 3
- Target-like comprehension of (non)factive complements starting at age 4 or 6

BUT
- First production of factive complements around age 4
- Use of complement-only strategy until 4 or 6

Asymmetry between production and comprehension??
Aim of the talk

Show that the intermediate stages in acquiring the concept of (non)factivity are reflected differently

... in production and comprehension

... in different comprehension tasks
Across comprehension tasks

Tasks assessing interpretation of (non)factive complements may probe different aspects of the phenomenon.

Before mastery:

Prediction for comprehension (P2)

Performance across different comprehension tasks may differ.
Example study with the same subjects

Experimental design
- Pretest: Comprehension of simple *wh*-questions
- Task 1: Understanding False Belief (FB)
- Task 2: Memory for complements
- Task 3: Assignment of truth-values

Subjects
- 15 monolingual German-speaking children (Mean age: 4;02; age range: 3;05 to 4;10)
- Control group of 15 monolingual German adults

Schulz & Ludwig (2008)
Task 1: Understanding False Belief

**Method**
Unseen displacement: predict behavior/mental state based on a character's false belief (cf. Wimmer & Perner, 1983)

**Design** (Videoclips from J. Weissenborn, Humboldt University, Berlin)
- Comprehension of 4 *wh*-questions as pretest
- 2 practice video trials
- 12 test trials (6 *change-of-location*, 6 *change-of-contents* video clips)
  - 6 simple False Belief questions (*Where will Jana look for X?*)
  - 6 mental state verb questions (*Where does Susi think X is?*)
Task 2: Memory for Complements

**Design** (replication of J. de Villiers & Pyers, 2002, for German; (cf. also de Villiers, 1995; de Villiers & Pyers, 1997, 2002; Hale & Tager-Flusberg, 2003)

1 practice trial
8 test trials (all with the communication verbs *say*).

*The woman said there was a bug in her cereal.*

*But look, it was just a raisin!*

*Was hat die Frau gesagt, ist in ihrem Müsli?*  
What did the woman say was in her cereal?  
*a bug*
**False Belief and Memory for Complements: Results**

FB mastery = at least 10 out of 12 correct responses (80 % correct)

MFC mastery = at least 7 out of 8 responses correct (87.5 % correct)

<table>
<thead>
<tr>
<th></th>
<th>FB failers</th>
<th>FB passers</th>
<th>Adults (all FB passers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFC failers</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MFC passers</td>
<td>4</td>
<td>8</td>
<td>15</td>
</tr>
</tbody>
</table>

Distribution sig. different from chance ($\chi^2$(df=1; n=15) = 6.234, $p=.026$)

All FB passers show ceiling performance in the memory for complements task
Task 3: Assignment of truth-values

Method
Variant of the truth-value judgment task: Assign truth-values to sentential complements of factive, propositional, and negative-implicative matrix predicates

Design (Schulz, 1997; 2003)
- 6 practice trials
- 12 main trials (10 test trials, 2 fillers)
- Verbs: *think that*, *forget that*, *find out that*, *forget to*, *fail to*
- 3 possible responses: *yes, no, don’t know*
Propositional test item

One morning, this boy and his mother made a beautiful cake for after dinner. The boy looked in the bowl and saw a dark spot.

The boy thought that there was an ant in the bowl.

Der Junge dachte, dass in der Schüssel eine Ameise ist.

Q1: Was there an ant in the bowl?
   maybe.

Q2: What did the boy see?
   Who knows, a raisin? It doesn't say.
FB and assignment of truth-values: results

Responses to propositional complements (composite score)

Significant difference between the performance of FB passers and FB fails (Wilcoxon W = 24.0, p=.014)

 ธ BUT: no ceiling effect for FB passers
Studies of comprehension of sentential complements: Summary

- **Memory of complements task**
  All FB passers master the memory of complements task

- **Assignment of truth-values**
  FB passers show significantly better performance on propositionals than FB failers (7% vs. 50 % correct), but are far from adult-like performance (93 %)

Matching a false complement against reality less complex than assigning an indeterminate truth value to propositional complements (P2 confirmed)

But is that asymmetry?
Conclusion

Intermediate stages in production
Stepwise acquisition of the components: matrix verbs, complement types

Intermediate stages in comprehension
Default interpretation strategies like Complement-only strategy (COS)

Only full understanding of the concept (non)factivity results in symmetrical production and comprehension abilities
Open questions

? Production of factive complements related to mastery of FB?

? Does the COS-default strategy also apply to languages like German, where word order differs in main and complement clauses?

Tom knows that [Sue has a dog].
Tom weiß, dass [Sue einen Hund hat.]

? What is the default interpretation strategy for nonfinite complements?
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If you are interested in a copy of the slides, email me: P.Schulz@em.uni-frankfurt.de
Selected references


