The role of Theory of Mind in the acquisition of factivity

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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
Factivity

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

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

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

**Factive complements**
Anaphoric expressions, bound to a specific event in the discourse
¬ Event binding triggered by interaction of a tensed complement and a potentially factive matrix predicate like forget
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*)

vs. alternative approaches that do not assume a causal relationship, assume a relation in the other direction, or a less specific contribution of language … (for a meta-analysis of several studies cf. Milligan, Astington & Dack, 2007)
Previous acquisition findings

- Correct interpretation of factive, negative-implicative, and propositional complements reported between age 4 (Macnamara et al., 1976; Abbeduto & Rosenberg, 1985; Pérez-Leroux & Schulz, 1999; Schulz, 1997, 1999; 2003) and ages 6 to 8 (de Villiers et al., 1997)

- FB understanding improves children’s performance on the assignment of truth-values to different sentential complements (Schulz & Meissner, 2003)
  **BUT**: wide age range (3;04 to 6;03)

- Mastery of FB after mastery of the sentential complements (e.g., de Villiers & Pyers, 2002, Hale & Tager-Flusberg, 2003, Perner et al., 2003)
  **BUT**: no factivity test included
The study

Experimental design

- Pretest: Comprehension of simple *wh*-questions
  (2 children excluded; ages 3;01 and 4;02)
- Experiment 1: Understanding False Belief (FB)
- Experiment 2: Memory for complements
- Experiment 3: (Non-)factivity

Subjects

- 15 monolingual German-speaking children
  - Mean age: 4;02 (age range: 3;05 to 4;10)
  - Enrollment in a standard preschool program
  - Typical language development attested via teachers
- 15 monolingual German adults as a control group
Research hypotheses

Hypothesis 1 (H1)
False belief understanding rests on the child’s mastery of the grammar of complementation (e.g., de Villiers & Pyers 2002)

- All FB passers master the memory of complements task
- FB failers may pass or fail the task

Hypothesis 2 (H2)
FB understanding is a prerequisite for the correct interpretation of the truth values of different sentential complements (cf. Schulz 2003, Schulz & Meissner, 2003)

- Better performance on sentential complements for FB passers than for FB failers
- Non-adultlike interpretation of sentential complements may persist after emergence of FB, due to lexical and syntactic properties
Experiment 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?)
Experiment 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>
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<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 ($\chi^2(df=1; n=15)= 6.234, p=.026$)
→ Weak correlation between performance on FB task and age ($r=.503; p=.056$)
→ **H1 confirmed:** FB understanding rests on the child's mastery of the grammar of complementation
Experiment 3: (Non-)factivity

- **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: *forget that*, *find out that*, *think 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.
(Non-)factivity: Results I

Responses to propositional complements (composite score)

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

→ H2 confirmed for propositionals
Factive test item

This boy was looking out of the window. He was a bit scared because there was a strange dog running towards the front door.

The boy forgot that he locked the door.

Der Junge vergaß, dass er die Tür abgeschlossen hat.

Q1: Did the boy lock the door?

yes.

Q2. What did the boy do with the door?

He locked it and forgot about it.
(Non-)factivity: Results I

Responses to factive complements (composite score)

- Higher performance for FB failers than FB passers …

<table>
<thead>
<tr>
<th>Response types</th>
<th>FB failers</th>
<th>FB passer</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>expressing truth</td>
<td>89</td>
<td>66</td>
<td>78</td>
</tr>
<tr>
<td>expressing falsity</td>
<td>11</td>
<td>34</td>
<td>22</td>
</tr>
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</table>
(Non-)factivity: Results II

Correct responses to factive and negative-implicative complements by verb (composite score)

- High performance for verbs embedding one type of complement
- Lower performance of *forget* in both conditions
Conclusion

FB and memory of false complements
Support for the Linguistic Determinism hypothesis:
All FB passers master the memory of complements task, varied performance of FB failers

Memory of false complements and (non-)factivity
Matching a false complement against reality less complex than assigning an indeterminate truth value to propositional complements (only 50 % correct for FB passers)
Conclusion

FB and (non-)factivity

- Verb class effects
  - Only with *propositionals* significantly better performance for FB passers than for FB failers
  - No effect of FB mastery for *factives* and *negative-implicatives*

- Syntactic effects
  - High performance on verbs taking one type of complement for FB failers and passers (*find out that*, *fail to*)
  - Low performance on verb with 2 complement types (*forget*)

FB understanding not always prerequisite for the correct interpretation of the truth values of sentential complements
Open questions

- Yes-responses to factives as default or reflecting target-like competence?

- Is there a stage of interpreting tensed complements as true in German?

- What is the relation between entailment (in negative-implicatives) and false belief?
Thank you!

If you are interested in a copy of the slides, please email me: P.Schulz@em.uni-frankfurt.de
Selected references


