

# The role of Theory of Mind in the acquisition of factivity

**Petra Schulz<sup>1</sup> & Carolyn Ludwig<sup>2</sup>**

<sup>1</sup>Goethe University Frankfurt

<sup>2</sup>University of Mannheim

P.Schulz@em.uni-frankfurt.de

**Symposium 1162 „Acquiring the semantics  
and syntax of presuppositions”**

IASCL

July 28 – Aug 01, 2008

University of Edinburgh, UK

# Factivity

Sentential complements differ regarding the status of the truth-values of the embedded propositions (cf. Kiparsky & Kiparsky, 1971; Karttunen, 1972; Schulz, 2002, 2003)

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

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

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

	<b>FB failers</b>	<b>FB passers</b>	<b>Adults (all FB passers )</b>
<b>MFC failers</b>	3	0	0
<b>MFC passers</b>	4	8	15

- 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.*

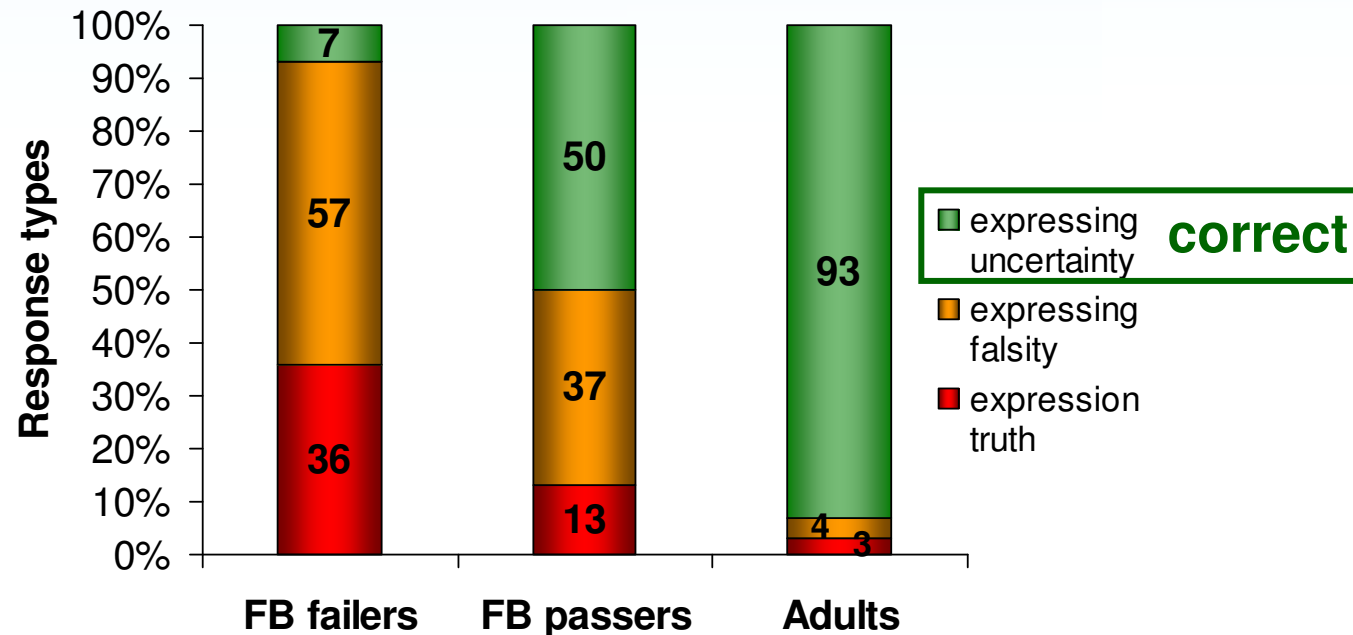
*Der Junge **dachte**, dass in der Schüssel eine Ameise ist.*

*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)

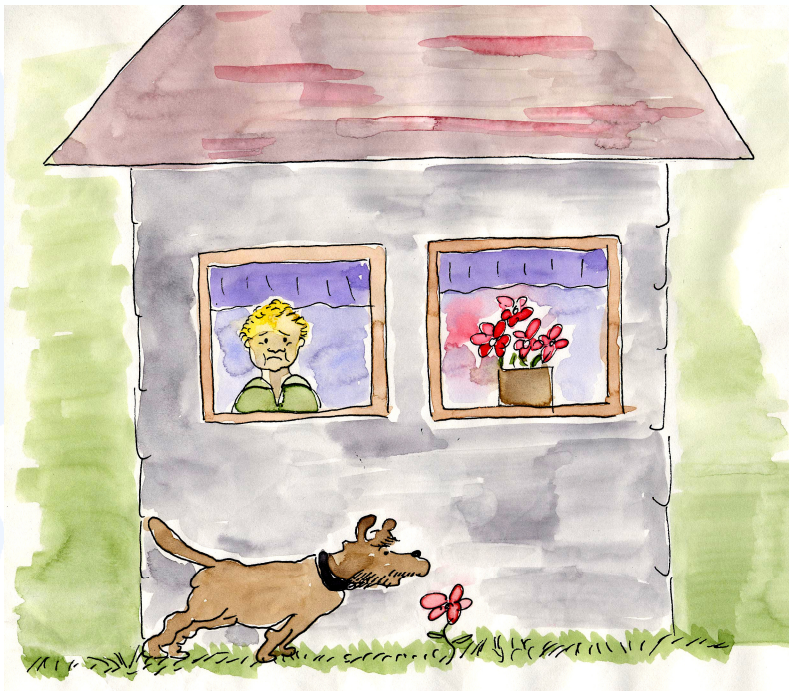


→ Significant difference between the performance of FB passers and FB failers (Wilcoxon  $W = 24.0$ ,  $p = .014$ )

→ **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?*

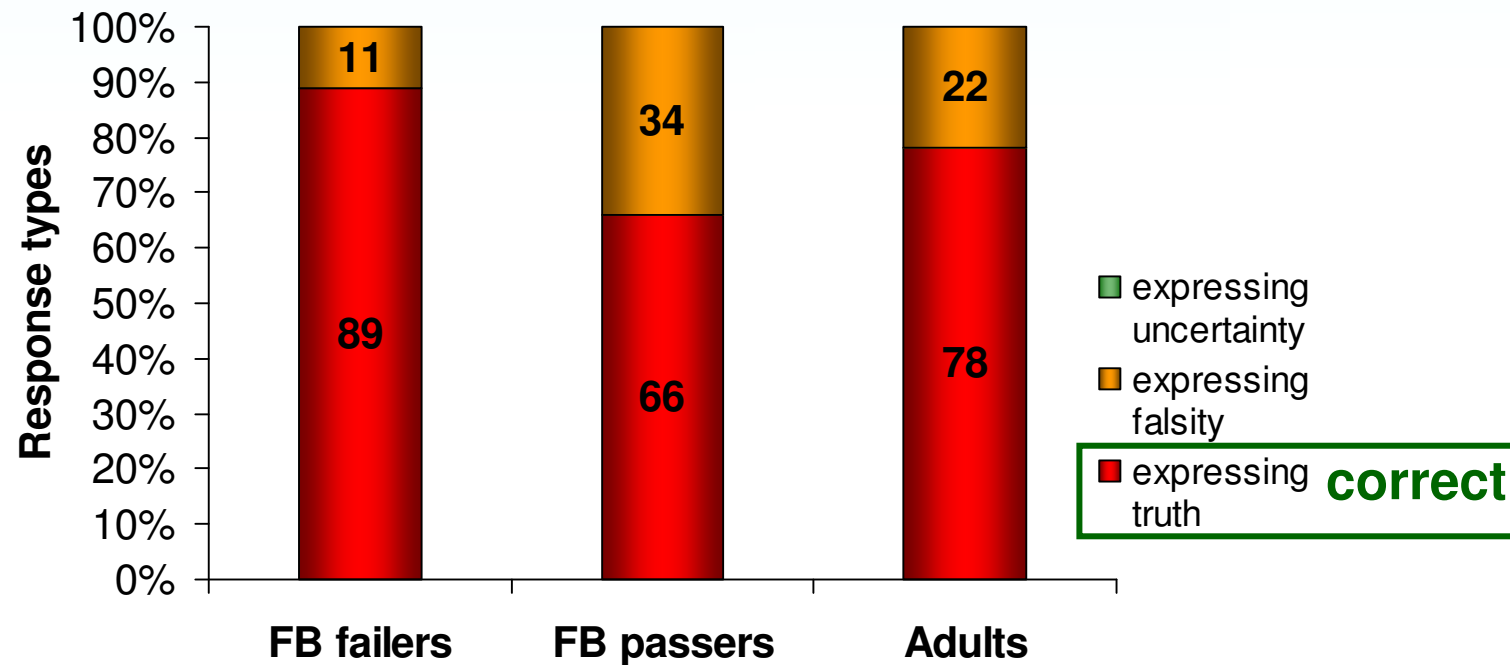
**yes.**

*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)

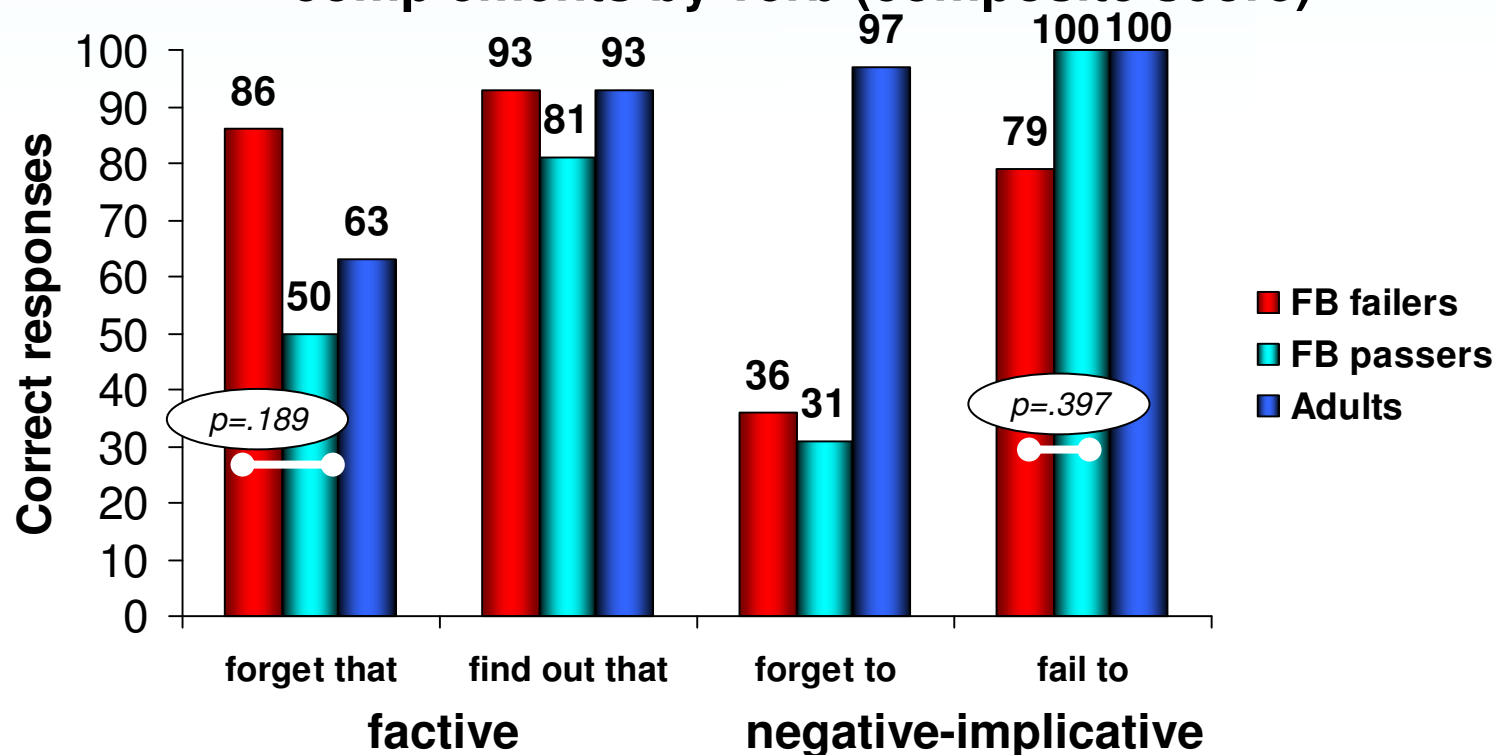


→ Higher performance for FB failers than FB passers ...



## (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 *actives* 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](mailto:P.Schulz@em.uni-frankfurt.de)

## Selected references

- de Villiers, J. (2003). Can language acquisition give children a Point-of-View? *Proceedings of Conference on Language and Theory of Mind*, Toronto, April 2002. Ms.
- de Villiers, Jill (2005). Can Language Acquisition Give Children a Point of View? In: Astington, J.W. & Baird, J.A. (Eds.). *Why language matters for theory of mind*. New York: Oxford University Press, 186-187.
- Hale, C. M. & Tager-Flusberg, H. (2003). The influence of language on Theory of Mind: A training study. *Developmental Science*, 61, 346-359.
- Milligan, K., Astington, J.W. & Dack, L.A. (2007). Language and Theory of Mind: Meta-Analysis of the relation between language ability and false-belief understanding. *Child Development*, 78:2, 622-626.
- Pérez-Leroux, A. & Schulz, P. (1999). The role of tense and aspect in the acquisition of factivity: Children's interpretation of factive complements in English, German and Spanish. *First Language*, Vol 19:1, 55, 29-54.
- Perner, J., Sprung, M. Zauner, P. & Haider, H. (2003). *Want that* is understood well before *say that, think that* and false belief: A test of de Villiers' Linguistic Determinism on German-speaking children. *Child Development*, 74:1, 160-169.
- Schick, B., de Villiers, P., de Villiers, J. & Hoffmeister, R. (2007). Language and Theory of Mind: A Study of Deaf Children. *Child Development*, 78:2, 376-396.
- Schulz, P. (2002). The interaction of lexical-semantics, syntax and discourse in the acquisition of factivity. In B. Skarabela, S. Fish & A. H.-J. Do (Hrsg.), *Proceedings of the 26th Annual Boston University Conference on Language Development*. Somerville, MA: Cascadilla Press, Vol 2, 584-595.
- Schulz, P. (2003). *Factivity: Its Nature and Acquisition*. *Linguistische Arbeiten 480*. Tübingen: Niemeyer.
- Schulz, P. & Meissner, A. (2003). *Understanding Theory of Mind and complementation - The linguistic determinism hypothesis revisited*. Talk presented at the 28th Annual Conference on Language Development (BUCLD) Boston, USA.
- Starakaki, S. (2003). Theory of Mind and comprehension of factive and non-factive structures in children with Williams syndrome. Talk presented at the *Child Language Seminar*, Newcastle, UK, July 2003.