

# Theory of Mind, linguistic development and mental language

Hannah De Mulder

Uil OTS (University of Utrecht)



## Introduction

- Background:** A particular milk carton contains a coin. Show someone else the carton and ask them what's in it. What will they say? Milk! But this is not so obvious for young children. Appreciating other people's beliefs is hard, especially if those beliefs differ from their own. Between 4 and 5 years old, children start to understand these "false" beliefs. The child then has a **Theory of Mind** (ToM).

- The debate:** How are language and ToM development related? Is language a prerequisite for ToM (de Villiers & Pyers 2002)? Or do you need an understanding of others in order to acquire (complex) language (Slade & Ruffman 2005)? (cf. Milligan et al. 2007 for a review)

- A different angle:** What about those aspects of language that directly require an understanding of mental states, like mental state verbs and indirect requests (**mental language**)?

- Main research question:** What predicts a child's *mental language* capacity? *ToM* or *general language*?

- Hypothesis:** an understanding of others is essential for acquiring language, especially for areas of language directly related to mental states. ToM will predict mental language; general language will be of lesser importance.

## Method

- Design:** pilot study on 32 3 to 5 year old Dutch children assessing ToM, general language and mental language

- Subjects:** 15 3 year-olds (mean 3;3, range 2;11-3;10), 9 4 year olds (4;7, 4;3-4;11) and 8 5 year olds (5;6, 5;3-5;11)

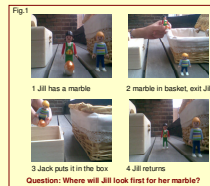
- Key features measures:**

- ToM: false belief understanding. Child predicts behaviour given an outdated belief.
- Language: composite measure for 3 different aspects of language
- Mental language: lexical level (words requiring an understanding of others' mental states) and discourse level (utterance interpretation and informative production). Mental language tasks require both general language and ToM skills.

## Materials

- False belief Theory of Mind tasks**

- Location change (fig. 1)
- Unexpected contents egg box with toy car & crayon box with string
- Appearance-reality cake/candle & toy car/ pencil sharpener



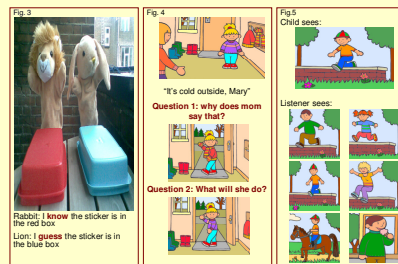
- General language tasks**

- Vocabulary PPVT test for receptive vocabulary
- Syntax selected parts Reynell test for language comprehension
- Sentential complementation (fig. 2)



- Mental language tasks**

- Lexicon: differences in speaker certainty know-think-guess; definitely-maybe; might-must (fig. 3)
- Discourse: comprehension of indirect requests (fig. 4) and picture description task (fig. 5)



## Results

- The analysis:** 3 independent and 3 dependent variables were considered in a regression analysis of the data

- Independent variables**

- ToM score: total score of the 3 tests (max=14)
- Language score: z-scores determined for each measure. Z-scores added up to form composite score
- Age: age in months

- Dependent variables**

- Total Mental Language score (MLtot)
- Mental Language Lexicon score (MLL)
- Mental Language Discourse score (MLD)

- Determination dependent variables:** z-scores for each mental language measure were used. MLtot represents a composite score for all measures; MLL and MLD represent composite scores for the lexical and the discourse measures respectively.

- Outcome**

- MLL The regression model was not a good fit for MLL ( $R^2=19.6\%$ ,  $R^2_{adj}=10.9\%$ ). The overall relation was not significant with  $F_{3,28}=2.269$ ,  $p=0.102$ .

- MLtot

The model was a reasonably good fit for MLtot ( $R^2=45.6\%$ ,  $R^2_{adj}=39.7\%$ ). The overall relation was significant with  $F_{3,28}=7.815$ ,  $p=0.001$ . All three factors were positively related to MLtot, but only age had a significant effect ( $t_{33}=3.318$ ,  $p=0.003$ ).

- MLD

The model is a good fit for MLD ( $R^2=53.3\%$ ,  $R^2_{adj}=48.3\%$ ). The overall relation was significant with  $F_{3,28}=10.655$ ,  $p=0.000$ . All three factors were positively related to MLD performance, but only age ( $t_{33}=2.324$ ,  $p=0.028$ ) and ToM ( $t_{33}=2.182$ ,  $p=0.038$ ) had a significant effect on MLD performance (see table 1).

Table 1. Regression coefficients for MLD

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
1						
(Constant)	-4,065	1,246			-3,262	,003
age	,064	,028	,387		2,324	,028
ToM	,251	,115	,400		2,182	,038
Language	,037	,144	,039		,258	,799

a. Dependent Variable: MLD

## Conclusions

- Research question:** The aim of the research was to consider what would be the best predictor of mental language capacity: ToM or general language. ToM was hypothesised to be the best predictor.

- Findings**

- The hypothesis was partly confirmed: regression analysis of MLD showed that ToM, but not language, was a good predictor of MLD performance.
- The hypothesis could not be confirmed for all aspects of mental language, as the model for MLL was not significant and the model for MLtot did not have a significant predictor other than age.

- Broader significance:** For some aspects of language at least, ToM is a good predictor of performance, better even than general language. The research thus tentatively supports the view that ToM development fuels the development of language. This, in turn, relates to views on the architecture of cognition and the process of cognitive development, supporting an interactive view as opposed to strictly modular views.

## Future directions

- Larger study:** The pilot study will be extended to include a considerably larger number of subjects.

- Data analysis:** Theoretical reasons underlie the choice of sentential complementation as one of the language measures. Given more subjects, the contribution of this aspect of language will be considered separately as well.

- Causality:** In order to study the relation between ToM, general language and mental language more closely, the following may be done

- Longitudinal data could be added, so that later mental language could be compared to earlier ToM and general language and vice versa
- An intervention study in which separate groups are trained on mental language, ToM and general language could give more conclusive data on the direction of causality

## Literature cited

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## For further information

Please contact [Hannah.DeMulder@let.uu.nl](mailto:Hannah.DeMulder@let.uu.nl)