

# Does Training Production of Tensed Complements Accelerate the Development of Theory of Mind?

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“If there were a verb meaning “to believe falsely,” it would not have any significant first person, present indicative.”

- Ludwig Wittgenstein

*Linguistic deterministic theory proposes that tensed complements structure and prepare children’s ability to understand that others can have beliefs that might not be true, a so-called Theory of Mind (ToM). Others found that training production of mental verbs advanced four-to-five year-olds’ ToM. In this pilot study 46 pre-schoolers completed a programme consisting of 16 intervention sessions, during which all children were read stories enriched with tensed complements. After the story reading, half of the children were trained in the active production of tensed complements. The trained children did not differ from the children that were passively exposed to tensed complements. This renders no support to the role of active production of such complements in ToM development. The findings lead to questioning of the concept of ToM as well as its relation to language.*

*Keywords:* Theory of Mind, language, tensed complements, mental verbs, active production of tensed complements

## 1 Introduction

This paper sets out to – through philosophical glasses – investigate the psychological impact of linguistic training on the social competencies of 3-6 year old pre-schoolers, more precisely on their so-called *Theory of Mind (ToM)*.

ToM refers to the gradually developing understanding of people as mental beings having knowledge, thoughts, desires, beliefs, intentions, and emotions and whose actions and interactions can be interpreted, explained, and predicted by taking these mental states into account. It is a cognitive achievement that enables us to express our propositional attitudes and to attribute such attitudes to others. It also helps us understand that we can hold beliefs about others and ourselves that might be false. In this way, ToM works as a social lubricant in many aspects of human life.

Children’s awareness of, and reflection on, their own and others’ mental states help them develop positive relationships with teachers (Garner and Waajid, 2008) and peers (Banerjee and Watling, 2005). In turn, these positive relationships predict later academic achievements, (Buhs, Ladd and Herald, 2006; Davis, 2003; Hamre and Pianta, 2001; Ladd, Birch and Buhs, 1999; O’Connor and McCartney, 2006; Pianta and Stuhlman, 2004). *Metacognition*, a term coined by John Flavell in the 1970s, is another predictor of academic success. According to Flavell (2000), research on ToM and metacognition has been relatively “distinct and unconnected” (p. 17), although both investigate children’s knowledge about and understanding of mental states. The terms ToM and metacognition are sometimes used indiscriminately (Flavell, 2000), but whereas ToM is about attributing attitudes to self and *others* and to use these attributions of mental states in our normal social intercourse, in planning, and in cooperation, metacognition is an *introspective* ‘knowing about knowing’. In Flavell’s own words:

”Metacognition refers to one’s knowledge concerning one’s *own*<sup>1</sup> cognitive processes and products or anything related to them, e.g., the learning-relevant properties of information or data. For example, I am engaging in metacognition if I notice that I am having more trouble learning A than B; if it strikes me that I should double check C before accepting it as fact.” (1976, p. 232)

Young children seem to be unclear about what it means for someone to know something and about how knowledge is acquired (Flavell and Miller, 1998). They are not aware that people experience mental states in an ever-flowing stream of consciousness. On the contrary, “they would ascribe no mental activity at all to a person who just sits quietly, ‘waiting’” (Flavell, 2004, p. 283).

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<sup>1</sup> My emphasis.

Recent longitudinal research has demonstrated that early ToM acquisition can be considered as a precursor to later metacognition. In two longitudinal studies Lockl and Schneider (2006; 2007) found that both ToM and language competencies significantly predicted later metamemory, a term for knowledge about memory, also coined by Flavell in the early 70s, or what he calls “applied ToM” (Flavell, 2000:17). Kuhn (1999) calls it “metastrategic knowing”.

There is broad consensus that explicit ToM comes about around age four in typically developing children. The children now begin to realize that some have thoughts in the mind that might not be true<sup>2</sup>. If Max has not seen his mother removing his chocolate bar from the cupboard where he put it and the child has, the child would know that the belief Max holds, namely that the chocolate is still in the cupboard, is not in compliance with reality and therefore false. Before the age of four, children do not master this intentional shift of perspective, as evidenced by false-belief tests and other different perspective-taking tests (Perner and Roessler, 2012). The question is: how do children come to this new understanding?

There is substantial evidence of a strong correlation between language acquisition and the development of ToM (cf. Astington & Jenkins, 1999; Milligan, Astington, and Dack, 2007; Ruffman, Slade, Rowlandson, Rumsey, and Granham 2003; Slade and Ruffman, 2005; Villiers, J., 2007; de Villers, P., 2005), but opinions differ as to which causes which.

### 1.1 Theoretical overview on language acquisition and the development of ToM

Some claim that ToM is innate, but that every child has to go through certain stages to achieve a level of linguistic and cognitive development where ToM becomes evident (Piaget and Inhelder, 1969). According to Piaget (1937/1954), children learn the public language on the basis of private symbolic representations. The child adds to its knowledge (*assimilation*) until its existing conceptions get so shaken by new information that the child is forced to *accommodate* this new knowledge by revising its present representations in order to gain *equilibrium* (Piaget, 1945/1962). Through public language, peers challenge one another’s thoughts and thus advance each other’s cognitive development (Bandura, 1986; Piaget, 1945/1962).

Piaget’s genetic epistemology took science as the paradigm form of knowledge. Chomsky’s view of language acquisition as hypothesis testing further kindled the idea of small children as scientists (Leudar & Costall, 2004; Leudar, Costall and Frances, 2004). This may form the basis of today’s mainstream psychology, in which language is a natural way of providing the child with the information it needs to be able to understand that different people know, believe, and want different things. It theorizes that the child’s brain has a natural desire to learn, which makes the child think and act just like a scientist: it devises, tests and revises theories (Gopnik, 2004; Gopnik, 2009; Gopnik and Meltzoff, 1997). Based on progress in neuroscience, a recent model of *active intermodal mapping* (Meltzoff and Moore, 1997) proposes

an intrinsic supramodal connection in the infant brain between acts it observes and actions it executes. Through everyday experience the infant associates its own actions with its own underlying mental states. These associations between actions and internal experiences are stored in a belief-predicting, cognitive mechanism and then projected onto the person(s) performing similar actions. This matching-to-target process results in the infant beginning to develop an understanding of other people’s minds and mental states<sup>3</sup>.

Other deny innateness and claim that ToM is built on cognitive processes that require language for their implementation, that children use semantic terms before they know the meaning of them and then acquire their meaning from use. In Vygotsky’s (1934/1994) account of cognitive development language is used in culture-bound social interactions. He argued that a lack of cultural context misleads us to hold causes of behaviour as residing within the child, rather than within its culture. On the contrary, during social interactions adults verbally interpret the child’s behaviour. Later, the child uses language to express control over others. Later still, the child controls its own actions by talking aloud to itself, so-called egocentric speech. Finally, speech is internalized and becomes thought<sup>4</sup>. In parallel with this, the capacity for self-monitoring and self-regulation develops through *more knowledgeable others* (ibid.). These individuals initially take responsibility for directing attention, setting goals, planning activities, and monitoring progress (*other-regulation*). As the child becomes increasingly competent of regulating his or her own cognitive activities, it gradually takes over the responsibility for these executive functions (*self-regulation*).

Recent socio-cultural views on development are moving towards a discursive learning theory (Erneling, 2010; Hutto, 2008). While admitting to the biological and genetic foundations of language production, it is suggested that language and ToM develop hand in hand as a package: “...the development of language and the development of social skills are prior to, jointly causally sufficient, and individually causally necessary for the acquisition of ToM” (Garfield, Peterson and Perry, 2001).

Cognition is plastic and shaped by language and language is an artefact created by the social environment (Erneling, 2010; Tomasello, 1999). Meaning thus emerges from social, communicative interaction and the sharing of meanings put constraints on individual meanings (Hoff and Naigles, 2002). Through the children’s social interaction with caregivers, teachers, and peers, the children are exposed to normative talk and narratives about mental states (cf. Erneling, 2010; Sinha and Jensen de López, 2000; Sinha, Thorseng, Hayashi, and Plunkett, 1994;). Lullabies, rhymes, stories, and triadic play all pave the way for the development of the folk psychological capacities that emerges in middle childhood (Sinha, 2009).

Although more or less radical embodied or dynamic theories are gaining influence, many researchers hold on to the nativist language theories. As this study investigates the

<sup>2</sup> Implicit ToM has been registered in infants (Chow and Poulin-Dubois, 2009; Onishi and Baillargeon, 2005; Poulin-Dubois, Sodian, Tilden, Metz, & Schoepper, 2007; Surian, Caldi, and Sperber, 2007; Trevarthen and Aitken, 2001), but as this field of research by its very nature can only cover implicit ToM, it will not be discussed in this study which deals with explicit, elicited responses.

<sup>3</sup> Note that the AIM model is not a *theory* (of mind), but a (simulation) *model*.

<sup>4</sup> Andy Clark (2001) goes as far as to propose that without language we would not have thoughts (or exist as a species!): “For as soon as we formulate a thought in words (or on paper), it becomes an object for both ourselves and others ... The process of linguistic formulation thus creates the stable structure to which subsequent thinking is attached” (p. 147).

relation between language and ToM development, a brief introduction to this research follows below.

### 1.2 Empirical background

Studies show that children's participation in conversation is critical to the development of ToM (Dunn, Brown, Slomkowski, Tesla, and Youngblade, 1991; Harris, 1999). Perner, Ruffman and Leekan (1994) showed that sibling constellation is another predictor of individual variation in ToM development. It has also been found that caregivers' use of mentalistic language is consistently correlated to children's early ToM development (Ruffman, Slade, and Crowe, 2002; Adrian, Clemente, Villanueva, and Rieffe, 2005; Farrant, Maybery and Fletcher, 2012).

Conversation may contribute to an understanding of perspective and mental states, but is it sufficient to allow for meta-representational interpretations of human behaviour? Some researchers argue that it is not. In his Language of Thought (LOT) theory, Fodor (1975) turns intentionality (i.e. the *aboutness* of a mental state) into propositional attitudes (beliefs and desires) in the sense that these attitudes figure as folk psychological explanations of behaviour: "he brought his umbrella because he expected *that* it was going to rain". Here we have an attitude ("he expected") followed by a proposition ("that it was going to rain").

Possibly picking up on Fodor's LOT theory, linguists Jill and Peter de Villiers explored the syntactic aspects of the linguistic input to children and found that as language develops, it is the increased resources in syntactic structures that provide the format required for mentalistic representation. Consequently, they proposed a much-debated *theory of linguistic determinism* (1999; 2000). According to this, a specific aspect of syntax, namely *tensed complements*, structures and prepares the child for false-belief thinking.

'Tensed complements' are full propositions embedded within sentences (cf. Fodor's propositional attitudes described above) and 'false-belief thinking' is thinking about thoughts that might not be true. Even if psychologist Joseph Perner is one of the critics of certain details in the linguistic determinism theory (Perner, Sprung, Zerner, and Haider, 2003), he offers an illustrating example in his false-belief task *Max and the chocolate* (Wimmer and Perner, 1983). In this story "Max *thinks* the chocolate is in the cupboard" and "Mother *knows* it's in the drawer" (Mother switched the location of the chocolate from the cupboard to the drawer while Max briefly left the room). The statements are equally true, in that, although Maxi's *belief* that the chocolate is still in the cupboard does not comply with reality, his having this belief is nonetheless true. In this way, tensed complements allow attitude and content of a person's mental state to be separated. The attitude describes the mental state (belief, desire, etc.) and the content (attribution) describes what the mental state is about (i.e. wanting chocolate).

In a longitudinal study de Villiers and Pyers, (2002) traced the development of the understanding of false beliefs and various measures of spontaneous language production and comprehension over the course of one year. They found that mastery of tensed complements is a precursor and possibly even a prerequisite of successful false-belief performance<sup>5</sup>.

If understanding false beliefs requires a propositional structure of a high degree of complexity, it should be predicted that children might not understand them unless they could also handle language of equivalent complexity. This is exactly what many studies involving children with language and cognitive impairments show, such as autistic spectrum disorder (ASD), or sensory impairment, such as deafness or blindness<sup>6</sup>, thus rendering support to the linguistic determinism theory (cf. reviews Astington and Jenkins (1999) and Garfield, Peterson and Perry (2001), anthology Baron-Cohen, Tager-Flusberg, and Cohen (1993), or Milligan, Astington and Dack (2007) for a more recent meta-analysis). Children with these disorders or functional impairments are late in both linguistic and ToM development or, as in many ASD cases, never reach a stage where they master these skills.

Some researchers found that especially the verbs *say* or *think* seem to give children understanding of a format that is needed to represent beliefs as false (de Villiers and de Villiers, 2000). Others found that the verb *want* followed by infinitival complements might bias the child's attention more towards the association of false belief and complement understanding because this verb makes the desire perceptually salient (Ng, Cheung and Xiao, 2010). Other studies yet acknowledge the importance of tensed complements, but give no support to the role of words like *say* or *think* (Hale and Tager-Flusberg, 2003; Lohmann and Tomasello, 2003).

Variation in language ability reliably correlates with individual differences in ToM. Astington and Jenkins (1999) found that the association between early language development and advanced false-belief understanding is observed even after controlling for individual differences in nonverbal intelligence and cognition. According to the linguistic determination theory, the far most significant factor in predicting success in false-belief test is the comprehension and production of sentences containing tensed complements (but not the other way around). Given this background, an important question at the preschool level is whether exposure to explicit metacognitive language will result in greater conceptual understanding of one's own and other people's beliefs. Peskin and Astington (2004) tested this and found that children exposed to stories enriched with mental verbs exhibited significantly more metacognitive verb production, but no improvement in metacognitive comprehension. The control group had not been exposed to metacognitive language. Instead the children in the control group were read stories and shown illustrations that implicitly required the children to think about perspectives other than their own. The control group outperformed the experimental group on a false-belief task battery, suggesting that the active construction of one's own mentalistic interpretations from illustrations and text implicitly draw attention to mental states.

Ornaghi, Brockmeier and Gavazzi (2011) interpreted these results as evidence that passively listening to stories with mental state terms alone is not enough to significantly improve understanding of metacognitive language or

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understanding is through false-belief tasks, this distinction will not be made here.

<sup>6</sup> This research is not held within the confines of this paper, but see the meta-analysis by Milligan et al. (2007) for autism; Schick, de Villiers, de Villiers, and Hoffmeister (2007) for deafness and McAlpine and Moore (1995) for blindness.

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<sup>5</sup> It should be noted here that a distinction ought to be made between false-belief *understanding* and false belief *performance*. However, as the most common way to measure explicit false-belief

accelerate ToM development. They suggested that having to actively construct one's own mentalistic interpretations of stories highlighting mental states would be more effective. Unlike the Peskin and Astington study, Ornaghi and her colleagues specifically encouraged the children in the training condition to actively "use mental state talk" (ibid.:242) in a set of language games. They found that the mean post-test scores of the children in the training condition were significantly higher than those of the children in the control group on a battery of false-belief tests and on metacognitive vocabulary comprehension, thus supporting their hypothesis.

Unfortunately, only children aged three and four were included in the study. As children are said to acquire ToM around the age of four, five-year-olds should have been included in the study. Furthermore, four-year-olds were tested on a battery of false-belief tasks, but the three-year-olds were only tested on the Sally-Anne false-belief test, a methodological choice that "was based on the literature, which reports that children's false-belief understanding is generally acquired at 4 years of age" (ibid.:233). This makes it impossible to compare the two age groups. The three-year-olds were not tested for false-belief understanding after the intervention period, owing to heavily skewed pre-test scores, where only one child out of 34 passed the change of location test. This means that all the study shows is that *four-year-olds* seem to have benefitted from the training in terms of enhanced scores on the false-belief tests. Furthermore, the training only consisted of making the children use eight different mental verbs in ordinary conversation: *getting scared*, *getting angry*, *wanting*, *remembering*, *knowing*, *thinking*, *believing*, and *deciding*. Besides the fact that *getting scared* and *getting angry* are affective, not cognitive verbs, the transcript in the appendix shows that the children are only trained in using the verb, not at all in using tensed complements. Furthermore, the ecological validity of the study is questionable in that "the sessions took place in a non-classroom area of the school building that had been specially laid out by the researcher" (ibid.: 246). Can behaviour in non-classroom environments be generalized to classroom areas?

However, the question whether it is the *active production* of or *being passively exposed to* that furthers the development of ToM is interesting, no matter whether it concerns mental verbs or the syntactic structure of tensed complements. If comparable at all, I would propose that actively producing tensed complements with mental verbs would be a little like constructing one's own mentalistic interpretations from illustrations and text, thus implicitly drawing attention to mental states, as in the Peskin and Astington (2004) study.

Many studies have explored the effect of sentential complements on ToM development, but, to my knowledge, so far none have investigated the effect of training typically developing children in the active production of tensed complements. As this pilot study is a conceptual replication of the Ornaghi et al. (2011) study I hypothesize that

1) Children trained in actively *producing* tensed complements with metal verbs will perform better on ToM measuring tasks than their controls who have merely been subjected to a passive exposure of the same, and that

2) Children with low ToM pre-scores will benefit more from training than children with high pre-scores.

## 2 Method

Given the limited temporal and economic resources of a master's thesis, the study was a pilot study. Before conducting it, approval was applied for at and granted by the Regional Ethical Review Board in Lund (exp. 2013/111). The study was conducted April-June 2013.

### 2.1 Participants

Participants were recruited from a pre-school in Kävlinge, a minor city in the south of Sweden. The city was chosen based on geographic and demographic considerations: it is close to Lund University and to the national mean figures in terms of socio-economic variables (Statistiska centralbyrån, 2012). Written information about the study and the implications for the children was distributed to all guardians of children 3-6 years at the pre-school, 91 in number. The guardians were also invited to a one-hour information meeting. Guardians of 65 children gave their written, informed consent to the participation of their child(ren).

As both the intervention group and the control group were exposed to the story telling, it would have been ideal to have a second control group who received no story telling and no training at all. But as studies involving young children by their nature often have a large dropout of participants, an initial sample of 65 children did not allow for three groups. As expected, a number of children fell long-term ill during the pre-test period, went on holiday with their families or simply refused to participate. The final sample thus consisted of 47 participants (26 females, 21 males). Fortunately, the dropouts were evenly distributed on the intervention and control groups. One child was absent during the post-tests; so 46 children completed the investigation (Fig. 1), 22 in the intervention group and 24 in the control group. Children with an absence rate higher than 25% during the intervention period were excluded from the final statistical calculations.

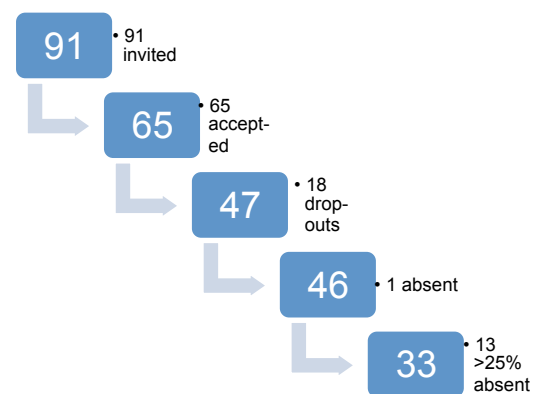


Fig. 1. Number of participating children from beginning to end

The final sample of 47 children was stratified into *hi-ToMs* and *lo-ToMs* based on their pre-scores on the false-true belief pre-tests and age (Fig. 2). No consideration was taken to the results of the doodle tests (see Material and Procedure), as these were not used in the study now conceptually replicated. As the number of children was limited, the line between *hi-ToMs* and *lo-ToMs* was drawn between the top 30% (three or four correct answers out of four possible) and the bottom 70% (nil, one, or two correct answers out of 4 possible). Participants were allocated in pairs to the intervention and control groups, respectively, by consecutively decreasing age and number of correct answers.

The intervention group and the control group thus ended up being as homogeneous as possible. As gender is not known to influence ToM at age 3-6 years, this variable was not taken into account during the stratification process.

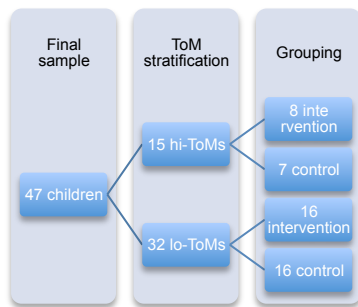


Fig. 2. Stratification process

## 2.2 Material and Procedure

As the validity of a child's score on psychological tests is threatened by such factors as shyness and unfamiliarity with the examiner, the children were given the opportunity to acquaint themselves with the experimenter on two occasions prior to data collection. To ensure ecological validity of the study, all assessments and training sessions were carried out in the preschool. The children were assessed one by one in a separate space at the children's respective sections. Interventions took place in the playrooms of the respective sections. Children not participating in the study were on the playground or in other activity rooms.

The study was divided into three parts: pre-tests, intervention phase, and post-tests (Fig. 3).

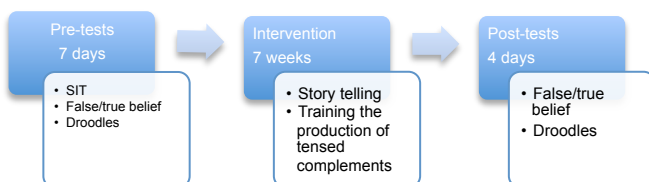


Fig. 3. Test procedure and running time

**2.2.1 Pre-tests.** Pre-tests were conducted during seven consecutive weekdays. Each child took all pre-tests within the same session.

**2.2.1.1 Language comprehension.** To ensure that the children were capable of understanding the instructions for the ToM tests, they were first tested for general language comprehension with the SIT test (Hellquist, 1989) for 3-year-olds and upwards. There is no Swedish standardized language comprehension tests for children as young as 3-6 years, but the SIT test correlates strongly with the TROG-2 which is a standardized test for ages 8-10 years and older (Aittomäki and Winell, 2011). In both tests the child is shown three pictures at a time. The pictures differ in grammatically essential items and the child is asked to point at the picture that best matches the sentence read aloud by the experimenter. Such a sentence could be "these are the most" and the child chooses between a picture with two big circles, three mid-size circles or five small circles. During the tests, each child was instructed to take his or her time looking at the pictures and then point at the one he or she found to be the best match.

## 2.2.1.2 Theory of mind assessment

**2.2.1.2.1 False/true belief tests.** Level of ToM (the child's ability to attribute false or true beliefs to others) was assessed by means of a false-belief test followed by a true-belief test. Both tests were first presented in a non-verbal condition where the child was asked to point at the chosen target, followed by a verbal condition where the child was asked to justify his or her choice.

False/true-belief tests come in various forms; in this study the commonly used 'change of location' task was applied. Animated versions of the Maxi/mother story based on Wimmer and Perner (1983) or the Sally/Anne story based on Baron-Cohen, Leslie and Frith (1985) (Appendix 1) were shown on a 13" laptop screen, accompanied by a speaker's voice outlining the plot. In both stories a person hides an object in a certain location and leaves the room. While this person is away a second person changes the location of the hidden object. On the return of first person, the participant is asked to predict where this person would look for the hidden object. In the true-belief test the first person does not leave the room and observes the change of location. A child with a fully developed ToM will understand that in the false-belief condition, the first person cannot know that the object has been displaced and consequently would look for the object at its original hiding place. In the true-belief condition the child must register that the first person has seen the object being displaced and therefore should know its new position. In the false-belief condition the child has to understand that its own knowledge differs from the knowledge of the first person, whereas the child and the first person share the same knowledge in the true-belief condition.

Half the children in the intervention and control groups, respectively, were pre-assessed with the Sally/Anne story and the other half with the Maxi/Mother story. The stories were reversed in the post-assessments.

**2.2.1.2.2 Doodle test.** A doodle is a fragment of a meaningful picture where the child must distinguish what it knows from what it sees (cf. Collet d'Escury-Koenigs, 1990). Sets of three doodles were used to assess participants' ToM level. All doodles were line drawings in A4 format. Set 1 depicted a cat, a flower, and a boat with a witch who has fallen overboard, set 2 a bunny, a giraffe, and an elephant. As was the case with the false/true-belief test, half the children in both intervention and control groups were pre-assessed with Set 1 and the other half with Set 2. The sets were reversed in the post-assessments.

The child was first given the complete picture and asked to describe what it showed. A thin cardboard sheet, from which a square had been cut out, was then placed on top of the drawing revealing only a fragment of the complete picture (Appendix 1). The child was asked, "What would your friend believe this picture shows, if he or she hadn't seen the original picture?" A child with a fully developed ToM would understand that not having seen the original picture, the friend would say anything coming to mind, except the motif of the original picture. In the case of the cat where the frame only revealed the tail, a child with a fully developed ToM could answer "a sock". A child that has not yet developed ToM would not understand that the friend does not share his or her own knowledge and would answer "a cat" or "a tail".

2.2.2 *Post-tests*. Post-tests (false/true-belief and droodles) were conducted during three consecutive weekdays starting the first weekday of the week following the intervention period, plus – due to holidays – one weekday one week later. Only 5 children were post-tested on the last day.

### 2.2.3 Scoring.

#### 2.2.3.1 False/true belief tests.

Non-verbal: “Point at where you think Sally/Max will look for the [object]”

- false belief, original hiding place: 1p
- false belief, new hiding place: 0p
- true belief, original hiding place: 0p
- true belief, new hiding place: 1 p

Verbal: “Why would Sally/Max look for the [object] in the [location to which the child had pointed]?”

- false belief, justification of correct target: 1p
- false belief, justification of incorrect target (or “don’t know”): 0p
- true belief, justification of correct target: 1p
- true belief, justification of incorrect target (or “don’t know”): 0p

The total maximum score on false/true belief tests was 4p.

#### 2.2.3.2 Doodles:

- repeating the original interpretation of the picture: 0p
- responding with a detail in the original interpretation: 0p
- responding “don’t know”: 1p
- response ignoring the child’s own knowledge and taking the friend’s perspective: 2p

The total maximum score on a set of three droodles was 6p.

### 2.2.4 Intervention phase

The intervention phase consisted of 16 sessions over seven weeks, starting the week after pre-tests, on two or three consecutive weekdays each week, depending on holidays or full-day excursions. In the city of Kävlinge children of caregivers out of work or on parental leave are only admitted to daycare for 15 hours a week. At the present pre-school these hours were scheduled to Tuesday, Wednesday, and Thursday mornings, so interventions took place on these weekdays only. Each session consisted of a story time in which all participating children took part, and a training time for children in the intervention condition only.

Four-year-olds can acquire the ability to offer justifications for a request or reasons for why certain things are as they are (*why-because*) in as short a training period as ten minutes a day for four days (McWilliam & Howe, 2004). However, because the increased resources in syntactic

structures expected to provide the format required for the representation of mental attitudes towards mental contents (*she wants that the doll be handed to her*) are more complicated than those required for expressing causalities (*she wants the doll because it’s hers*), the training was set to 15 minutes a day for a total of 16 days. This also replicates the Ornaghi et al. (2011) study.

The participating children came from five different sections. Three of these were of even size, 11-16 children. Children from two smaller sections were added together, totalling 14 children, rendering four groups. Half of the children in each section were stratified to the intervention condition as described above, the other half to the control condition. Each session lasted 30 minutes and took place between 9 am and noon in one section at a time according to a rolling schedule, so that each section was intervened with at a different time each day.

For the intervention phase, seven tales (Carlsson, n.d.) were enriched with sentential complements with a variety of mental verbs (Appendix 2). The tales were read aloud to the children by the experimenter in sessions of 12-13 minutes, thus exposing all participating children to an average of 29 complements per session. After the story reading the children in the control condition joined their non-participating peers, and the children in the intervention condition stayed on for the training.

The training was arranged as an informal conversation about the story just read. During the training the children were continuously reminded to use sentential complements with whatever mental verb they found relevant. To give all children the same opportunities to produce complements, less active children were encouraged to speak up and highly active children were asked to wait for their turn. During the training the children were given illustrations from the stories to facilitate conversation and to keep their attention alert. The children were asked questions like “What did Felix think when he saw the dragon?” and would encourage the children to answer, “Felix thought *that* (*att* in Swedish) it was dangerous” or “he thought *that* it was dangerous” instead of merely “it was dangerous”.

## 3 Results

Although not all children had Swedish as their first language, everyone had a normal language comprehension. A couple of 6-years-olds scored a bit below normal on the SIT test, but as they were high in ToM pre-scores, this could be ascribed to lack of interest, maybe because they found the SIT test too simple.

Table 1 presents the correlations among the false- and true-belief scores in the verbal and non-verbal conditions. There is a large correlation (Cohen, 1988:79-81) between

Table 1. Correlation between false- and true-belief measures on pre- and post-tests.

	Verbal false-belief	Non-verbal true-belief	Verbal true-belief
<i>Pretests</i>			
Non-verbal false-belief	.78**	.08	.06
Verbal false-belief	-	.14	.18
Non-verbal true-belief		-	.91**
Verbal true-belief			-
<i>Posttests</i>			
Non-verbal false-belief	.92**	-.41**	-.17
Verbal false-belief	-	-.44**	-.23
Non-verbal true-belief		-	.73**
Verbal true-belief			-

\*\* Correlation is significant at the 0.01 level (2-tailed)



Table 2. Improvement in false-belief performance after intervention: all participants (condition 1) and controlled for absence >25% during the intervention phase (condition 2).

	Condition 1			Condition 2		
	Intervention	Control	Number of participants	Intervention	Control	Number of participants
Deterioration	1	0	1	1	0	1
No change	16	17	33	13	14	27
Improvement	5	7	12	1	4	5
Total	22	24	46	15	18	33

the false-belief scores in the verbal and non-verbal conditions in both the pre- and the post-tests ( $r = .78$ ,  $N = 56$ ,  $p < .00$  and  $r = .92$ ,  $N = 46$ ,  $p < .00$ , respectively) as well as between the true-belief scores in the verbal and non-verbal conditions ( $r = .91$ ,  $N = 56$ ,  $p < .00$  and  $r = .73$ ,  $N = 46$ ,  $p < .00$ , respectively). However, surprisingly the correlations between non-verbal false-belief and verbal and non-verbal true-belief conditions are weak ( $r = .06$ , and  $r = .08$ , respectively) and not only weak, but also negative between false-belief verbal and true-belief verbal and non-verbal ( $r = -.18$  and  $r = -.14$ , respectively). In the post-tests all correlations are negative and weak, respectively medium between false-belief non-verbal and true-belief verbal and non-verbal ( $r = -.17$  and  $r = -.41$ , respectively) as well as between false-belief verbal and true-belief verbal and non-verbal ( $r = -.23$  and  $r = -.44$ , respectively). With this pattern, the false-/true-belief scores could not be added to one value and as such correlated with the doodle tests, in order to get a single measure for ToM level.

The hypothesized effect of training the active production of tensed complements on ToM measures was not found. An independent t-test revealed no significant difference in improvement between the intervention group and the control group, neither in false-belief scores (intervention  $M = .18$ ,  $SD = .50$ , control  $M = .29$ ,  $SD = .46$ ;  $t(44) = -.77$ ,  $p = .44$ ), nor in doodle-scores (intervention  $M = 1$ ,  $SD = 2.09$ , control  $M = .12$ ,  $SD = 2.72$ ;  $t(44) = 1.23$ ,  $p = .22$ ). Controlling for more than 25% absence during the intervention phase, age, gender, and section made no difference to the result.

Cross tabulations (Table 2) show that the majority of the children did not improve at all in false-belief performance (33 of 46). As false- and true-belief scores did not correlate (Table 1), consideration was given to false-belief performance only. One child in the intervention group performed worse in the post-test. Five in the intervention group and seven in the control group performed better in the post-tests. When controlling for absence higher than 25%, there was still no change in the majority of children (27 of 33). One in the intervention group performed worse in the post-test, while one in the invention group and four in the control group performed better.

Due to problems with the SPSS software beyond my control, I could not analyse the correlations between false- and true-belief tests prior to stratification of the children into hi-ToMs and lo-ToMs. The later-found lack of correlation between the ToM tasks eliminates the possibilities to investigate hypothesis 2, as the stratification seems to have been done on unreliable data (see 2.1 Participants).

## 4 Discussion

This study renders no support to the hypothesis that training the active production of tensed complements accelerates ToM development, as measured with false/true-belief tasks.

However, descriptive statistics indicate that the little improvement in the false-belief post-tests that had actually

occurred was larger in the control group than in the intervention group. This may, of course, be owing to pure incidence, but it could also have a *biological* explanation. Through childhood, the brain-mass increases during certain irregularly occurring periods commonly called *growth spurts* (Epstein, 1979). If the children who did improve their false/true-belief performance were in the midst of a growth spurt, and if more of these children happened to be in the control group, this could explain why the improvements were found rather in this group. However, as this – for obvious reasons – cannot be tested, there is little point in pursuing this track.

An alternative reason could be *cognitive* overload in the intervention group. Having to produce the complex syntactical structure of tensed complements may have forced the children in this group to concentrate on the format itself, thus blocking the acquisition of its implications, namely that a belief does not necessarily have to be true. Conversely, the children in the control group who merely listened to the story may have had sufficient cognitive resources left over to implicitly understand the perspective of someone else. This would be consistent with Alice Howard Gola's (2012) findings, namely that ToM development in children over-hearing characters in video format discussing the mental states of someone else were scaffolded to a greater extent than children interacting with the video. This result may have significance for education and the design of study material and further studies are needed to explore this particular aspect.

A third and more *sociocultural* explanation for the failing effect of the training (that does not necessarily exclude any of the two others) could be that the link between preschool and ToM is either a function of increased exposure to language or the result of the overall cognitive complexity of the preschool environment *per se*. The children may already have had received all the training they could absorb, leaving no room for further improvement. In fact, and quite in line with the Vygotskian view, the Swedish National Agency for Education (*Skolverket*) explicitly mandates preschools to train the children in social competencies through a pragmatic approach<sup>7</sup>. I will revert to this point at the end of the discussion.

### 4.1 Methodological considerations

<sup>7</sup> "The preschool must encourage and strengthen the child's compassion and empathy with other people's situation" (Skolverket, 2011:4), "...shall strive to ensure that every child develops a capacity for listening, reflecting, and expressing its own perceptions and endeavors to understand others' perspectives" (ibid.:9), and "Children acquire ethic values and norms primarily through concrete experiences." (ibid.:4). My translations.

4.1.1. *Correlation between false- and true belief tasks.* It was a surprise that the false- and true-belief scores did not correlate. The stories are the same, except from the fact that in the true condition the child knows that Sally/Max has seen the ball/chocolate being displaced. Sharing the knowledge of Sally/Max should result in better performance, but it did not in the pre-tests.

I see two possible methodological reasons for this. One could be that each participating child was tested in his or her own section to make the children feel as comfortable with the situation as possible and to ensure ecological validity. It was not possible to prevent the children from exchanging experiences, which may have resulted in competition between the children. Although they were explicitly instructed to concentrate and to take their time, utterances like “Huh, it was a piece of cake!” or “I was really quick!” were commonly heard among the children. This could have spurred the children not yet assessed to speed up their performance at the cost of accuracy. Having the children perform the tasks in laboratory environments could have prevented them from communicating directly after having done their tasks. On the other hand, it would implicate a loss of ecological validity, as there is a risk that results will diverge in the two settings. Besides, some degree of competition is part of children’s everyday experience, as we – regardless of age – construe our social self by comparing ourselves with other people (Festinger, 1954; see also Suls and Wheeler, 2000; Wood, 1996).

A second, and perhaps more likely, reason for the lacking correlation between false- and true-belief tasks could be that the children watched the films sequentially, with no pause or distraction between them. After the false-belief condition had been shown, the children were instructed: “You will now see a short film which is similar to the one you have just seen. But there are some differences and therefore you must watch and listen carefully”. Nevertheless, the children could very well have been distracted or confused, mixing up the films. Future studies would gain from adding a pause or filler task between the false- and the true-belief tasks.

Furthermore, it is noteworthy that the weak correlations of the pre-tests turned into medium *negative* correlations in the post-test. This could indicate that the children were less concentrated, and maybe more eager to ‘get out of there’ during the post-tests than during the pre-tests. The post-tests were carried out at the beginning of June, with holidays coming up and many special activities going on at the preschool. What child would miss out on an ice cream in favour of looking at the same old film twice? Full-scale studies should avoid the months of May and June.

4.1.2 *Doodles.* The commonly used false-belief task battery consists of change-of-location, change-of-content and appearance/reality tasks that are quite alike in their structure. They are presented in the form of narratives and have been criticized for testing children’s narrative competencies rather than their false-belief understanding (cf. Bloom and German, 2000). During the planning of the study doodles therefore seemed a good alternative. However, the scores on this test turned out to be unexpectedly low, indicating a floor effect. Indeed, it seems that four- to six-year-olds tend to behave as if seeing only a part of an object is sufficient for someone else to share the children’s own knowledge about the object’s identity. Only at the age of six or even seven they tend to get this right and understand that a person cannot be certain of an

object’s identity when only a detail of it is visible (Lalonde and Chandler, 2002; Taylor, 1988). Why is this so?

I propose that the negation “if your friend *hadn’t* seen that [original] picture...” makes the child get lost in a verbal description that demands too much cognitive processing for ages younger than six or seven. I leave it to linguistics to say more about children’s mastering of negations and suffice to say that with this experience to hand doodles should not be used in studies incorporating pre-schoolers.

4.1.3 *Sample size, baseline levels, and scores.* Full-scale studies should have a much larger sample which – in order to establish the role of the preschool environment in ToM development – should include children whose day-care is other than preschool. Participants should preferably be recruited from different socio-economic districts, as complexity of parental interaction with the children may vary with the parents’ educational level. Polarized samples would make possible socio-economically based developmental differences more apparent than their average correspondents. Also, with a larger sample individual differences in health and general shape of the day would even out.

Within-subject designs in which each participant contributes many data points to each condition are more powerful and tend to produce more reliable outcomes. With repeated measures, it is possible to obtain a more precise estimate of performance in each condition, at least in the pre-tests. Future studies would gain credibility with such baseline measurements.

Additionally, the results exhibited some rather large standard deviations in the false-/true-belief tests. This is likely to be due to the binary scores (correct or incorrect). A finer graded scoring procedure would allow for a more nuanced picture of the distribution and is as such to be recommended.

Finally, the non-verbal condition of this study is still an elicited response and thus measures explicit ToM. Measurement of implicit false-belief understanding in full-scale studies, for instance by means of eye tracking, would add a variable and thereby make the study less sensitive to effect size.

## 4.2 Theoretical implications

Pilot studies are not meant to render generalizable results. They are meant to reveal weaknesses of the design of the study and problems with its implementation. But even if a pilot study by its very nature suffers from some shortcomings, the result of this study may have implications for the *theory-theory*<sup>8</sup> that are worthwhile following up in full-scale studies.

Whereas mainstream psychology still finds that the development of ToM as measured by false-belief tasks is some kind of milestone marking the entry into an adult folk psychology, the much later acquisition of doodle understanding could indicate that there are at least two watershed events: the mastering of false-belief tasks and the mastering of doodle tasks. But folk psychology is not just about understanding that people hold beliefs that might be false. It is also about telling lies, having secrets, pretending, deceiving, teasing, using irony, and repairing misunderstandings. Those are not activities that are *off* during infancy and become turned *on* around the age of four.

<sup>8</sup> The *theory* that we hold *theories* of other people’s mental states.



Those are activities that children practice from early infancy, interacting with others in pragmatic contexts.

The human endeavour to categorize and label phenomena allows no conceptual spaces between categories, so we create demarcation lines to keep them apart. In the case of ToM, these lines implicate an initiation into another stage in a hierarchical developmental system. At the same time a growing body of evidence shows that young infants are capable of grasping the intentions of others through the perception of bodily movements, gestures, facial expressions, and the similar *actions* (cf. Trevarthan, 1979; Trevarthen and Aitken, 2001). We thus have a problem that the *theory-theory* does not explain. Rather, it has forced us to resort to a number of *post hoc* speculations, like for instance the notion of *implicit* or *unconscious* ToM.

The concept of ToM is in trouble. It appears unlikely that *Understanding* and *explaining* human behaviour should be based on the existence of some dedicated mind reading mechanism, or forged by some theorizing function. Could it be that we have become obsessed by the *form* of language, rather than observing what language is used *for*? What if linguistic capacity is simply the result of children beginning to participate in conversations that require recognition of conflicts of view? On consideration, how often – and when – do we explicitly think about other people's beliefs and desires? In everyday life we probably do not, not until discrepancies between what we expect from experience and what we observe become salient. When the child experiences such dissonance it will probably react in a way that encourages adults to engage in explanatory conversations with the child that help the child to "make sense of actions in terms of reason" (Gallagher and Hutto, 2008:7).

I will not rule out that syntactical training might enhance folk psychology in older children, but I find it much more plausible that understanding the *meaning* of mental terminology depends on the concept of the Wittgensteinian language games that "bring into prominence the fact that the speaking of language is part of an activity, or a form of life" (PI 23, Stanford Encyclopedia of Philosophy, n.d.), rather than on a syntactical reference to an inner state. We might be looking at an inseparable mix of biology, evolution, and socializing, offering a world of new explorations.

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## Appendix 1

*Max-Mother**False-belief condition in Swedish (53 seconds):*

Det här är Max. Max har fått en chokladkaka av sin pappa. Max ska lägga undan chokladkakan i köket så att han kan äta den efter maten. Max öppnar skåpet i köket och lägger in chokladkakan. Sedan stänger Max skåpet igen. Max går nu iväg för att tvätta sina händer inför middagen [lämnar köket]. Under tiden Max tvättar sina händer hittar mamman chokladkakan i skåpet. Mamma [kommer in i köket] tar chokladkakan och lägger den i lådan istället, så att den inte ska smälta i det varma skåpet [lämnar köket]. Nu har Max snart ätit färdigt [kommer in köket igen]. Undrar var Max kommer att leta efter sin chokladkaka?

*False-belief condition in English:*

This is Max. Max got a chocolate bar from his dad. Max puts the chocolate bar away so that he can eat it after dinner. Max opens the cupboard in the kitchen and puts in the chocolate bar. Max then closes the cupboard again. Max goes away in order to wash his hands before dinner [leaves kitchen]. While Max is away, Mum [enters kitchen] finds the chocolate bar in the cupboard. Mum takes the chocolate bar and puts it in the drawer so that it won't melt in the hot cupboard. Now Max has finished dinner [enters kitchen]. I wonder where Max is going to look for his chocolate?

*True-belief condition in Swedish (53 seconds):* Det här är Max. Max har fått en chokladkaka av sin pappa. Max ska lägga undan chokladkakan i köket så att han kan äta den efter maten. Max öppnar skåpet i köket och lägger in chokladkakan. Sedan stänger Max skåpet igen. Max går nu iväg för att tvätta sina händer inför middagen [lämnar köket och kommer tillbaka]. När max kommer tillbaka till köket ser han sin mamma [kommer in i köket]. Mamma tar chokladkakan och lägger den i lådan istället, så att den inte ska smälta i det varma skåpet [båda lämnar köket]. Nu har Max snart ätit färdigt [kommer in köket igen]. Undrar var Max kommer att leta efter sin chokladkaka.

*True-belief condition in English:*

This is Max. Max got a chocolate bar from his dad. Max puts the chocolate bar away so that he can eat it after dinner. Max opens the cupboard in the kitchen and puts in the chocolate bar. Max then closes the cupboard again. Max goes away in order to wash his hands before dinner [leaves kitchen and comes back]. When Max comes back, he sees Mum [enters kitchen]. Mum finds the chocolate bar in the cupboard. Mum takes the chocolate bar and puts it in the drawer so that it won't melt in the warm cupboard [both leave kitchen]. Max has finished dinner [enters kitchen]. I wonder where Max is going to look for his chocolate?

*Sally-Anne**False-belief condition in Swedish (43 seconds):*

Det här är Sally och Anne. Sally står upp och lekar med en boll. Anne sitter ner och tittar på när Sally lekar med bollen. Nu ropar fröken på Sally [röst i bakgrunden: Sally, kan du komma hit]. Sally lägger bollen i korgen och täcker över den med en filt. Sally går iväg för att se vad fröken vill [lämnar].

Under tiden tar busiga Anne bollen ur korgen. Anne lägger den i lådan och sätter på locket [lämnar]. Efter en stund kommer Sally tillbaka igen [kommer tillbaka]. Undrar var hon kommer att leta efter sin boll?

*False-belief condition in English:*

This is Sally and Anne. Sally is standing up and plays with a

ball. Anne is sitting down and watches Sally playing with the ball. Now the teacher asks Sally to come to her [voice in the background: Sally, please come here]. Sally puts the ball in the basket and covers it with a blanket. Sally leaves to find out what the teacher wants [leaves]. While Sally is away, teasing Anne takes the ball out of the basket. Anne puts the ball in the box and puts on the lid [leaves]. After a while, Sally comes back [enters]. I wonder where she is going to look for her ball?

*True-belief condition in Swedish (45 seconds):*

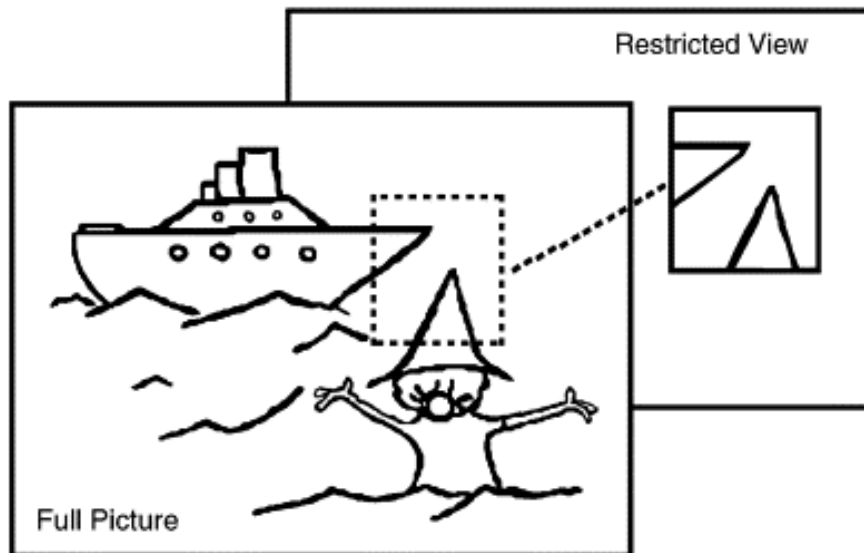
Det här är Sally och Anne. Sally står upp och lekar med en boll. Anne sitter ner och tittar på när Sally lekar med bollen. Sally lägger bollen i korgen och täcker över den med en filt. Busiga Anne tar bollen ur korgen. Anne lägger den i lådan och sätter på locket [lämnar]. Nu ropar fröken på Sally [röst i

bakgrunden: Sally, kan du komma hit]. Sally går iväg för att se vad fröken vill [lämnar]. Efter en stund kommer Sally tillbaka igen [kommer tillbaka]. Undrar var hon kommer att leta efter sin boll?

*True-belief condition in English:*

This is Sally and Anne. Sally is standing up and plays with a ball. Anne is sitting down and watches Sally playing with the ball. Sally puts the ball in the basket and covers it with a blanket. Teasing Anne takes the ball out of the basket. Anne puts the ball in the box and puts on the lid [leaves]. Now the teacher asks Sally to come to her [voice in the background: Sally, please come here]. Sally leaves to find out what the teacher wants [leaves]. After a while, Sally comes back [enters]. I wonder where she is going to look for her ball?

*Droddles – Ship/witch example*



## Appendix 2

Number of sentential complements with mental verbs per story:

Verb / Story	Gammal- gäddan	Ballong- färden	Troll- drycken	Elvira	Rädd- haran	Draken	Presenten	Total
<b>ana att</b> <i>have a feeling that</i>						1		1
<b>berätta att</b> <i>tell that</i>		1		3	1	2	3	10
<b>bestämma att</b> <i>decide that</i>	2	3	2		2	2	2	13
<b>fundera att</b> <i>wonder that</i>					1	1		2
<b>föreslå att</b> <i>suggest that</i>		1		1				2
<b>förklara att</b> <i>explain that</i>						1		1
<b>förstå att</b> <i>understand that</i>			3	7	5	7	2	24
<b>försöka att</b> <i>try to</i>				1		1		2
<b>gilla att</b> <i>like that</i>					2	1		3
<b>gissa att</b> <i>guess that</i>				1		1		2
<b>glädja sig att</b> <i>be happy that</i>					1			1
<b>glömma att</b> <i>forget that</i>	4	1	4				1	10
<b>gäspa att</b> <i>yawn that</i>						1		1
<b>hoppas att</b> <i>hope that</i>			4			1	1	6
<b>höra att</b> <i>hear that</i>				3	1	4		8
<b>inse att</b> <i>realize that</i>				1	1	2		4
<b>kolla att</b> <i>check that</i>						2		2
<b>komma ihåg att</b> <i>remember that</i>	5	1	2		1	3		12
<b>komma på att</b> <i>find out that</i>						1		1
<b>känna att</b>	3	1	3	10	11	14	8	50
<b>lista ut att</b> <i>understand that</i>		1						1
<b>lova att</b> <i>promise that</i>				1	2	2		5
<b>läsa att</b> <i>read that</i>				1				1
<b>mena att</b> <i>think that</i>						1		1
<b>märka att</b> <i>feel that</i>			1	2	3	3		9
<b>nicka att</b> <i>nod that</i>						1		1
<b>påminna att</b> <i>remind that</i>					1			1
<b>ropa att</b> <i>shout that</i>			1					1
<b>se att</b> <i>see that</i>	1	2	2	2	5	7	2	21
<b>skrika att</b> <i>yell that</i>			1	2		1		4
<b>skymta att</b> <i>see dimly that</i>				1				1
<b>stå att</b> <i>stand that</i>	1							1
<b>sucka att</b> <i>sigh that</i>					1			1
<b>säga att</b> <i>say that</i>	8	9	12	6	1	8	2	46
<b>tro att</b> <i>believe that</i>	6		6	1	2	10		25
<b>trösta att</b> <i>comfort that</i>					1			1



Verb/Story	Gammal- gäddan	Ballong- färden	Troll- drycken	Elvira	Rädd- haran	Draken	Presenten	Total
<b>tycka att</b> <i>think that</i>	9	13	7	7	9	11	14	<b>70</b>
<b>tänka att</b> <i>think that</i>		6	5	5	5		2	<b>23</b>
<b>uppfatta att</b> <i>understand that</i>					1			<b>1</b>
<b>upptäcka att</b> <i>discover that</i>	5	3	5	2	2	8		<b>25</b>
<b>vara rädd att</b> <i>be</i> <i>afraid that</i>		1					3	<b>4</b>
<b>vara säker att</b> <i>be</i> <i>sure that</i>					3	3		<b>6</b>
<b>vara övertygad att</b> <i>be convinced that</i>					1			<b>1</b>
<b>varna att</b> <i>warn that</i>						1		<b>1</b>
<b>veta att</b> <i>know that</i>	4	2	7	3	8	4		<b>28</b>
<b>vilja att</b> <i>want that</i>		3	3	2	1	1	1	<b>11</b>
<b>visa sig att</b> <i>turn out</i> <i>that</i>						1		<b>1</b>
<b>viska att</b> <i>whisper</i> <i>that</i>		4	2	1		1		<b>8</b>
<b>önska att</b> <i>wish that</i>			2			1	3	<b>6</b>
	48	52	72	63	72	109	44	<b>460</b>