

Acquisition and use of mental verbs by Dutch children

Inge Stok

Master's Thesis
General Linguistics
Radboud University, Nijmegen
December 2019

Inge Stok
s4134575

First supervisor: Dr. Lila San Roque
Second supervisor: Dr. Saskia van Putten

Acknowledgements

This thesis wouldn't be anywhere near what it is now without the help and support from Lila San Roque¹. Thank you, Lila, for the initial idea to focus on mental state language, for the tea and chocolate and kind words when I needed it, for the borrowing of your Zotero library, and for always finding the time to give amazing feedback, even from smoke-filled Sydney. I cannot thank you enough and I hope, someday, our paths will cross again.

Thank you, Saskia, for being willing to be my second supervisor, for being an amazing listener, and for telling me my preliminary results “actually sounded real nice” when I was completely tangled in an overload of data.

Thank you, Anne Merel, for agreeing to be my second coder and never even complaining about the extra work outside office hours. I owe you another rainbow cake.

Thank you, Jelmer, Arianne and Daniël, for giving me reasons to be at the library early in the morning and for all the shared coffee breaks. Thank you, Yentl, for being the critical philosophical voice in the back in my head.

Thank you, Jannes, for making me coffee and breakfast every morning, for proofreading, for letting me figure things out by rambling about them to you, and most of all for never failing to support me.

Thank you, Mees, for being your own sassy, messy, happy self, for hiding stuffed animals in my bag when I went to “grown-up school”, and for showing me every day how amazing a language-learning child is.

¹ San Roque's supervision of this thesis was supported through Radboud University, the Netherlands Organisation for Scientific Research (NWO Veni Award 275-89-024, Learning the Senses) and the John Templeton Foundation. The opinions expressed do not necessarily reflect the views of these organisations.

Table of contents

Acknowledgements	ii
Table of contents	iii
Abstract	iv
1 Introduction	1
2 Previous literature	3
2.1 Experimental research	3
2.1.1 Theory of Mind Scale	3
2.1.2 False-belief in infants and criticism of the Theory of Mind Scale	4
2.1.3 Diverse desire	6
2.2 Natural language research	6
2.2.1 Why natural language?	6
2.2.2 Definitions and distinctions	7
2.2.3 Longitudinal studies	8
2.2.4 Other studies	13
2.3 Research questions	13
3 Methodology	16
3.1 Database	16
3.2 Terms	18
3.3 Coding categories and procedures	20
3.4 Reliability	21
4 Results	23
4.1 Frequency and age of emergence of desire and belief verbs	23
4.1.1 General frequency of desire and belief verbs	23
4.1.2 Age of emergence of desire and belief verbs	24
4.1.3 First uses of desire and belief verbs	25
4.1.4 Qualitative analysis of the Groningen corpus	27
4.2 Functions of desire and belief verbs	29
4.2.1 Desire verbs	29
4.2.2 Belief verbs	34
4.3 Control measures	41
4.3.1 Verbal ability of the children, as proxied by mean length of utterance	42
4.3.2 Frequency of mental verbs in parental input	42
4.4 Summary of results	43
5 Discussion	45
5.1 Frequency and age of emergence of desire and belief verbs	45
5.2 Functions of desire and belief verbs	46
5.3 Universality of theory of mind development	47
5.4 Limitations and suggestions for future research	49
5.5 Conclusion	50
References	51
Appendices	53
Appendix A: tables from previous natural language literature	53
Appendix B: Dutch desire and belief verbs	56
Appendix C: List of glosses	58
Appendix D: Full coding scheme	59
Appendix E: Figures for individual children	60
Appendix F: Mental verbs in the input of the Groningen corpus	66

Abstract

Various studies into the theory of mind of young children suggest that there is a universal developmental pattern. Under experimental conditions, children can demonstrate understanding of desire before belief, and in several natural language studies it has been shown that they produce desire verbs at a younger age than belief verbs. It has been argued that this pattern is due to universal cognitive development. In this thesis, I study the mental state language of Dutch children aged 1;0-3;9, using three longitudinal corpora. Consistent with earlier natural language research, Dutch children refer to mental states of desire before referring to states of belief. However, there also are differences with the English data and within the three Dutch corpora used. These differences suggest that language-specific features and the pragmatic context of conversation can influence early mental state language.

1 Introduction

About half a year ago, my then almost four-year-old daughter Mees got some candy at home, and decided she wanted to save some for her friend Vera. When we met Vera that day at daycare, Mees was telling her about the candy and how Vera should keep it a secret for her mom. Some minutes later, Mees said: *Vera, eigenlijk weet ik niet of je wel kan onthouden dat je niet tegen je mama mag zeggen dat je een snoepje van mijn mama krijgt*. Freely translated: “Vera, I actually don’t know for sure whether you can remember to not tell your mommy that my mommy will give you some candy.”

In this one sentence, Mees showed an awareness of two different mental states: her own state of knowing (or to be more precise: not knowing for sure), and Vera’s state of remembering or not remembering. This ability to impute mental states to oneself and to others is called theory of mind. It not only encompasses states of belief, such as knowing and remembering, but also emotions, perceptions, states of desire and other inner states. These states are not directly observable, yet we make inferences about the states of mind of other people, and use these inferences to predict the behavior of others (Premack & Woodruff, 1978). For example, when we see someone walking to the kitchen and opening the fridge, we assume he *wants* something to eat and *believes* there is food in the fridge. Young children, like Mees, can use mental verbs to refer to desires and beliefs from themselves or from others. They have theory of mind – but the extent to which their theory of mind is adult like, and how their theory of mind develops, is still something we don’t fully understand.

In this thesis, I will investigate the theory of mind of young children, from about two years to four years old. I will do so through examining natural language. As it is often argued that theory of mind is largely a belief-desire understanding of mind and action (see, among others, Bartsch & Wellman, 1995; Davidson, 1963), these are the states I will focus on in this thesis. I study how Dutch children around this age use mental verbs of desire and belief, looking at three corpora. The age at which the children first use mental verbs and the way they use them can give us insight in their theory of mind. This first study into the development of Dutch mental state language adds to what we know from experimental research and from earlier corpus studies concerning English-speaking children. In particular, I will examine two questions, discussed in more detail at the end of chapter 2. Firstly, how do certain features of the mental state language of Dutch children compare with findings from English and other languages? And secondly, what are some common functions of desire and belief verbs in children’s early conversations?

I will first present a survey of existing work on children’s theory of mind and mental state language and describe the research questions central to this thesis (chapter 2). Building on the previous work described in chapter 2, I describe available Dutch child language corpora, give an overview of mental verbs occurring in these corpora, and outline an adapted coding scheme for Dutch desire and belief language (chapter 3). Then, I present qualitative and quantitative results in comparison with earlier work on mental language of English children and take a closer look at the way Dutch children use

mental verbs (chapter 4). Finally, I will discuss the results, give suggestions for further research and draw conclusions (chapter 5).

2 Previous literature

In the following sections, I will first give an overview of previous experimental research concerning children's theory of mind (section 2.1). I will then turn to a description of previous natural language research (section 2.2) before describing the research questions that are central to this study (section 2.3).

2.1 Experimental research

In the 40 years since Premack and Woodruff (1978) coined the expression “theory of mind”, theory of mind research has expanded tremendously. Early theory of mind research was mostly focused on children aged four to six and their understanding of “false belief tasks” (see section 2.1.1). Contemporary research encompasses diverse subjects, such as non-human primates, infants, older children, adults, deaf people and people with autism, all from diverse cultures speaking many different languages. It also encompasses diverse topics such as emotion understanding, pretend play and lying (Wellman, 2018).

2.1.1 Theory of Mind Scale

Early theory of mind research focused primarily on experimental false belief tasks. A false belief is when someone believes something that does not reflect the facts. For example, one can believe that there are cookies in the kitchen, even though it is actually the case that someone else has just secretly eaten the last one. Investigators have been interested to see from what age children are able to understand the concept of false belief.

False belief tasks ask participants (most often children) about the actions of an agent that is led by a false belief. There are many forms of false belief tasks. A common task involves changing the location of an object in view of the child, sometimes framed as a mini-narrative. For example, a child sees a character put some bananas in a box. The character then leaves, and while she is gone, the bananas are moved from the box to a drawer. The character then returns, and the child is asked “where does *character* think her bananas are?” or “where will *character* look for her bananas?”. The target answer is that the character thinks her bananas are in the box, even though that belief is false. Older children and adults do indeed give this answer. Younger children, however, answer that the character thinks the bananas are in the drawer instead, where the bananas actually are at that moment. An alternative false belief task that is often used concerns unexpected contents. For example, children are shown a Smarties container and are asked what they think it contains. They say they think it holds Smarties, but when the box is opened they see it actually contains pencils. They are then asked what someone else, who has not yet looked inside, will think the box contains.

Multiple studies and meta-analyses show that most children perform consistently and correctly on these kinds of false belief tasks by age 4;6 – 5;0. Granted some individual variation, this benchmark occurs at a similar age in different languages and countries, such as Korea, Austria, Japan and U.S. (Wellman, 2018).

However informative the false belief task is, it is misleading to use it as the only measure for a developing theory of mind. Our theory of mind involves much more than false beliefs or even beliefs in general. It also encompasses perceptions, emotions, desires and

more. It is generally held that desires and beliefs together are most important in our theory of mind, as you need both to explain and predict people's actions. To explain why someone is walking to the cupboard, you need to understand both what he believes to be true (e.g. that there is food in the cupboard) and what he desires (e.g. to eat something).

Thus, the Theory of Mind Scale was developed, to encompass more tasks than just false belief. It tests the following competencies (list based on Wellman (2018)):

1. Diverse Desires (DD): the understanding that people can have different desires, even different desires for the same thing;
2. Diverse Beliefs (DB): the understanding that people can have different beliefs, even different beliefs about the exact same situation;
3. Knowledge-Access (KA): the understanding that someone might not know something that is true;
4. False Belief (FB): the understanding that someone might believe something that is not true;
5. Hidden Emotion (HE): the understanding that someone can feel some way while displaying a different emotion.

Many studies have shown that this above order (1-5) is also the order in which children acquire these competences (Wellman, 2018). A compelling test case concerns deaf children of hearing parents. The families of these children often don't know sign language or only start learning after the child is born. Because of this, the children are likely to have limited input of language, including mental state language, and to be restricted in their play and communication with others. It has been shown that deaf children of hearing parents are delayed on the Theory of Mind Scale. False belief, for example, is only achieved by age 11 or 12, about seven years later than normally developing hearing children. Strikingly though, both the order of acquisition and the rate of progression for the Theory of Mind Scale are similar to hearing children (Wellman, 2018; Wellman & Liu, 2004).

In various cultures, such as the U.S.A., Austria and Japan, the theory of mind sequence is argued to be DD>DB>KA>FB>HE, even for deaf children of hearing parents. Research considering Chinese, Iranian and Turkish children, however, gives evidence of a consistent theory of mind sequence where Knowledge Access and Diverse Beliefs are reversed: DD>**KA>DB**>FB>HE. One possible explanation is that Chinese, Iranian and Turkish culture share collectivist family values, which emphasize knowledge acquisition and respect for the wisdom of elders, and have low tolerance for children's assertions of disagreement or independent belief (Wellman, 2018).

2.1.2 False-belief in infants and criticism of the Theory of Mind Scale

Recently, many studies have reported that children aged 1;0 to 2;0, sometimes even younger, are able to pass all kinds of non-verbal false-belief tasks (see Baillargeon, Scott, & He, 2010 for a review). These tasks often use eye-tracking data to track the children's expectations, instead of verbally eliciting a response. If children this young are able to pass false belief tasks, why then should the Theory of Mind Scale be so robust? After all, it seems like all the conceptual resources necessary to succeed in the Theory of Mind

Scale tests are available some two years earlier than the children actually begin passing its easiest items.

There are many possible explanations. Some researchers propose that verbal and non-verbal false belief tasks require different kinds of understanding, and that children have both an early, implicit and late, explicit understanding of false-belief (see, among others, Apperly & Butterfill, 2009; Clements & Perner, 1994). Baillargeon (2010) and Westra and Carruthers (2017) argue that verbal tasks involve both mental and pragmatic processes that are not implicated in non-verbal tasks. For example, in verbal tasks a process of response selection is present. The pressure to select a response can distract the child from the situation she is shown. The response selection can also be influenced by the child's tendency to help the protagonist in the false-belief narrative, thus saying the real location of the item, or by the child's feeling that a pedagogic situation is happening in which she is prompted to express her knowledge about the facts. This links to a process of what is sometimes called "the pull of the real": a child's tendency to answer questions based on one's own knowledge about the state of affairs.

It is thus argued that children are able to perform third-person mindreading processes from a young age, and do represent the agent's false belief throughout the task. However, they don't use this information when interpreting the experimenter's question, because they are drawn to more salient alternative interpretations (Westra & Carruthers, 2017). This also provides a possible explanation for why studies find a distinction between elicited- and non-elicited-response false belief tasks. For example, He et al. (2012) ran a false-belief experiment using anticipatory looking with children aged 2;6. The children passed when the question "I wonder where she will look for her scissors?" was self-addressed by the experimenter while gazing at the ceiling. When the same words were directed at the children, however, they failed the task.

Rubio-Fernández and Geurts (2013) give yet a different explanation. In their verbal false-belief task with three-year-olds, they tried to make it as easy as possible to keep track of the protagonist's perspective. In their first experiment, they let 25 children do the Smarties task as described in section 1.1.1. The success rate was only 22.7%. Then, they let the same children do the moving-object task as described in section 1.1.1, introducing two sets of variations to the experiment. Firstly, they made sure that throughout the session the child could see the protagonist (a Duplo girl), by letting her walk toward the child (with her back to the scene) instead of disappearing from scene. Secondly, during the test phase they gave the Duplo girl to the child, asking, "What happens next? What is she going to do now?". The success rate was now 80%.

Rubio-Fernández and Geurts argue that it is crucial to make sure the child is able to keep track of the protagonist's perspective. When they asked different children of the same age to do the same experiment, but removed the protagonist from the scene, the success rate was 17.6%. When they asked yet other children of the same age to do the same experiment, but asked, "where will the girl look for the bananas?" instead of inviting the child to play with the Duplo girl, the success rate was 22.2%. Both the removing of the protagonist from the scene, and the question "where will x look for y", seem to throw children off track. This is a very important finding, as hundreds of studies have used this in experimental false-belief experiments, possibly underestimating many young children's theory of mind abilities.

2.1.3 Diverse desire

The other tasks from the Theory of Mind Scale, including diverse desire, are much less researched than false belief, even though it is widely accepted that children learn to understand and talk about desire at a younger age than belief. Children pass the standard diverse desire task from the Theory of Mind Scale around age 2;6-3;0. Repacholi and Gopnik (1997) conducted a food-request task with children aged 1;2 and 1;6, where the experimenter expressed disgust as she tasted one type of food and happiness as she tasted another type of food. The experimenter then asked the child whether they could give her some food, holding up her hand. The 1;2 year olds reacted egocentrically, offering the food they preferred themselves. The 1;6 year olds correctly inferred that the experimenter wanted the food that the experimenter was happy to eat before, even though the children themselves preferred the other type of food. As with the false belief tasks, it seems to be the case that children can do diverse desire tasks correctly at a younger age when the task is non-verbal and non-eliciting.

2.2 Natural language research

2.2.1 Why natural language?

Experimental research into theory of mind seems to yield a developmental paradox: if young infants already understand diverse desire and false belief, then why do they fail the elicited-response diverse desire and false belief tasks found in the Theory of Mind Scale? Do the Theory of Mind Scale studies underestimate young children's understanding of theory of mind, or do the more recent spontaneous-response tasks falsely attribute the understanding of theory of mind (De Bruin & Newen, 2012)? This is no easy question to answer. It might be helpful to take yet another angle to look at children's theory of mind, such as children's own natural speech through the use of mental verbs as *think* or *want*. This way, we can see how children behave in a situation that is verbal, but non-eliciting. Furthermore, natural language research includes the desires and beliefs of the child itself and its addressee, while experimental research is often focused on the desires and beliefs of a third person. It could be the case that children have an easier time referring to their own mental states.

While it is not necessarily the case that the use of mental language directly maps to theory of mind, a child's use of mental language can help us get insight into the way children's theory of mind develops. Research by Bartsch and Wellman (1995), for example, has shown that English children refer to desire in a meaningful way from age 2;0 and to belief from age 3;0. This difference in age of acquisition of desire and belief, Bartsch and Wellman argue, cannot be explained by parental input or linguistic development. This suggests that children understand mental states from an earlier age than the Theory of Mind Scale has been able to capture, but also that the desire-belief order of the Theory of Mind Scale is visible in natural language use as well.

In the rest of this section I present a detailed overview of key studies of natural language that are relevant to the current study. The examination of mental terms in natural language was undertaken quite early in the development of theory of mind research. Limber (1973) found that children from 2;6 years use mental terms such as *think*, *know* and *remember*, and Bretherton et al. (1981) and Bretherton and Beeghly (1982) have shown that expression of internal states such as fatigue, pain, disgust, distress and affection emerges late in the second year for English children. However, the occurrence of such terms doesn't necessarily entail that young children have a theory of mind.

Adults often use expressions like *you know* and *don't you think?* without making direct reference to a mental state (Rice & Newman, 2018; Shatz, Wellman, & Silber, 1983). Instead, these phrases fulfill a conversational function, such as asking for attention or filling a pause. It is possible that children learn to use mental terms as pragmatic formulas without being aware of mental states themselves. Therefore, the mere identification of mental terms in children's speech is not sufficient to claim mental awareness (Shatz et al., 1983).

Though interest in children's natural use of mental terms stretches back for many decades, focused studies on this topic have been sporadic. There is only a handful of studies that take a close look at mental terms in longitudinal, naturalistic data from young children. I will describe three of them here, in chronological order: Shatz, Wellman and Silber (1983), Bartsch and Wellman (1995) and Tardif and Wellman (2000). Of these, the Bartsch and Wellman study is both the most extensive and the most important for the study described here, and is therefore discussed in most detail. I will also shortly touch upon some other (non-longitudinal) studies concerning mental state language. First, however, I will briefly outline some important definitions relevant in all studies described in this chapter and to the thesis itself: the difference between desire and belief, the definition of a mental verb and the ways a mental verb can be used.

2.2.2 Definitions and distinctions

2.2.2.1 *Desire and belief*

When reading the introduction of this thesis, you probably didn't wonder what a belief or a desire actually entails. Most people have a clear intuition about the difference between desire and belief. Still, it is not easy to put these concepts in words and define them clearly.

Bartsch and Wellman define belief and desire as follows:

[B]eliefs are meant to refer to a general category of thoughts encompassing knowledge, opinions, guesses, convictions, and hunches, that is, all mental states that attempt to reflect something true about the world. (...) Desires are also to be understood as a general category including wants, urges, and states of caring about something; that is, a whole range of 'pro-attitudes' toward or about something. (Bartsch & Wellman, 1995, p. 5)

Bartsch and Wellman also refer to Searle (1983) and what he has termed 'direction of fit'. If I have a desire (to eat an apple), but the world is discrepant with that desire (I don't have an apple), I typically try to change the world to fit my desire (I'll go get an apple in the kitchen or the store). If I have a belief (that Henry likes apples), but the world is discrepant with that belief (I see Henry make a disgusted face when offered an apple), I typically change my belief to fit the world (Henry doesn't like apples). In short: desires have a mind-to-world fit whereas beliefs have a world-to-mind fit. In this thesis, I will maintain Bartsch and Wellman's definition of desire and belief.

2.2.2.2 *Mental verbs and their use*

A mental verb is a verb that can be used to explicitly refer to a mental state. If you are walking outside and see dark clouds coming in, you can say something like "it might be raining soon" or "I believe it's going to rain". In both cases, you express a belief (namely,

that it is going to rain), but only in the second case you express a belief while explicitly referring to that belief. The fact that mental verbs can be used to refer to a mental state, doesn't mean they are *always* used that way. Mental verbs can also be used in a non-referential way, for example when getting someone's attention by starting a sentence with *you know*. The "know" in *you know* doesn't have anything to do with an actual state of knowing, it is only a formulaic expression.

Shatz et al. define reference to mental state as follows:

[A]n utterance is classified as Mental State only if the mental term is judged, with regard to its context, to refer to the thoughts, memories or knowledge of the speaker, listener, or a third person. (Shatz et al., 1983, p. 307)

In this thesis, I will maintain this definition of reference to mental state, although I will include desires in this definition.

I will also distinguish between (non-)referential use of a mental verb and the conversational function of that verb. In the literature, these categories are often treated as mutually exclusive. However, when a mental verb is used in a referential way, it can still (and often will) serve a conversational function, especially when looking at natural language. When, for example, a child asks whether she can do something, her mother can reply with "I think that's not a very good idea". Here the verb *think* refers to an actual thought, but the phrase *I think* also functions to mitigate the sentence, as to not be too harsh on the child.

2.2.3 Longitudinal studies

In this section I will discuss three longitudinal studies by Shatz et al. (1983), Bartsch and Wellman (1995) and Tardif and Wellman (2000). When describing their studies, I will use the terminology they use themselves. The most important terms are those denoting when a mental verb is used to refer to a mental state. Shatz et al. use simply "mental state", Bartsch and Wellman use "genuine psychological reference" and Tardif and Wellman use "reference to mental state".

2.2.3.1 Shatz, Wellman and Silber (1983)

Shatz, Wellman and Silber (1983) have examined the way mental terms are used in the natural language of young children. They conducted two studies: one describing the frequency and function of mental verbs in the speech of one child from 2;4-4;0, and one examining shorter samples of speech collected from 30 two-year-olds over a six-month period. The first study was based on an existing corpus from a child called Abe, whose parents recorded him approximately twice a week for 20 to 30 minutes. All mental terms were identified in the transcripts, encompassing mental verbs (such as *know*, *think*, *mean*, *forget*, *remember*, *guess*) mental nouns (*idea*, *dream*) and mental adjectives (*pretend*). Shatz et al. only took belief terms into account, not desire. Because 95% of the mental terms consisted of verbs, the researchers excluded nouns and adjectives from the rest of the study. For a full overview of the mental terms used by Abe and the age they first occurred, see appendix A, Table 6-1.

The utterances containing one or more mental verbs were categorized by the following mutually exclusive categories:

1. Mental state: an utterance is classified as Mental State only if the mental term is judged, with regard to its context, to refer to the thoughts, memories or knowledge of the speaker, listener, or a third person.
2. Modulation of assertion: the mental term strengthens or weakens the utterance;
3. Directing the interaction: utterances are used to guide the interaction, such as attempts to gain attention, introduce information, or introduce an activity;
4. Clarification: utterances clarifying one of the speaker's utterances, or asking for clarification;
5. Expression of desire: utterances in which the mental term is paraphrasable with 'want';
6. Action-memory: utterances in which verbs of knowing or memory are used to refer to actions or the omission of an action, e.g. "don't forget my scarf";
7. I don't know: utterances consisting of the phrase "I don't know" without a predicate complement.

(Shatz et al., 1983, pp. 307–308)

Table 2-1 shows the functional uses of mental verb utterances in 5-month age periods. Shatz et al. summarize:

Mental verbs were present in Abe's speech as early as 2;4. Nevertheless, both the frequency and variety of mental verbs increased over time. Such verbs were first found in idiomatic or conversational phrases, but soon thereafter they began to serve a wider variety of functions, with mental state expressions making their first appearance by 2;8. (Shatz et al., 1983, p. 314).

Table 2-1: Functional uses of mental verb utterances at the different age periods, derived from Shatz et al. Table 2 (p. 311)

Proportion of mental verb utterances classified into	Age period							
	2;4-2;8		2;9-3;1		3;2-3;6		3;7-3;11	
Mental State	3	(4%)	79	(23%)	118	(28%)	208	(43%)
Expression of Desire	2	(3%)	10	(3%)	21	(5%)	7	(1%)
Modulation of Assertion	7	(9%)	39	(11%)	29	(7%)	29	(6%)
Directing the Interaction	14	(18%)	91	(27%)	125	(30%)	174	(36%)
Clarification	1	(1%)	6	(2%)	29	(7%)	25	(5%)
Action-Memory	1	(1%)	4	(1%)	12	(3%)	14	(3%)
I Don't Know	51	(65%)	106	(31%)	84	(20%)	28	(6%)

Shatz et al.'s second study, meant to corroborate the intensive first study, consisted of examining language samples from 30 additional children. At the time of the first visits, the children ranged in age from 2;0 to 2;6. The children were recorded four times for 20-30 minutes over a period of six months. Seven of the 30 children produced no belief verbs at all in any of the sessions. As a group, the children from the second study behaved similarly to Abe at the first age period. No children were observed using belief verbs to express mental state before the age of 2;6. All children that did use belief verbs to express mental state had used belief verbs to serve the 'direct the interaction'-function before.

Shatz et al. conclude that the earliest uses of belief verbs are for conversational functions rather than for mental reference. Most of the children studied had the linguistic capacity to refer to mental states, they could for example use a complementizer-structure necessary to say “I think that...”. Still, they didn’t do so. The researchers argue that even though young children use mental state verbs, they lack awareness of mental states themselves.

2.2.3.2 Bartsch and Wellman (1995)

Bartsch and Wellman (1995) criticize the fact that Shatz et al. only focus on belief verbs, while Bartsch and Wellman approach theory of mind as an understanding of both beliefs and desires. Bartsch and Wellman investigate children’s developing understanding of mind by looking at children’s talk about beliefs, thoughts and desires. They predict among other things that children understand desires before belief, based on earlier studies (Astington & Gopnik, 1991; Flavell, Flavell, Green, & Moses, 1990; Wellman, 1992).

Bartsch and Wellman analyze a database containing natural speech of ten English-speaking children, with age ranging from 0;7 to 6;0. The transcriptions were compiled from six different corpora. Most of the data occurs in the range 2;5-4;0. They look at five desire terms: *want*, *hope*, *wish*, *care (about)*, and *afraid (that)*; and six belief terms: *think*, *know*, *wonder*, *believe*, *expect* and *dream*. The vast majority of utterances using these mental verbs occurred with one of three verbs: *want* (97% of desire utterances), *think* (26% of belief utterances) and *know* (70% of belief utterances). They found that in terms of frequency, desire verbs exceed belief verbs, both in total and for each child individually. Before 2;8, it is characteristic to see an overwhelming use of desire verbs, often with no belief verbs found in the earliest transcripts. After that time, the amount of belief verbs increases, with belief often exceeding desire from 4;0 onwards. For an overview of the total belief and desire utterances per child per age-category, see appendix A, Table 6-2.

However, Bartsch and Wellman were not interested in pure frequency, but in the way children use mental verbs and the underlying theory of mind they express with it. As seen in Shatz et al.’s study, it might well be the case that many of these utterances are purely conversational in function and don’t refer to a mental state. Therefore, all found utterances were coded for genuine psychological reference, similar what to Shatz et al. called mental state. All utterances that were not coded as genuine psychological reference were excluded from further investigation.

In Bartsch and Wellman Example 1, Marks utterance “he thought there were haunted things” was judged to be a genuine psychological reference. Ross’s “I don’t know” was not, as it is purely a formulaic response following joke question and answer rules. Thus, Mark’s utterance was included in further analysis, while Ross’s utterance was excluded.

Bartsch and Wellman Example 1: Mark at 3;11 and Ross at 5;9

Mark: Why did the chicken cross the road?
Ross: I don’t know.
Mark: Well, because his house always... always got... haunted.
Father: Haunted? And he didn’t like it?
Mark: Yeah, he, he think... he thought there were haunted things in his house.

Table 2-2 shows the percentages of the coding categories. For desire, 74% of utterances were coded as genuine psychological reference. For belief, this is only 40%. Bartsch and Wellman don't give an explanation for this difference.

Table 2-2: coded mental verb utterances, derived from Barsch and Wellman pp. 43 and 72-73

	Desire		Belief	
Genuine psychological references	5558	(74%)	1727	(40%)
Other substantive uses	1646	(22%)	1014	(23%)
Conversational uses, including repetitions	49	(1%)	1240	(28%)
Uncodable/unclear	254	(3%)	371	(9%)
Total	7507		4352	

Table 2-3 illustrates the first mental verb uses for the individual children. Bartsch and Wellman found that genuine psychological reference to desire is well established by 2;0 years of age, while genuine psychological reference to belief appears first just before 3;0 years of age. The average gap between desire and belief is seven months, but this is an underestimation, because more than half of the children were already making reference to desires in the first transcripts available. Both genuine belief and desire references seem to be preceded by non-mental uses.

Table 2-3: Age at children's first use of desire and belief verbs and reference to desire and belief, derived from Bartsch and Wellman Table 4.1 (p. 75) and 5.3 (p. 104)

Child	Age at first available transcript	First use of desire verb	First reference to desire	First use of belief verb	First reference to belief
Adam	2;3	2;3	2;4	2;4	2;11
Abe	2;4	2;4	2;4	2;4	2;8
Sarah	2;3	2;3	2;3	2;5	2;9
Ross	2;6	2;6	2;6	2;6	2;7
Naomi	1;8	1;8	1;10	2;3	2;8
Allison	1;4	2;4	2;4	2;10	2;10
Eve	1;6	1;6	1;6	1;8	1;9
Nathaniel	2;6	2;6	2;6	2;7	3;5
Peter	1;9	1;10	1;10	1;11	2;4
Mark	0;10	1;6	2;5	2;6	3;5

Comparable to the conclusion from Shatz et al., Bartsch and Wellman conclude that conversational uses precede genuine psychological reference. Furthermore, references to desire precede references to belief, by seven months on average. Bartsch and Wellman argue that this pattern of talking about desires first and beliefs second reflects a potentially universal shift in how children conceptualize people and their mental states. If this is indeed the case, the same pattern should occur in different languages. Thus, it is possible to test their conclusion by repeating their research in a different language. This is what Tardif and Wellman focus on in their study of Mandarin-speaking and Cantonese-speaking children.

2.2.3.3 Tardif and Wellman (2000)

Tardif and Wellman (2000) have examined the mental state language of Mandarin-speaking and Cantonese-speaking toddlers, in order to compare the results with those of

the English-speaking children. Mandarin and Cantonese are good languages to compare to English, because they are different from English in several important ways. I will here explain two of those differences. First, Tardif and Wellman claim that mental state conversation typically depends on verbs such as 'want', 'think' and 'know'.² Verb learning in general could influence the pattern of acquisition of mental state language. English-speaking children acquire more nouns than verbs in the early stages of language learning, while Mandarin-speaking children produce at least as many verbs as nouns in their early conversations. Since Mandarin-speaking children acquire verbs at a younger age, it might also be the case they acquire mental verbs at a younger age. Second, most verbs used in Cantonese and Mandarin to refer to mental states are polysemous, meaning they can refer both to desire and belief. If children have the universal tendency to develop a conceptual understanding of desire before belief, Mandarin- and Cantonese-speaking children might use the polysemous verbs to indicate desire before they produce these verbs to indicate belief.

Ten Mandarin-speaking children were recorded for an hour at least biweekly over a six-month period, starting at age 1;10. 50 hours of transcript were used in the analysis. The Cantonese-speaking children were part of an existing corpus. The ages ranged from 1;5 to 2;8 at the beginning of the recordings, and all children were recorded for a year. Coding was similar to Shatz et al. (1983) and Bartsch and Wellman (1995) and was performed by native speakers of Mandarin or Cantonese. Tardif and Wellman's results only include those verbs that are used in a mentally referring way.

All children produced desire verbs before producing belief verbs. Mandarin-speaking children, however, were early in their acquisition of desire verbs: seven out of ten children used desire terms in a well established way at the first recordings, aged 1;10. For both languages, there was a non-polysemous verb similar to 'want' that was much more frequent than the other mental verbs: in Mandarin, *yao1* makes up 100% of the mental state verbs at 21 months of age and drops to 70% in the following months; in Cantonese, *jiu3* also makes up 100% of the mental state verbs at 21 months of age and swings around 60% in the following months. For Mandarin, there is also the polysemous verb *xiang3* that can refer both to desire and thought. The Mandarin children used *xiang3* in only its desire sense up to age 2;0. After that, some children start to use the verb to refer to thinking, but only infrequently. See appendix A, Table 6-3 for a full overview of the Mandarin-speaking children and Table 6-4 for a full overview of the Cantonese-speaking children.

The results, Tardif and Wellman state, are similar to Bartsch and Wellman's results with English-speaking children. Both Mandarin-speaking and Cantonese-speaking children use verbs for desire well in advance of verbs for belief. Tardif and Wellman argue that these findings indeed suggest global consistency in the overall theory of mind development, but variation in the timing of beginning and end points.

² Note, however, they don't have a reference to show that this is the case for languages other than English.

2.2.4 Other studies

2.2.4.1 Pascual et al. (2008)

Pascual, Aguado, Sotillo and Masdeu (2008) have looked at the development of mental state language in 25 Spanish-speaking children, assessed at ages 3, 3;6, 4, 4;6 and 5. At those ages, the children were recorded at home for one hour, while engaging in mother-child play, a picture-book reading session, and child-child play. The coding was similar to Bartsch and Wellman's method. Of the 40,250 utterances coded, 3% contained mental verbs. Pascual et al. found that between ages 3 and 5 years Spanish children increasingly produced references to belief, as Bartsch and Wellman also found in English children. The frequency of references to desire stayed approximately the same. While not explicitly mentioned, it seems likely that for all children desire references were well established at the time of the first recordings.

2.2.4.2 Kristen et al. (2014)

Another supporting study, although using quite a different method, is the one by Kristen et al. (2014). Kristen et al. conducted a parental questionnaire on the composition of almost 300 children's internal state vocabulary in four languages: Italian, German, English, and French. The children were aged 2;6 to 2;8 months. Across languages, children were said by parents to know a higher proportion of volition words (out of a set of 4-5) than of cognition words (out of a set of 9-12).

2.2.4.3 Choi (1991)

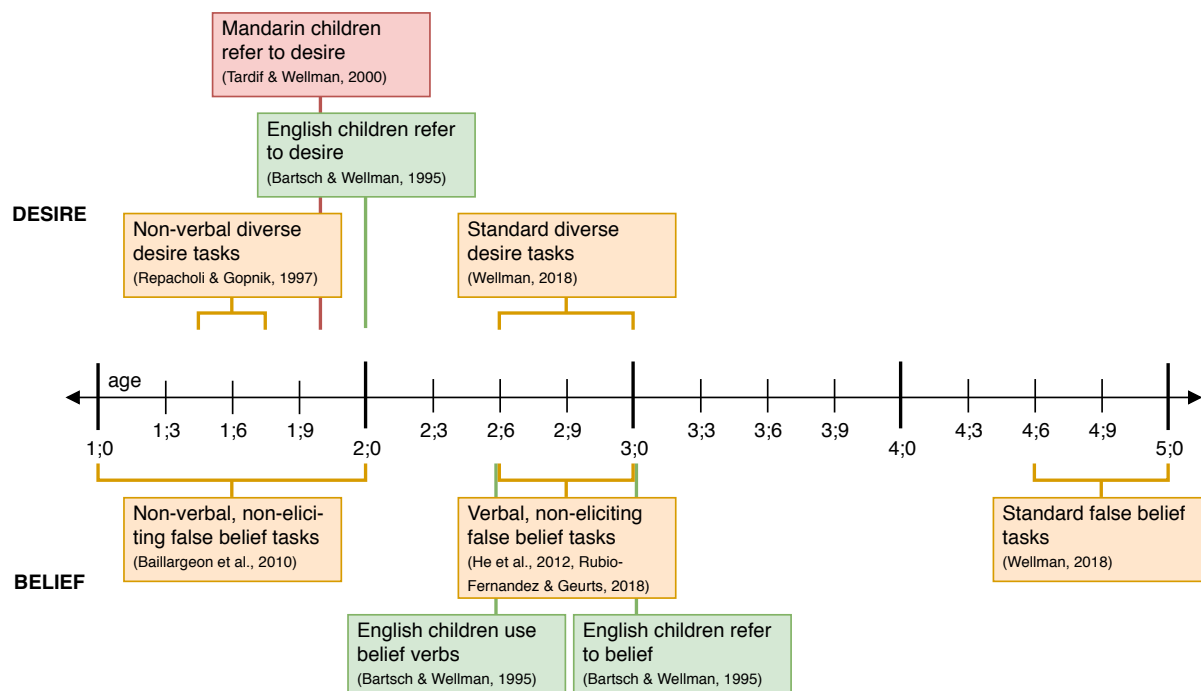
Finally, Soonja Choi (1991) found a contrasting result in young Korean children. In Korean, it is mandatory to end a sentence with a suffix that denotes epistemic meaning. There are 3 epistemic meanings: 1) the information has been recently acquired by the child through direct experience, and it is in the process of being processed in the child's knowledge system (-TA); 2) the information has been processed in the child's knowledge system (-E); and 3) the information is established, certain and shared with the listener (-C1). Choi's data suggests that Korean children can correctly make these epistemic distinctions before age 2;0. Korean also has markers for deontic meaning, including desire. Korean children were able to make epistemic distinctions *before* deontic ones. This seems to imply that Korean children understand the concept of belief before the concept of desire.

2.3 Research questions

We have seen in the introduction that experimental research shows a robust Theory of Mind Scale, but that children can do those tasks at a much younger age when the tasks are modified to be non-verbal and non-eliciting. Based on the three studies involving natural language, a clear pattern emerges as well. English-speaking, Mandarin-speaking and Cantonese-speaking children use desire verbs before using belief verbs *and* make mental references to desire before making mental references to belief. English children use desire and belief verbs in a non-referential way before they start making mental references. Shatz et al. argue that even though young children use mental state verbs, they lack awareness of mental states themselves. Mandarin-speaking children start to refer to mental states of desire at a younger age than English-speaking children. Tardif and Wellman argue that these findings indeed suggest global consistency in the overall theory of mind development, but variation in the timing of beginning and end points.

Figure 2-1 shows an overview of theory of mind literature, visualized as a timeline for a child's age. For sake of clarity, this figure doesn't encompass all literature described in this chapter, but rather the most important milestones that emerge from the literature.

Figure 2-1: timeline based visualisation of theory of mind literature



This current study aims to build towards a more complete understanding of children's mental state language, taking the position that it is beneficial to examine the expression of mental states in other languages than English. This way, we can try to find evidence whether the universal, gradually developing theory of mind as proposed by Bartsch and Wellman (1995) is indeed universal, or rather language-specific, as hinted at by certain experimental findings and earlier corpus-based work (Choi 1991).

An important focus here is on comparing the age of acquisition of desire verbs with the age of acquisition of belief verbs, to further examine whether the proposed order of the Theory of Mind Scale holds in natural language as well. In the data used in existing longitudinal research, children often already used desire verbs in the earliest recordings. This has made it difficult to pinpoint at what age children start to use desire verbs. The current study will therefore include children from a very young age.

Another focus regards the pragmatic context. Experimental work has identified that pragmatic context has a big influence on children's responses to experimental tasks. However, existing longitudinal studies have sometimes left aside the pragmatic functions of mental state verbs (especially those that involve non-referential use), as their focus has been on referential use as a child's most important achievement. It would be good to take a look at pragmatic influence on natural language situations, as it might well be the case, for example, that the earlier references to desire are caused by the pragmatic need to express desire to your caregivers.

Dutch is an appropriate language to study for several reasons: as of yet, there has been no research at all concerning the mental state language of Dutch children; there is sufficient data available for Dutch children; and Dutch mental state language has some specific features of interest. For example, impressionistically, the belief word *vinden* (to think, to find) seems to be more salient than *denken* (to think) in young children's language, and might influence the way Dutch children acquire belief verbs.

In this study, I will investigate two main questions: at what age do Dutch children start to use mental verbs, and in what way do they use these verbs? In addressing these questions, I will look at three Dutch corpora. More specifically, I address the following:

Research question 1: Does the order of emergence and frequency of desire and belief verbs in Dutch children's speech match earlier findings in English children's speech?

- a) What is the frequency of desire and belief verbs?
- b) At what age do desire and belief verbs emerge?
- c) Are desire and belief verbs first used in a referential or non-referential way?

Research question 2: From a more exploratory perspective, what are some early functions of desire and belief verbs in conversation between Dutch children and their caregivers? Could this provide a possible rationale for the results to be found for research question 1?

If Bartsch and Wellman's proposal of a gradually developing theory of mind is indeed true and universal, this should be reflected in the Dutch data. Dutch children should then talk about desire before talking about belief, and use belief verbs in a non-referential way before using them in a referential way. If this is indeed the case, this strongly supports Bartsch and Wellman's theory. If Dutch children behave differently from English children, it could be the case that Dutch and English differ in such a way that it affects the child's mental language and perhaps even theory of mind development. Looking closely at the way Dutch children use mental verbs can help us see whether there are some language-specific aspects that might influence features of theory of mind.

3 Methodology

This chapter describes the methods used in this thesis. It describes the database used in this study (section 3.1), the Dutch mental terms that the study focuses on and how this list of terms was derived (section 3.2), the coding scheme and procedures (section 3.3) and finally an overview of the reliability of the coding (section 3.4).

3.1 Database

The corpora used in this study are a part of the Child Language Data Exchange System (CHILDES), organized by Brian MacWhinney and Catherine Snow. CHILDES has fourteen Dutch corpora available. Of these, only three are naturalistic and longitudinal, concern non-delayed children and are recorded in the Netherlands (as opposed to Flanders, Belgium). An overview of these corpora is shown in Table 3-1.

Table 3-1: overview of corpora used in this thesis

Corpus	Age range	N	Year collected
Groningen	1;5 - 3;8	7	1992 - 1994
Van Kampen	1;6 - 6;0	2	1988 - 1994
CLPF	1;0 - 2;11	12	1988 - 1991

The Groningen Corpus was compiled by Gerard Bol, Caroline Elskamp, Evelien Krikhaar, Paulien Rijkhoek and Frank Wijnen from 1992 to 1994 (Wijnen & Bol, 1993). The corpus contains longitudinal data from seven Dutch children. The recordings for each child started between age 1;5 and 2;1 and occurred monthly for 18 to 24 months. Recordings were made in an unstructured regular home setting, talking with their father and/or mother and an investigator. One of the children, Iris, developed middle ear problems not long after the first taping session, which turned out to be rather persistent and to hinder her linguistic development. As a result, Iris's data is not included in this thesis.

The Van Kampen Corpus was collected by Jacqueline van Kampen, who is also the mother of the recorded children (van Kampen, 2009). The recordings were made roughly once or twice every month from age 1;9 to 5;10 (Laura) and age 1;6 to 6;0 (Sarah), between 1988 and 1994. All recordings occurred in unstructured, regular home settings between the child and the mother. Because this current study focuses on the early acquisition of mental verbs, only the transcripts up to 3;9 are used.

The CLPF Corpus was collected by Paula Fikkert and Clara Levelt from 1988 to 1991 (Fikkert, 1994; Levelt, 1994). The recordings for each child started between age 1;0 and 1;11. Most children were recorded every other week, for seven to 15 months. The one exception is Leonie, who was recorded weekly for two months. The recordings lasted on average 30 to 45 minutes. Recordings were made in the child's home during natural, spontaneous, interactive sessions with one or both of the experimenters and occasionally with one of the parents. Typically the investigator would interact with the child by reading books or playing with toys and occasionally asking the child what she saw in books or what she was doing. In this corpus, only the child's utterances have been selected from each recording and transcribed. The context of the child's utterance is not included. Unintelligible utterances were left out, but false starts, errors, breakdowns etc. were transcribed.

Table 3-2 shows an overview of the children in each corpus.

Table 3-2: overview of the children in each corpus

Corpus	Name	Age Range	Sex	Sessions	Frequency	Length in minutes
Groningen	Abel	1;10 – 3;4	M	29	Monthly	45
	Daan	1;7 – 3;3	M	35	Monthly	45-60
	Josse	2;0 – 3;4	M	29	Monthly	45
	Matthijs	1;5 – 3;7	M	43	Monthly	45-60
	Peter	1;5 – 2;9	M	28	Monthly	45-60
	Tomas	1;7 – 3;1	M	27	Monthly	45*
Van Kampen	Laura	1;9 – 3;9	F	46	(Bi)monthly	45
	Sarah	1;6 – 3;7	F	35	(Bi)monthly	45
CLPF	Catoetje	1;10 – 2;7	F	16	Bimonthly	30-45
	David	1;11 – 2;3	M	6	Bimonthly	30-45
	Elke	1;6 – 2;4	F	19	Bimonthly	30-45
	Enzo	1;11 – 2;6	M	16	Bimonthly	30-45
	Eva	1;4 – 1;11	F	12	Bimonthly	30-45
	Jarmo	1;4 – 2;4	M	23	Bimonthly	30-45
	Leon	1;10 – 2;8	M	23	Bimonthly	30-45
	Leonie	1;9 – 1;11	F	7	Weekly	30-45
	Noortje	1;7 – 2;11	F	21	Bimonthly	30-45
	Robin	1;5 – 2;4	F	23	Bimonthly	30-45
	Tirza	1;7 – 2;6	F	20	Bimonthly	30-45
	Tom	1;0 – 2;3	M	25	Bimonthly	30-45
Total		1;0 – 3;9	9F 11M	547		

* It is unclear from the corpus description how long the recordings of Tomas are. I've estimated it to be about 45 minutes.

Table 3-3 shows an estimate of the recorded hours per three-month age category. These categories will also be used to present the data. This is done because dividing the data per month would make the amount of data in that category too small to say something meaningful, but bigger categories would be too broad to get a sense of the development happening over age.

Table 3-3: estimate of recorded hours per three-month age category

	Age-category										
Corpus	1;0-1;3	1;3-1;6	1;6-1;9	1;9-2;0	2;0-2;3	2;3-2;6	2;6-2;9	2;9-3;0	3;0-3;3	3;3-3;6	3;6-3;9
Children represented	1	4	11	18	18	18	13	8	7	6	3
Recorded hours	3	9	31	60	64	60	44	27	24	13	6
Total recorded hours	341										

Ages 1;6-2;9 yield the most data, with 11 to 18 out of 20 children represented in each age category and about 259 recorded hours (76% of the total 341 hours). Ages 1;0-1;6 are not very well represented, only containing about 12 hours of recordings. This is not

big problem, as we don't expect a lot of mental language in that age category anyway. Ages 2;9-3;0 and 3;0-3;3 still contain considerable amounts of hours, ages 3;3-3;6 and 3;6-3;9 less so. As children are expected to talk more at that age, it will probably still be meaningful to look at their language at those ages.

Over the three corpora, gender is quite evenly distributed, with recordings from 9 girls and 11 boys. However, the corpora for which context is available, namely Groningen and Van Kampen, total 6 boys and 2 girls. Some studies that focused on false belief tasks found that girls have a slight advantage over boys (Calero, Salles, Semelman, & Sigman, 2013; Charman, Ruffman, & Clements, 2002). This doesn't necessarily mean that girls have an advantage when it comes to mental verbs in natural language, but it might still be the case that some results from this study are an underestimation because they are based on data from predominantly boys.

All three corpora will be used to look at the frequency of desire and belief verbs and the age at which these verbs emerge (research question 1a and 1b). The Groningen corpus and Van Kampen corpus will be used to see whether the desire and belief verbs are first used in a referential or non-referential way (research question 1c), as the CLPF corpus does not contain enough conversational context to do so. Finally, the Groningen corpus will be used to look at the different functions of desire and belief verbs in conversation between Dutch children and their caregivers (research question 2).

3.2 Terms

Lists of Dutch desire verbs and belief verbs can be found in appendix B. These lists are derived using dictionaries, thesauri and the intuition of native Dutch speakers. While it is impossible to know for sure whether all desire and belief verbs are listed, I am confident that all the more common verbs are included. Apart from verbs, the frequency of mental nouns and adjectives was quickly checked as well, concerning terms like *idee* (idea), *gedachte* (thought), and *droom* (dream). However, these were so infrequent in the children's speech that they were left out of consideration. This is in keeping with what Shatz et al. (1983) and Bartsch and Wellman (1995) found.

To make sure that all occurrences of the verbs were found, all possible conjugations were used to search the corpora. This included unconventional forms like *wi* for *willen* (to want), as some corpora transcribed the children's speech mostly phonetically. Each form that was used at least once to refer to the target verb is included in the final lists, found in Table 3-4 and 3-5. Most verbs occurred only in present tense and/or in the past participle. Only *willen* (to want), *denken* (to think), *kennen* (to know) and *weten* (to know) had forms in past tense. Almost all verbs contained at least the form used for the first person singular.

After looking at the data, it was clear that there were some verbs that the Dutch children did not use to refer to mental states. *Nodig hebben* (to need) only was used to refer to something that was necessary, not to express a desire. *Wensen* (to wish) only occurred two times when a child was saying a rhyme, and *kunnen* (to be able to) was only used to express abilities or possibilities, not to express know-how. These verbs were therefore excluded from further analysis.

Table 3-4: forms of Dutch desire verbs found in the three corpora (unconventional forms are marked with italics)

Desire verb	Forms found in corpora	Translation
(niet) hoeven	hoef; hoeft; hoeven; <i>hoe; hoefā; hoefe; hoeve; ikhoef; ikhoefniet</i>	To not care for something (e.g. food)
Nodig hebben*	nodig	To need
Wensen*	wens; wensen	To wish
Willen	wil; wilde; wilden; willen; wilt; wou; <i>ikwil; ikwilpappa; kwil; wi; wilā; wilkoekje; wille; woude; wout; wouw</i>	To want
Zin hebben (in)	zin; <i>sin</i>	To feel like, to fancy

* These verbs were later excluded from analysis

Table 3-5: forms of Dutch belief verbs found in the three corpora (unconventional forms are marked with italics)

Belief verb	Forms found in corpora	Translation
Bedoelen	bedoel; bedoelt; <i>doel</i>	To mean
Begrijpen	begreep; <i>gggrepen; grepen</i>	To understand
Denken	bedenken; dacht; denk; denken; denkt; nadenken; <i>denke</i>	To think
Doen alsof	alsof	To pretend
Geloven	geloof; geloven	To believe
Kennen	ken; kende; kenden; kent; <i>kenne</i>	To know
Kunnen*	kan; kon; konden; kun; kunnen; kunt; <i>kannen; kanā; kanne; kanie; kannie; kannjie; konne; konnie; kunne;</i>	To be able to, to know
Menen	meen	To think
Raden	raadt; raden	To guess
Snappen	snap	To understand
Vergeten	vergeten; <i>geten</i>	To forget
Verzinnen	verzin; <i>zin; zinnen</i>	To think up, to make up
Vinden	gevonden; vind; vinden; vindt; <i>fin; find; finde; finne; gevond; gevonde; vi; vin; vinne; vint</i>	To think
Weten	weet; weetend; weten; wist; <i>kweet; weeta; weete; wete;</i>	To know

* This verb was later excluded from analysis

3.3 Coding categories and procedures

All verbs identified in the corpus according to the procedure outlined in 3.2 were extracted. The first utterances from the Van Kampen corpus and the full Groningen corpus were coded in relation to their meaning in context. The coding scheme is based on Bartsch and Wellman's coding scheme (see chapter 2). The main coding consisted of four categories: referential use, non-referential use, unclear and excluded. For the category referential use, Bartsch and Wellman's definition of "genuine mental reference" was used. All other utterances were marked as non-referential use, except when unclear or excluded.

In Example 1³ Josse uses *ken* (know) in a referential way, as he refers to the mental state of the investigator.

Example 1, Josse (3;0): Josse and the investigator are playing with a new toy zoo.

Investigator: *maar van wie heb je dit gekregen dan ?*
"but from whom did you get this?"
Josse: *van , van Rosie .*
"from, from Rosie."
Investigator: *ja ?*
"Yes?"
Josse: *ken je toch wel...*
know.SG you surely POS
"you do know her, right..."
Investigator: *ja , die ken...*
"yes, I know..."
Josse: *...Rosie ?*
"...Rosie?"
Investigator: *ja , die ken ik wel , ja .*
"Yes, I do know her, indeed."

In Example 2, Abel uses *weet* (know) in a non-referential way, as he doesn't refer to someone's mental state. Instead, he uses *weet je* (you know) to get the attention of the investigator.

Example 2, Abel (2;11):

Abel: *weet je , Gerard , ik heb pizza gegeten .*
know.SG you, Gerard, I have pizza eat.PTCP.
"You know, Gerard, I did eat pizza. "

Utterances were marked unclear if it was not possible to say whether a verb was used referentially or not, because of a lack of context or because the child used the verb in a strange way. Utterances were excluded from further analysis if they were reported speech, a memorized song or rhyme, or if the mental verb was polysemous and the non-target meaning was used. For example, children often used the verb *vinden* (to find) to

³ All examples show the original Dutch transcript, as well as a free translation to English. For the child utterances containing a mental verb, an interlinear gloss is provided as well. An overview of the glosses used can be found in appendix C.

refer to location-related finding of something, instead of thinking or having an opinion. These instances were excluded.

The Groningen corpus was coded as a whole. As research question 2 focuses on the functions of desire and belief verbs in conversational context, both referential and non-referential utterances were coded for conversational function as well. A coding scheme was created by looking at earlier coding schemes, e.g. by Shatz et al. (1983), and by closely looking at a subset of the Dutch data to identify recurring functions. This led to the following coding categories for conversational functions:

- directing the interaction, e.g. *weet je* (do you know) to get someone's attention;
- requesting an object, action or something else, e.g. *ik wil dat koekje* (I want that cookie);
- rejecting an object, action, suggestion or idea, e.g. *nee, ik wil niet!* (No, I don't wanna!);
- evading the question, e.g. using *weet ik niet* (I don't know) as a formulaic response to a question;
- evaluation, e.g. *ik vind dat leuk* (I like that);
- imitation of earlier utterance of self or other;
- fixed expression, such as an interjection, filler, stop word, proverb, or idiom;
- other.

These categories were not mutual exclusive; utterances could serve multiple functions. They are not used to quantify the data, but to get a sense of the different ways in which young children use mental verbs. The different functions will be further exemplified and discussed in chapter 4. The full coding scheme can be found in appendix D.

3.4 Reliability

As a reliability check, a cross-section of the Groningen corpus was coded by a second coder. Both the main coding of referential vs. non-referential use and the extra coding of conversational function were taken into account. The double-coded cross-section contained all utterances from ages 2;3-2;6. This section was chosen because it comprises the middle of the full age-range 1;3-3;8, and children were using desire verbs and belief verbs both in a referential and non-referential way. Furthermore, this section contained data from all children in the Groningen corpus. The section chosen for double coding contained 31 transcripts (16.7% of the total corpus), which yielded 264 utterances containing mental verbs (16.3% of the total utterances in the corpus). Of these utterances, 180 contained a desire verb (19.0% of total desire utterances in the corpus) and 83 contained a belief verb (12.5% of total belief utterances in the corpus).

For the 180 utterances containing a desire verb, agreement on whether these utterances were used referentially was 88% (Cohen's kappa = .71). There were 21 utterances containing a desire verb on which the coders disagreed whether it was used referentially. All disputed utterances were re-evaluated. If one of the coders thought the utterance to be unclear or non-target, it was marked as such. In all other cases, the coders discussed the correct interpretation, marking an utterance as unclear if they couldn't come to an agreement. In the end, 11 utterances were changed from the original coding by the first coder: 6 utterances were marked as referential use that had not been marked as such in the original coding, and 5 utterances were marked as unclear that had

been marked as referential use in the original coding. As the proportion of coding that needed to be changed was quite small, and because the amount of utterances switched to referential use and to non-referential use is almost equal, it is unlikely that the overall proportion of referential use in the results would be much different.

For the 83 utterances containing a belief verb, agreement on whether these utterances were used referentially was 78% (Cohen's kappa = .57). There were 18 utterances containing a belief verb on which the coders disagreed whether it was used referentially. All disputed utterances were re-evaluated. If one of the coders thought the utterance to be unclear or non-target, it was marked as such. In all other cases, the coders discussed the correct interpretation, marking an utterance as unclear if they couldn't come to an agreement. In the end, 4 utterances were changed from the original coding by the first coder: 3 utterances were marked as referential use that had not been marked as such in the original coding, and 1 was marked as unclear that had been marked as referential use in the original coding. The amount of changed coding is low, because it was often the case that the first coder was more conservative to begin with, and the recoding was done conservatively as well. It might be the case that the final set of belief verbs is coded too conservative, thereby slightly underestimating the frequency of referential use.

4 Results

In this chapter, I will describe the results of the analysis and coding of the Dutch corpora. Each section will look at the results for one research question. Section 4.1 will focus on research question 1: Does the order of emergence and frequency of desire and belief verbs in Dutch children's speech match earlier findings in English children's speech? Section 4.2 will target research question 2: What are some early functions of desire and belief verbs in conversation between Dutch children and their caregivers?

4.1 Frequency and age of emergence of desire and belief verbs

First, I will describe the general frequency of desire and belief verbs for the Dutch and English children (section 4.1.1). Second, I will look at the age at which the desire and belief verbs are first recorded (section 4.1.2). For both research question 1a and 1b all three Dutch corpora and the English data were analyzed⁴⁵. Third, I will analyze the first occurrences of mental verbs for the 2 Dutch corpora of which context was available: Groningen and Van Kampen (section 4.1.3). This targets research question 1c: are desire and belief verbs first used in a referential or non-referential way? In section 4.1.4, I will take a closer look at the frequency, age of emergence and referential use in the Groningen corpus, looking in more qualitative detail at the findings sketched in the other sections.

4.1.1 General frequency of desire and belief verbs

For each corpus, Figure 4-1 shows the mean frequency of recorded belief and desire verbs as a percentage of all recorded utterances. The pattern shown in Figure 4-1 reflects the patterns of the individual children quite well. Because of clarity, the figures for the individual children can be found in appendix E.

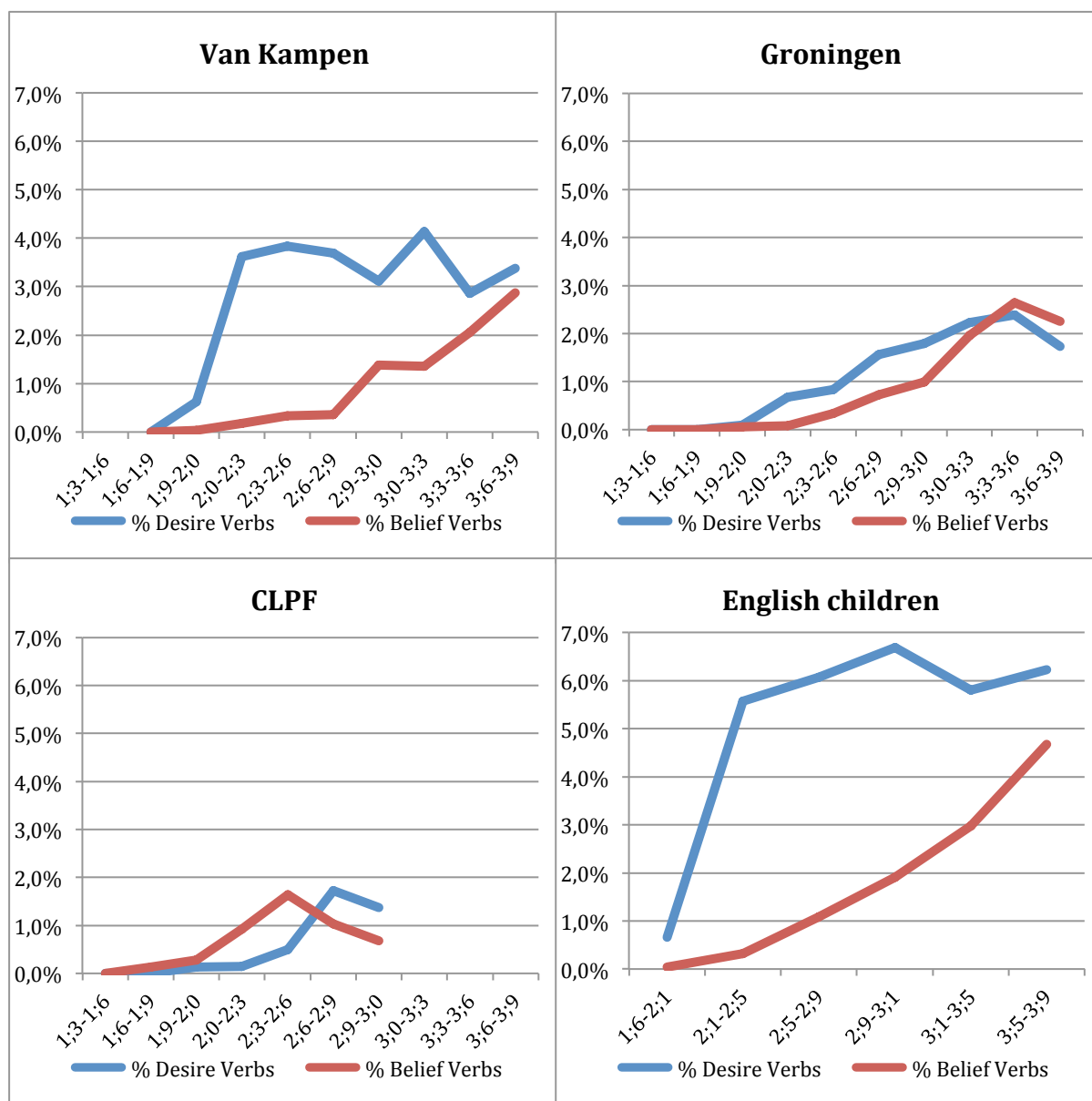
Looking at the frequency of mental verbs, the difference between the three Dutch corpora is striking. In the Van Kampen corpus, desire verbs emerge on average at a younger age than belief verbs. Desire verbs also occur more frequently than belief verbs, although belief verbs get more frequent as the children grow older. In the Groningen corpus, the same pattern is visible, but less extremely: desire verbs on average still emerge at a younger age than belief verbs, and occur more frequently than belief verbs, but the difference is much smaller. In the CLPF corpus, on the other hand, this pattern is reversed: *belief* verbs on average emerge earlier than desire verbs, and belief verbs occur more frequently than desire verbs.

Not only do the Dutch corpora look very different from each other, they differ considerably from the English data as well. The English data looks most similar to the Van Kampen data, as desire verbs on average emerge at a younger age and occur more frequently than belief verbs. However, both desire and belief verbs occur much more frequently in the English data than in the Dutch data.

⁴ For the CLPF corpus, four children were excluded (Elke, Jarmo, Leonie and Tom), as only 2 or less utterances containing a mental verb were recorded for them.

⁵ The English data is taken from overview tables from Bartsch and Wellman (1995), not from the English corpora themselves.

Figure 4-1: The mean frequency of desire and belief verbs per age category for each Dutch corpus and the English data



4.1.2 Age of emergence of desire and belief verbs

Table 4-1 provides us with a closer look at the age of emergence of mental state verbs in Dutch children. For all children except Laura and Enzo, the earliest transcripts don't show occurrences of mental verbs. This means that the age at which the mental verbs first emerge in the corpora is a good estimate of the age of acquisition of these verbs.

For six of the 16 children, the first occurrence of a desire verb preceded the first occurrence of a belief verb. For four children, they occurred at approximately the same age, and for six children, first occurrence of a belief verb preceded the first occurrence of a desire verb. Four of the children from the CLPF corpus had so few desire utterances available that the data might not be representative. However, even when these four children are excluded, for only half of the children of the three corpora (six out of 12) a desire verb was recorded before a belief verb.

Table 4-1: age of emergence of mental state verbs in Dutch children

Corpus	Child	Age at first available transcript	First occurrence of desire verb	First occurrence of belief verb
Groningen	Abel	1;10	1;11	2;1
	Daan	1;8	2;0	2;2
	Josse	2;0	2;1	2;1
	Matthijs	1;10	2;4	2;0
	Peter	1;5	2;0	2;1
	Tomas	1;7	2;0	1;10
Van Kampen	Laura	1;9	1;9	2;3
	Sarah	1;6	1;9	2;0
CLPF	Catootje*	1;10	2;2	2;2
	David*	1;11	2;3	2;1
	Enzo	1;11	1;11	1;11
	Eva*	1;4	1;9	1;6
	Leon	1;10	1;10	2;4
	Noortje	1;7	2;7	2;5
	Robin	1;5	1;11	1;11
	Tirza*	1;7	2;5	2;2

* less than 3 utterances containing a desire verb occurred in the recordings

In the English data, for 8 out of 10 children the first occurrence of a desire verb preceded the first occurrence of a belief verb, and for two children they occurred at approximately the same age. For these last two children, the age at which both desire and belief occurred was also the age of the first available transcript. Age of emergence of desire and belief verbs in Dutch children's language thus diverges from the English data. The Dutch children in these corpora show no clear desire-belief order. They also use belief verbs at an earlier age than English children.

4.1.3 First uses of desire and belief verbs

For eight children, namely those of the corpora Groningen and Van Kampen, the first occurrences of mental verbs were coded and analyzed. Only these two corpora contained enough context to see whether a verb was used to refer to a mental state. Table 4-2 gives an overview of the first occurrences of mental state verbs. For all eight children, the age at the first transcript is given, and for both belief and desire two measures are given: first occurrence of a mental verb and first referential use of that mental verb, as per the coding methods outlined in 3.3.

For all children, the first occurrence of a desire verb and the first referential use of a desire verb occur in the same month, or with a maximum of one month in between. A closer look at the data shows that for the two children that have a month between the first occurrence of a desire verb and their first referential use of a desire verb, the first few occurrences of the desire verb are actually coded as 'unclear', not as being used in a non-referential way. It thus seems plausible that reference to desire occurs as soon as children use desire verbs at all. This is what Bartsch and Wellman (1995) suspected as well for the English data, but didn't have enough support for, since most English children referred to desire already in the first transcript available. In contrast, only 3

Dutch children use a belief verb in a referential way in the same month a belief verb occurs for the first time. On average, there is a three-month gap between the first occurrence of a belief verb and the first referential use of a belief verb. This is a little smaller than the English children, who showed a mean gap of five months between the first occurrence of a belief verb and the first referential use of a belief verb.

Table 4-2: first use of mental state verbs in the Groningen and Van Kampen corpus

Child	Age at first available transcript	First occurrence of desire verb	First referential use of desire verb	First occurrence of belief verb	First referential use of belief verb
Abel	1;10	1;11	1;11	2;1	2;1
Daan	1;8	2;0	2;0	2;2	2;7
Josse	2;0	2;1	2;1	2;1	2;6
Matthijs	1;10	2;4	2;5	2;0	2;6
Peter	1;5	2;0	2;0	2;1	2;1
Tomas	1;7	2;0	2;0	1;10	2;5
Laura	1;9	1;9	1;10	2;3	2;3
Sarah	1;6	1;9	1;9	2;0	2;3

We have seen in section 4.1.2 that there is no clear desire-belief order when looking at the emergence of desire and belief verbs in Dutch children. However, for all eight children taken into account here, the first *referential* use of a desire verb precedes the first *referential* use of a belief verb. This is comparable to the data from Bartsch and Wellman, as shown in Table 4-3. Dutch children refer to belief earlier than English children. Where the English children showed a mean gap of 6 months (range 1-12) between the first reference to desire and the first reference to belief, which might still be an underestimation because of the unavailability of early records, the Dutch children show a mean gap of 4 months (range 1-7).

Table 4-3, Table 2-3 repeated: Age at children's first use of desire and belief verbs and reference to desire and belief, derived from Bartsch and Wellman Table 4.1 (p. 75) and 5.3 (p. 104)

Child	Age at first available transcript	First use of desire verb	First reference to desire	First use of belief verb	First reference to belief
Adam	2;3	2;3	2;4	2;4	2;11
Abe	2;4	2;4	2;4	2;4	2;8
Sarah	2;3	2;3	2;3	2;5	2;9
Ross	2;6	2;6	2;6	2;6	2;7
Naomi	1;8	1;8	1;10	2;3	2;8
Allison	1;4	2;4	2;4	2;10	2;10
Eve	1;6	1;6	1;6	1;8	1;9
Nathaniel	2;6	2;6	2;6	2;7	3;5
Peter	1;9	1;10	1;10	1;11	2;4
Mark	0;10	1;6	2;5	2;6	3;5

4.1.4 Qualitative analysis of the Groningen corpus

Because of time constraints, only the Groningen corpus was coded entirely. The current section and section 4.2 are an analysis of the data from the Groningen corpus, taking six children into account. Excluded from analysis were 55 occurrences of desire verbs and 61 occurrences of belief verbs. These verbs were most often excluded because they had a non-target meaning, for example when *vinden* was used to refer to location-related finding. Sometimes a verb was excluded because it occurred in a story, rhyme or reported speech.

Table 4-4 shows the frequency of referential use, non-referential use and unclear utterances for both belief and desire. In general, desire verbs were more frequent in the Groningen corpus. Utterances containing a desire verb were more often coded as unclear than utterances containing a belief verb. This is mostly because many desire utterances were fragmentized, containing unfinished phrases.

Table 4-4: frequency of referential use of mental verbs in the Groningen corpus

	Desire		Belief	
Referential use	649	(71%)	281	(45%)
Non-referential use	90	(10%)	295	(47%)
Unclear or fragmented	173	(19%)	51	(8%)
Total	912		627	

Table 4-5 shows the frequencies of genuine references that Bartsch and Wellman (1995) found. Although the categorizing is not exactly the same, the percentage of referential use (called “genuine psychological references” in Bartsch and Wellman) is very similar: 40% for belief (45% in the Dutch data) and 74% for desire (71% in the Dutch data). Since the frequency of utterances containing a mental verb is so much higher in the English children’s data, as seen in section 4.1, this means that English children refer to a mental state of belief or desire much more often than Dutch children.

Table 4-5, Table 2-2 repeated: summary of Bartsch and Wellman’s data

	Desire		Belief	
Genuine psychological references	5558	(74%)	1727	(40%)
Other substantive uses	1646	(22%)	1014	(23%)
Conversational uses, including repetitions	49	(1%)	1240	(28%)
Uncodable/unclear	254	(3%)	371	(9%)
Total	7507		4352	

Figure 4-2 shows the frequency of desire verbs in general and the frequency of referential and non-referential use of desire verbs. Desire verbs emerge at an early age, with a large percentage of verbs being used in a referential way from the start. The proportion of verbs used in a non-referential way gets a little larger over time, but stays very small.

Figure 4-2: frequency of desire verbs and references to desire in the Groningen corpus over time, as a percentage of total utterances

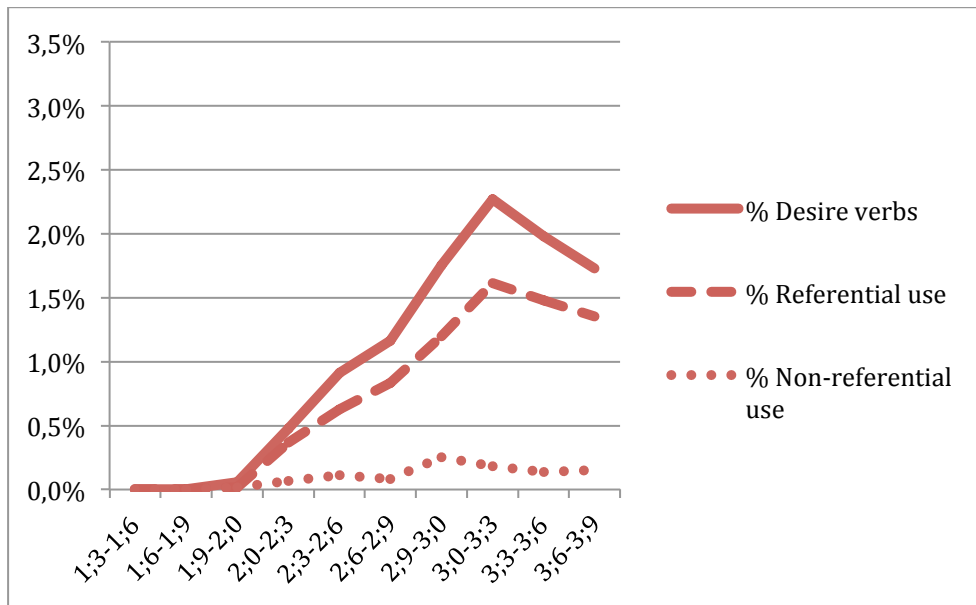
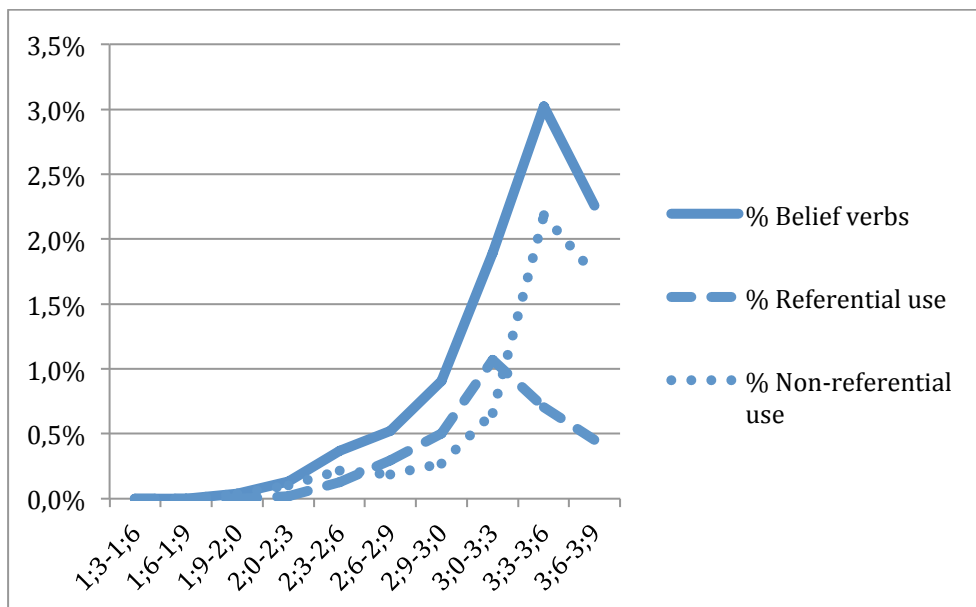


Figure 4-3 shows the frequency of belief verbs in general and the frequency of referential and non-referential use of belief verbs. When children start using belief verbs, they do so mostly in a non-referential way. Very soon, references to belief start to occur and grow more frequent. Around age 3;0, this pattern flips again, and children start to both use belief verbs less in a referential way and more in a non-referential way.

Figure 4-3: frequency of belief verbs and references to belief in the Groningen corpus over time, as a percentage of total utterances



Section 4.2 will focus on the different ways in which the children from the Groningen corpus use desire and belief verbs. Here, the patterns from Figure 4-1 and 4-2 will also be looked at more closely.

4.2 Functions of desire and belief verbs

This section pertains to research question 2: what are some early functions of desire and belief verbs in conversation between Dutch children and their caregivers? I will take a closer look at the way desire (4.2.1) and belief verbs (4.2.2) are used. These descriptions are by no means exclusive, but they list most of the common ways in which the verbs were used. These various functions may potentially be important to understanding why children start to use these verbs and what they want to do with them. In both section 4.2.1 and 4.2.2 I will describe the functions of the mental verbs in approximately the order in which they appear in the data.

4.2.1 Desire verbs

Table 4-6 shows an overview of the different desire verbs occurring in the Groningen corpus. Of the utterances containing a desire verb, a large majority is made using the verb *willen* (to want). The same pattern holds when looking at the frequency with which verbs are used in a referential way.

Table 4-6: Frequency of individual desire verbs in the Groningen corpus

Desire verb	Translation	Occurrences		Of which referential use		Children that used the verb
<i>Willen</i>	To want	852	(93.4%)	618	(95.2%)	6
<i>(Niet) hoeven</i>	To (not) care for something	55	(6.0%)	27	(4.2%)	6
<i>Zin hebben (in)</i>	To feel like, to fancy	5	(0.5%)	4	(0.6%)	3
Total		912		649		

The earliest utterances containing a desire verb were mostly requests, where the utterance refers to a mental state (e.g. desiring some juice), but also serves a conversational function (e.g. asking someone to give you some juice). Though they are grammatically simple, even the earliest requests using a desire verb can be more complicated than a simple *ik wil die* (I want that), paraphrasable with “give me that”. The next example is the earliest use of a desire verb in the corpus, in which Abel tries to express the complex proposition that he wants to sit with his mother.

Example 3, Abel (1;11): Abel is sitting at the Table with his mother and the investigator, and he wants to sit with his mother.

Abel: *ik wil jou .*
 I want.SG you
 “I want you” (meaning: I want (to be) with you)

Abel: *ik wil jou .*
 I want.SG you
 “I want you” (meaning: I want (to be) with you)

Abel: *ik ik ik xxx .*
 “I, I, I, xxx”

Mother: *Abeltje , ga eens even goed in je stoel zitten .*
 “Abeltje, go sit nicely in your chair.”

Some children express grammatically complex requests early on as well. The following example occurs only one month after Peter has started using desire terms at all.

Example 4, Peter (2;1): Peter wants to look at the recording device.

Peter: *Peter, Peter wil apparaat kijk-en .*
Peter, Peter wants device look-INF.
"Peter wants to look (at the) device."

In the next example of a request, Josse is able to reflect on what is offered and expresses what it is he actually wants, even though he only has used desire verbs for two months at this point.

Example 5, Josse (2;4):

Father: *wat wil jij drinken , Josse , sap ?*
"What do you want to drink Josse, juice?"
Josse: *sap .*
"Juice."
Josse: *koffie .*
"Coffee."
Josse: *ik wil koffie .*
I want.SG coffee.
"I want coffee."
Father: *wil jij ook koffie ?*
"Do you want coffee as well?"
Josse: *ja .*
"Yes."

Apart from requests, desire verbs were used early on to make rejections as well. Example 6 and 7 are examples of rejections using a desire verb.

Example 6, Abel (2;3):

Mother: *oh, gaan we lekker even knippen .*
"oh, let's go cut (paper) for a moment."
Abel: *niet zin in.*
not liking for.
"don't fancy."

Example 7, Abel (2;10):

Mother: *even je trui aan ?*
"put on your sweater?"
Abel: *nee , dat hoef ik niet even .*
no, that care.for.1SG I not for.a.bit.
"No, I don't want that."

Children could also express their own desire without it being a request or rejection (Example 8).

Example 8, Josse (2;3): there is a baby girl born at the neighbors, and Josse's mother is pregnant as well.

Josse: *ik ook broertje zusje .*
 "Me too brother sister." (meaning: I'm also getting a brother or a sister)
 Father: *ja , jij krijgt een broertje of een zusje .*
 "Yes, you will also get a brother or a sister."
 Josse: *ik wil meis-je .*
 I want.SG girl-DIM
 "I want girl."
 Father: *je wil een meisje , ja .*
 "Yes, you want a girl."

They also referred to the desire of others to explain actions of others (Examples 9 and 10).

Example 9, Josse (2;1): Josse and his father are reading a lift-the-flap book of Dribbel, a cartoon puppy, who hears different animals and looks under things in the house to find them.

Father: *en Dribbel die hoort iets .*
 "And Dribbel is hearing something."
 Father: *onder de tafel .*
 "Under the table."
 Josse: *muisje .*
 "Mouse."
 Father: *ja , daar zit een muisje .*
 "Yes, there is a mouse."
 Josse: *kijk-en muis-je wil-len .*
 look-INF mouse-DIM want-INF.
 "wants to look at mouse." (Meaning: Dribbel wants to look at the mouse)

Example 10, Abel (2;3):

Mother: *hee .*
 "Hey."
 Mother: *waar gaat de baby heen ?*
 "Where's the baby going?"
 Abel: *wil op de auto lig-gen .*
 want.SG on the car lie-INF.
 "Wants to lie on the car."

Apart from explaining the actions of others, the children also referred to their own desires to explain their own requests (Example 11) and actions (Examples 12 and 13).

Example 11, Peter (2;2): Peter is sitting in the rocking horse.

Peter: *mama Peter uit pakken .*
 "Mama take Peter out."
 Peter: *Peter wil bal schop gev-en .*
 Peter want.SG ball kick give-INF.
 "Peter wants to kick the ball."

Example 12, Abel (2;1):

Mother: *zullen we alles weer in de doos doen , Abel ?*
 "Shall we put everything back in the box, Abel?"

Abel: *nee .*
 "No."

Mother: *je zit er een beetje een puinhoop van te maken .*
 "You are making kind of a mess."

Abel: *trein bouwen .*
 "Build train."

Abel: *ik wil trein bouw-en .*
 I want.SG train build-INF.
 "I want to build a train."

Example 13, Daan (2;10):

Mother: *niet staan op de stoel !*
 "Don't stand on the chair!"

Mother: *he !*
 "Hey!"

Mother: *kom op , denk erom .*
 "Come on, mind you."

Daan: *ik wil staan even stoel .*
 I want.SG stand-INF for.a.bit chair
 "I want to stand chair."

Mother: *nee dat mag niet .*
 "No, that's not allowed."

Mother: *kom er maar af .*
 "Come on down."

The children also referred to desires of others in an inquiring way (Example 14).

Example 14, Josse (2;11):

Mother: *mag ik ook een blokje klei ?*
 "Can I also have a piece of clay?"

Josse: *ja .*
 "Yes."

Mother: *geef die bruine maar .*
 "Give me the brown one."

Josse: *dat ?*
 "That one?"

Mother: *dat is een groene .*
 "That is a green one."

Josse: *nee , je wil deze ?*
 No you want.SG this.one?
 "No, you want this one?"

Mother: *ja .*
 "Yes."

Similar to referring to their own desires to make a request or rejection, children also referred to someone else's desire to offer something (Example 15).

Example 15, Daan (2;5): Daan was pretending he was selling apples, and has just found a real apple in the kitchen.

Mother: *nou heb je een echt appeltje.*
 "Now you've got a real apple."
 Daan: *wil even appel-tje.*
 want.SG for.a.bit apple-DIM.
 "I want an apple."
 Daan: *wil jij ook nog appel-tje ?*
 want.SG you also another apple-DIM?
 "Do you also want apple?"
 Daan: *ja .*
 "Yes."
 Mother: *ja .*
 "Yes."
 Daan: *jij nog appeltje .*
 "Another apple for you."
 Mother: *(eating apple)*

These kinds of expressions later seem to evolve into a fixed expression. Asking *wil je...?* (do you want...?) is a common polite way to offer someone something in Dutch, similar to English *would you like...?* This can be seen in Example 16.

Example 16, Josse (3;0):

Mother: *ga maar vragen of Gerard een kopje koffie wil .*
 "Go and ask whether Gerard would like a cup of coffee."
 Josse: *wil je kop-pie koffie ?*
 want.SG you cup-DIM coffee?
 "Would you like a cup of coffee?"
 Investigator: *ja , wil ik wel , ja .*
 "Yes, I would like one, yes."

Another common fixed expression using *willen* is a polite requesting-formula using the second person pronoun (Examples 17 and 18).

Example 17, Abel (2;7): Abel comes to the investigator with a wrapped candy.

Abel: *wil jij deze open mak-en ?*
 Want.SG you this.one open make-INF?
 "Could you open this?"

Example 18, Peter (2;8):

Peter: *mama .*
 "Mama."
 Peter: *wil je even met Peter even hier naartoe*
 Want.SG you for.a.bit with Peter for.a.bit here toward
lop-en .
 walk-INF.
 "Would you just walk over here with Peter."
 Peter: *daarzo .*
 "Over there."

This politeness form is often taught to Dutch children explicitly, as it is considered rude for children to tell adults what to do. In Example 19 this can be seen clearly, as even the

investigator tells Matthijs to be more polite, even though she normally doesn't correct him.

Example 19, Matthijs (3;6): Matthijs wants some roosvicee, a kind of lemonade for children.

Matthijs: *moet je nog roosvicee voor me maken .*
 "You have to make me roosvicee."
 Investigator: *moet ik dat maken ?*
 "Do I have to make that?"
 Matthijs: *ja .*
 "Yes."
 Investigator: *kun je dat niet vragen ?*
 "Can't you ask me to?"
 Matthijs: *wil je roosvicee mak-en !*
 Want.SG you roosvicee make-INF!
 "Would you make roosvicee!"
 Investigator: *ja , dat wil ik wel .*
 "Yes, I would."

Formulaic expressions like these start to occur around 2;6, when the use of desire verbs is well established.

4.2.2 Belief verbs

Table 4-7 shows an overview of the different belief verbs occurring in the Groningen corpus, which are more varied than the desire verbs. The most frequent verbs were *weten* (to know), *vinden* (to find, to think) and *denken* (to think). These are also the only verbs used by all 6 children. When looking at the frequency with which verbs are used in a referential way, *weten* and *vinden* switch places in ranking: *vinden* is used the most often in a referential way.

Table 4-7: Frequency of individual belief verbs in the Groningen corpus

Belief verb	Translation	Occurrences	Of which referential use	Children that used the verb
<i>Weten</i>	To know	318 (50.7%)	71 (25.3%)	6
<i>Vinden</i>	To find, to think	187 (29.8%)	157 (55.9%)	6
<i>Denken</i>	To think	62 (9.9%)	31 (11.0%)	6
<i>Geloven</i>	To believe	15 (2.4%)	2 (0.7%)	3
<i>Bedoelen</i>	To mean	13 (2.1%)	9 (3.2%)	3
<i>Vergeten</i>	To forget	12 (1.9%)	1 (0.4%)	3
<i>Kennen</i>	To know	9 (1.4%)	7 (2.5%)	3
<i>Begrijpen</i>	To understand	4 (0.6%)	1 (0.4%)	1
<i>Snappen</i>	To understand	3 (0.5%)	2 (0.7%)	2
<i>Verzinnen</i>	To think up, to make up	2 (0.3%)	0 (0.0%)	2
<i>Doen alsof</i>	To pretend	1 (0.2%)	0 (0.0%)	1
<i>Menen</i>	To think	1 (0.2%)	0 (0.0%)	1
Total		627	281	

The earliest utterances containing a belief verb are mostly responses to questions by saying *weet ik niet* (I don't know). Although it could be the case that children sincerely

want to express they don't know the answer, it seems more likely that they use *weet ik niet* as a generic response to difficult or problematic questions. This stays common as children get older, with 28% of all utterances containing a belief verb being coded as 'evading'. Often, this happens when an adult asks a prompting question, meant to get the child to show what he knows. Example 20 shows the earliest occurrence of a belief verb in the corpus. It seems likely that Tomas uses *weet ik niet* to ignore the question. In Example 21 this is even more evident, as the answer Peter is giving is pragmatically incorrect: the investigator asks whether he *can* say something, so Peter should have said *kan Peter niet* ("Peter can't") instead of *weet Peter niet* ("Peter doesn't know").

Example 20, Tomas (1;10): Tomas and his mother are reading a picture book

Mother: *wat voor kleur is dat ?*
 "What color is that?"

Tomas: *weet ik niet .*
 know.SG I not.
 "I don't know."

Tomas: *tekker .*
 "Tractor."

Mother: *ja .*
 "Yes."

Tomas: *tekker .*
 "Tractor."

Mother: *een rode trekker .*
 "A red tractor."

Example 21, Peter (2;5): Peter and the investigator are playing with a toy farm

Investigator: *laten we maar zeggen dat het een graanschuur is, he .*
 "Let's say this is a granary, right."

Investigator: *een silo .*
 "A silo."

Peter: *daar kan ze even naar binnen ?*
 "She can go in there for a bit?"

Investigator: *kan jij dat zeggen, silo ?*
 "Can you say that, 'silo'?"

Peter: *weet Peter niet .*
 know.SG Peter not
 "Peter doesn't know."

Referential uses of belief verbs only occur some time after sentences using *weet ik niet* are well established. The first references to thought and belief occurring in the children's data are evaluations using the verb *vinden*. In Dutch, there is no verb specifically meant for evaluation, like the English *to like*. When you want to say you like something, you say *ik vind het leuk* (literally: I find/think it's nice). The two earliest examples of an evaluating use of *vinden* are given in Examples 22 and 23.

Example 22, Abel (2;1): Abel is singing and stamping on the floor, his mother corrects him.

Mother: *he , doe je even rustig met het parket ?*
 "Hey, would you take it easy with the parquet?"

Mother: *kan niet , hoor .*
 "Not okay."

Abel: *vin niet leuk .*
 find.SG not nice.
 "I don't like it."

Mother: *vind je niet zo leuk .*
 "You don't like that."

Example 23, Peter (2;1): Peter has just chosen which chair he wants to sit on during lunch.

Mother: *daar aan tafel he .*
 "There at the table, right."

Peter: *gaat Peter zitten .*
 "Peter go sit."

Mother: *ja hoor .*
 "Yes, of course."

Peter: *vind fijn .*
 find.SG nice.
 "I like it."

When the evaluating use of *vinden* is established, children also use *vinden* to express more diverse thoughts and beliefs (Examples 24 and 25).

Example 24, Abel (2;10): Abel is pouring the investigator some juice.

Investigator: *nee , ik wil nog een beetje .*
 "No, I would like a little more."

Abel: *oh , wil je nog een beetje ?*
 "Oh, would you like a little more?"

Investigator: *ja .*
 "Yes."

Investigator: *als het mag .*
 "If that's alright."

Abel: *beetje noeg*
 "A little enough."

Abel: *ik vind het heel beetje noeg .*
 I find.SG it very little enough
 "I think it's very a little enough."

Example 25, Josse (3;2): The investigator has put a drawing of Santa that Josse made in the Christmas tree.

Josse: *maar dat is mijn kerstman .*
 But that is my Santa.

Josse: *nou ik vind dat ie eruit moet .*
 now I find.1SG that he out should
 "Well, I think it has to go out."

While *vinden* is often used to express quite strong thoughts and opinions, such as in Examples 24 and 25 above, *denken* (to think) seems to be used more often to refer to a neutral thought (Example 26) or the general act of thinking (Example 27).

Example 26, Peter (2;8): Peter and the investigator are playing with cars and a gate.

Peter: *ik denk ik denk dat de verkeerde kant is.*
I think.1SG, I think.1SG that the wrong side is.3SG.
"I think that's the wrong side."
Investigator: *ja ?*
"Yes?"
Peter: *hij moet naar een slagboom toe rijden.*
"He has to drive to a gate."

Example 27, Abel (3;0): Abel, his mother and the investigator are building a train track.

Abel: *je moete goed na weet-, denk-en, hoor.*
you have.to.SG well PRFX know-, think-INF INTJ.
"You have to think very carefully."
Mother: *ja, we moeten even goed nadenken met zijn allen.*
"Yes, we have to think very carefully together."
Mother: *denk, denk, denk.*
"Think, think, think."

This difference between *vinden* and *denken* can also be seen in discussions or conversations comparing thoughts and beliefs. When there is a contrast in thoughts or beliefs, it is often the verb *vinden* that is used to express this contrast. In Example 28, Josse not only contrasts the beliefs of himself, his mother, the investigator, and his brother Ruben, he also contrasts the belief something is scary with the belief something is nice.

Example 28, Josse (3;2): talking about Bassie and Adriaan, two clowns from a Dutch tv-program.

Mother: *vind je ze niet een beetje eng ?*
"Don't you think they're a bit scary?"
Josse: *nee.*
"No."
Mother: *nee ?*
"No?"
Mother: *oh.*
"Oh."
Mother: *ik vind ze altijd een beetje eng.*
"I always think they're a bit scary."
Investigator: *ik ook.*
"Me too."
Josse: *jij ook niet.*
"You not too."
Josse: *jij was, vind-t ze niet eng.*
you were, find-3SG them not scary.
"You were, don't think they're scary."
Investigator: *ja, ik vind ze een beetje eng.*
"Yes, I think they're a little scary."
Josse: *maar Ruben vind-t ze niet eng.*
but Ruben find-3SG them not scary.
"But Ruben doesn't think they're scary."
Investigator: *nee ?*
No?
Josse: *maar ik vind het clown-tje die nou bel-t vind ik*
but I find.SG the clown-DIM that now call-3SG find.SG I

niet een klein beetje, vind ik niet een klein beetje
not a little bit, find.SG I not a little bit

eng .

scary.

"But I think the clown that's calling now I think is not a little, I think is not a little scary."

Josse: *maar die vind ik wel, wel leuk .*
but that.one find.SG I POS, POS nice.
"But I think that one is nice."

Apart from thoughts and beliefs, children also often referred to knowledge or a lack thereof. Even though *weet ik niet* (I don't know) was often used to evade a question, as we have seen at the start of this section, there were also many occurrences in which this phrase was actually referring to a mental state of ignorance (Examples 29-31).

Example 29, Matthijs (2;6): Matthijs and his father are reading a picture book. His father is asking Matthijs what all the animals are.

Father: *en daar ?*
"And over there?"
 Matthijs: *papegaaien !*
"Parrots!"
 Father: *nee !*
"No!"
 Father: *schildpad .*
"Turtle."
 Matthijs: *nog een .*
"Another one."
 Matthijs: *die ə schildpad ?*
"That a turtle?"
 Matthijs: *ik weet het niet .*
I know.SG it not.
"I don't know."
 Father: *weet je het niet ?*
"You don't know?"
 Father: *ik denk het wel .*
"I think so, yeah."
 Father: *ook een schildpad .*
"A turtle as well."

Example 30, Daan (3;0): Daan is making a puzzle.

Daan: *dee moet eh, dee moet, dee moet...*
"This one goes er, this goes, this goes..." (Meaning: this piece of the puzzle goes...)
 Daan: *weet ik nog niet .*
know.SG I yet not.
"I don't know yet."
 Daan: *da hoort ie niet .*
"It doesn't belong there."

Example 31, Daan (3;1): Daan's mother has hidden a toy mouse, which Daan has to try and find.

Mother: *moet jij goed zoeken .*
 "You have to search really well."
 Mother: *piep piep .*
 "Squeak squeak."
 Daan: *waar nou, huh weet ik niet .*
 where now, huh know.SG I not.
 "Where now, huh, I don't know"
 Daan: *hallo .*
 "Hello." (Calling the mouse.)
 Mother: *ga maar zoeken !*
 Go and search!

Children also referred to the knowledge of someone else, both being able to ask whether they knew something (Example 32) and state that they knew something (Example 33).

Example 32, Abel (2;7): Abel is looking for some licorice in the kitchen cupboard, but he can't find it.

Abel: *weet je drop-je is ?*
 know.SG you licorice-DIM is.3SG?
 "Do you know where the licorice is?"
 Mother: *ah, dropje .*
 "Ah, licorice."
 Abel: *ja, in de kast .*
 "Yes, in the cupboard."

Example 33, Peter (2;7): Peter and his mother are looking for a toy moped. Note that Peter refers to himself using the second pronoun.

Mother: *waar kan je brommer nou toch zijn ?*
 "Where could your moped be?"
 Mother: *zou die nog boven zijn ?*
 "Could it be upstairs?"
 Mother: *nee ik weet het .*
 "No, I know."
 Peter: *mama weet het de brommer .*
 mama know.3SG it the moped
 "Mama knows where the moped is."
 Peter: *mama, mama, mama gaat de brommer voor jou pakken .*
 "Mama is going to get the moped for you."

Around age 2;6, when the referential use of belief verbs is established and *weet ik niet* has been used to evade questions for some months, other conversational functions of belief verbs start to occur as well. Only past three years old do these conversational functions become common. Children used, for example, utterances containing *weet je* (you know) to change the subject or to get someone's attention (Examples 34).

Example 34, Matthijs (3;7): Matthijs and the investigator are playing with a train set.

Matthijs: *weet je, deze trein kan zo gaan .*
 know.SG you, this train can.SG like.this go.INF
 "You know, this train can go like this."
 Matthijs: *weet je, deze trein kan +*
 know.SG you, this train can.SG
 "You know, this train can..."

Investigator: *ja ?*
 "Yes?"
 Matthijs: *+ zo gaan .*
 "...go like this."
 Investigator: *hoe dan ?*
 "Like what?"
 Matthijs: *zo achteruit .*
 "Backwards, like this."

Children also used *geloof ik* (I believe) and *denk ik* (I think) to mitigate a sentence (Examples 36 and 37).

Example 35, Tomas (2;8): Tomas is playing with a toy car, and has found something that looks like a spare wheel.

Tomas: *e wiel kijk nou .*
 "A wheel, look at that."
 Investigator: *ja , lijkt wel op een wiel, he?*
 "Yes, it looks like a wheel, doesn't it?"
 Tomas: *ja .*
 "Yes."
 Investigator: *ja .*
 "Yes."
 Tomas: *band denk ik .*
 tire think.1SG I
 "A tire, I think."

Example 36, Josse (3;4): Josse and the investigator are playing with Duplo, some colorful stacking blocks and toys.

Investigator: *er ligt iemand onder de voorwielen van de traktor .*
 There's someone underneath the front wheels of the tractor.
 Josse: *oh , ik ga hem eruit halen .*
 Oh, I'm going to get him out.
 Investigator: *ja .*
 Yes.
 Investigator: *leeft ie nog ?*
 Is he still alive?
 Investigator: *oh , gelukkig maar .*
 Oh, that's fortunate.
 Investigator: *wie was dat nou ?*
 Who was that?
 Josse: *dat is een man-netje , geloof ik .*
 that is a man-DIM, believe.1SG I.
 "I believe that's a man."
 Josse: *die onder de traktor , geloof ik .*
 that.one underneath the tractor, believe.1SG I.
 "That one underneath the tractor, I believe."
 Investigator: *hm , hm .*
 "Hm, hm."
 Josse: *maar nou is er geen mens onder de traktor .*
 "But now there's no human underneath the tractor."

Finally, children use longer fixed expressions such as *weet je wel* (you know, right) and *dacht het niet* (I didn't think so) (Examples 38 and 39). These expressions emerge quite late in the corpora.

Example 37, Tomas (2;10):

Investigator: *ik ga zo weer naar huis .*
 "I'll be going home soon."
 Tomas: *nee .*
 "No."
 Investigator: *ja , dacht ik wel .*
 "Yes, I thought so."
 Tomas: *ik dacht het niet .*
 I thought.SG it not.
 "I didn't think so."
 Investigator: *ik dacht het wel .*
 "I did think so."
 Father: *mag niet .*
 "Not allowed."
 Tomas: *mag niet .*
 "Not allowed."
 Father: *van wie mag dat niet .*
 "Who says it's not allowed?"
 Tomas: *van Tomas .*
 "Tomas."

Example 38, Josse (3;4): Josse and the investigator are playing with Duplo. They have made a castle.

Josse: *mama wil er iemand in .*
 "Someone wants (their) mommy in."
 Josse: *maar mama wil daarin .*
 "But mommy wants in there."
 Investigator: *ja ?*
 "Yes?"
 Josse: *ja .*
 "Yes."
 Josse: *van die man-netje , weet je wel ?*
 Of that man-DIM, know.SG you right?
 "Of that little man, you know, right?"
 Investigator: *oh ja .*
 "Oh, right."

4.3 Control measures

There are several background factors that could influence a child's understanding and production of mental language. Some examples are the socio-economic status of the child's family; the culture in which the child is raised; the child's general verbal ability; the child's relationship with her parents; her interaction with her parents, siblings and peers; and the input she hears. Here, I will look at two control measures: the verbal ability of the children, as proxied by their mean length of utterance (MLU) at a certain age, and the frequency of mental verbs in parental input.

4.3.1 Verbal ability of the children, as proxied by mean length of utterance

General verbal ability might influence children's developing understanding of mind: children that are more developed in language in general, could also be more developed in language of mind. To examine this, we can use mean length of utterance (MLU) as a proxy for verbal development, and check for a relation with the age at which the children start to refer to mental states. Bartsch and Wellman did this check for references to belief only, using MLU at the third birthday. They found no relationship between children's MLU and children's age at first genuine reference to belief, $r(7) = -.19$, n.s. (Bartsch & Wellman, 1995, p. 132).

I used the mean MLU at ages 2;6-2;9 as a measure, as the MLU varied quite a bit for each transcript. This age category was the latest age category in which all children have transcripts. No relationship was found between MLU and the children's age at first reference to desire, $r(7) = -.025$, n.s. No relationship was found between MLU and the children's age at first reference to belief, $r(7) = -.38$, n.s. Thus, it seems unlikely that the moment children start to talk about desires and beliefs is a consequence of their linguistic abilities.

4.3.2 Frequency of mental verbs in parental input

The input a child hears can potentially have a big influence on the child's developing mental language. The Groningen corpus has most adult utterances in the recording transcribed as well. Sometimes, when adults are talking to each other for a long time, there is a gap in the transcription, but all child-directed speech is transcribed. Because of this, it was possible to compare the frequency of the mental verbs uttered by the children to the frequency of those verbs in the input the children get.

Some of the mental verbs used by the adults also have a non-target meaning. This can't be controlled for fully, as it is not possible to check all adult utterances one by one. However, some specific forms that are mostly used in a non-target way could be excluded. This was done for the form *gevonden* ("found") from the verb *vinden*, as this is seldom used in a mental referring way, and for *alsof* ("as if"), as this occurred frequently apart from the verb *doen alsof* ("to pretend", literally "to do as if"). Still, in particular the frequencies of the verbs *vinden* and *zin hebben* are higher than they should be, because of the unavoidable inclusion of some non-target uses.

All the children got comparable input. For all children, on average 3,5% of the utterances contained a belief verb (range 2,9%-3,9%), while on average 1,8% of the utterances contained a desire verb (range 1,5%-2,0%). Further details can be found in appendix F. Table 4-8 and 4-9 show the frequency of the mental verbs that occur in the children's speech at age 3;0-3;9, where the use of both desire and belief verbs is well established, and the frequency of mental verbs in adult's speech. Compared with the verb frequency of the children at this age, the adult order of frequency is comparable for both desire and belief. The most noticeable difference is that children use *weten* more frequently, while adults use *denken* more frequently. This can perhaps be explained by the way children use *weet ik niet* (I don't know) frequently to evade a question, something rarely occurring in adult speech.

Table 4-8: child and adult frequencies for desire verbs in the Groningen corpus

Desire verb	Child frequency (age 3;0-3;9)		Adult frequency	
<i>Willen</i>	374	(96,9%)	2537	(85,7%)
<i>(Niet) hoeven</i>	12	(3,1%)	298	(10,1%)
<i>Zin hebben (in)</i>	0	(0,0%)	124	(4,2%)
Total	386		2959	

Table 4-9: child and adult frequencies for belief verbs in the Groningen corpus

Belief verb	Child frequency (age 3;0-3;9)		Adult frequency	
<i>Weten</i>	216	(55,0%)	1684	(29,1%)
<i>Vinden</i>	116	(29,5%)	1640	(28,3%)
<i>Denken</i>	31	(7,9%)	1432	(24,7%)
<i>Geloven</i>	11	(2,8%)	282	(4,9%)
<i>Kennen</i>	5	(1,3%)	185	(3,2%)
<i>Vergeten</i>	4	(1,0%)	104	(1,8%)
<i>Bedoelen</i>	3	(0,8%)	269	(4,6%)
<i>Begrijpen</i>	2	(0,5%)	50	(0,9%)
<i>Snappen</i>	2	(0,5%)	95	(1,6%)
<i>Doen alsof</i>	1	(0,3%)	excluded	
<i>Menen</i>	1	(0,3%)	11	(0,2%)
<i>Verzinnen</i>	1	(0,3%)	41	(0,7%)
Total	393		5793	

In the adult data the amount of desire verbs is lower than the amount of belief verbs. In the child data at age 3;0-3;9, the frequency of desire verbs was almost equal to the amount of belief verbs. Moreover, we have seen that children often produce desire verbs before producing belief verbs, and use desire verbs more frequently at an early age. If the mental verbs they produce would have been a close reflection of the input they hear, we would expect children to produce belief verbs more frequently. Since this is not the case, it seems likely that frequency with which children use mental verbs is not directly related to the frequency of mental verbs in the parental input.

4.4 Summary of results

In general, desire verbs occurred more frequently in the corpora than belief verbs. However, this pattern of frequency is not consistent over the corpora taken into account. The difference between desire and belief verbs is most clear in the English data, as taken from Bartsch and Wellman (1995), where children talk much more frequently about desire than about belief. In the Van Kampen corpus, this pattern is similar but the difference is smaller; in the Groningen corpus it is even smaller; and in the CLPF corpus the pattern is reversed: children talk more often about belief than about desire.

Age of emergence of desire and belief verbs in Dutch children's language diverges from the English data. The Dutch children in these corpora show no clear desire-belief order. They also use belief verbs at an earlier age than English children. Still, for all eight children for which context was available, the first referential use of a desire verb preceded the first referential use of a belief verb. As the first referential use of a desire

verb nearly always occurs in the same month as the first occurrence of a desire verb, it seems plausible that reference to desire occurs as soon as children use desire verbs at all. On contrast, there is a mean three-month gap between the first occurrence of a belief verb and the first referential use of a belief verb.

In the Groningen corpus, desire verbs were used more often to refer to a mental state than belief verbs. From the moment children start producing desire verbs, a large percentage is used in a referential way. When children start using belief verbs, they do so mostly in a non-referential way, due to the frequent use of *weet ik niet* ("I don't know"). Very soon, references to belief start to occur and grow more frequent. At age 3;0, when children start to use belief verbs for other conversational functions such as getting attention, this pattern flips again.

The children from the Groningen corpus used desire and belief verbs in many different ways. They expressed desire to make requests and rejections, to express a general desire, to explain actions of others and themselves, to inquire about someone else's desire, and to offer things. They used desire verbs in a non-referential way to make formulaic requests and offerings. They expressed thoughts and beliefs to evaluate things, to compare their thoughts with those of someone else, to talk about a thought or thinking in general, to express their or someone else's knowledge or, oppositely, their ignorance. They used belief verbs in a non-referential way to evade questions, to get someone's attention, to change a subject or to mitigate a sentence.

Neither MLU nor parental input appear to be strong predictors for the patterns observed in children's mental language in this study.

5 Discussion

How does theory of mind develop in young children? Earlier research showed divergent results: children can complete non-verbal, non-eliciting theory of mind tasks at a very young age; they can complete the verbal, eliciting variants of these tasks years later; and somewhere in between they start to use mental verbs in their natural speech to refer to mental states. All three approaches of theory of mind suggest that children's understanding or production of desire precedes belief. This study set out to answer two main questions: Does the order of emergence and frequency of desire and belief verbs in Dutch children's speech match earlier findings in English children's speech, and what are some early functions of desire and belief verbs in conversation between Dutch children and their caregivers? In this chapter, I will discuss the results for these two questions (sections 5.1 and 5.2 respectively) and discuss the results in relation to the universality of theory of mind development (section 5.3). Finally, I will describe the limitations of the current study and list possible directions for further research (section 5.4) and formulate a conclusion (section 5.5).

5.1 Frequency and age of emergence of desire and belief verbs

There are both differences and similarities between the Dutch and English children's frequency and age of emergence of desire and belief verbs. I will here give a short summary of the differences and similarities, before discussing them in more detail in the following paragraphs. Concerning frequency of desire and belief verbs (research question 1a), English children use much more mental verbs in general, but both Dutch and English children use more desire verbs than belief verbs. Concerning age of emergence (research question 1b), Dutch children don't show the clear desire-belief verb emergence order that is apparent in the English children's data. Looking at whether the verbs are first used in a referential or non-referential way (research question 1c), there are mainly similarities: both Dutch children and English children refer to desire before they refer to belief; Dutch children refer to desire as soon as they use desire verbs, which Bartsch and Wellman suspected English children do as well; and both Dutch and English children first use belief verbs in a non-referential way before using them referentially. However, Dutch children use belief verbs and refer to belief earlier than English children. The gap between non-referential and referential use of belief verbs is smaller for Dutch children as well.

A striking difference is the one concerning the frequency of desire and belief verbs: English children use mental verbs much more frequently than the Dutch children. There were big differences between the three Dutch corpora as well. The most plausible explanation for the difference between the Dutch corpora seems to be due to the adults that appear in them. In the Van Kampen corpus, where the frequency of desire utterances was much higher than belief utterances, the main adult interlocutor is Van Kampen herself, who is both the mother of the two girls and the investigator. In the Groningen corpus, where the frequency of desire utterances is still higher than belief utterances but the difference is smaller, both a parent (most often the mother) and the investigator are present during the recordings. In the CLPF corpus, where the frequency of *belief* utterances was higher than desire utterances, the recording sessions were mostly focused on the child and an investigator, and occasionally a parent.

Since early uses of desire verbs were predominantly requests and rejections, it seems plausible that the children from the three corpora use desire verbs more often when talking to their parents, as they are the ones that will be answering their requests and rejections the most. With the investigators, on the other hand, conversation will probably turn toward the toys or books that are being played with, perhaps prompting questions about what the child thinks about a picture. With this taken into account, it is not very surprising that the three corpora give such different results. This importance of pragmatic context is consistent with the critique given on the Theory of Mind Scale tasks, claiming that pragmatic context has a great influence on way a child answers a question.

For the difference between the frequencies from the English and Dutch data, however, pragmatics doesn't seem to be the full answer. The English data encompassed six different corpora and it is not the case that only one or two of them have a striking higher frequency of mental verbs. It might be the case that English children simply express desires and beliefs more often than Dutch children. It could also be the case that Dutch children do express desires and beliefs as often, but do so without using a mental verb. Whichever reason, there doesn't seem to be an explanatory factor for this difference, except for the children's native language.

The second difference between the Dutch and English data concerned the age of emergence of desire and belief verbs. In the English data, there was a clear order of desire verbs before belief verbs. In the Dutch data, this was the case for some children, but certainly not all of them. It is difficult to say why this might be the case. Further research might be necessary to see whether this pattern holds when more children are taken into account.

Dutch children not only used belief verbs at a younger age than the English children, they also used them in a referential way at a younger age. This difference could be explained by the Dutch belief verb *vinden* (to think, to find), that Dutch children use early on to express what they like or don't like (*leuk/lekker vinden*). Because expressing your likes and dislikes is important to young children, who cannot yet for example make their own food or buy their own clothes, this could prompt them to learn this belief verb at an early age. The English verb *to like* has not been included as a belief verb in previous work. It might be that the age of first referential use of a belief verb would have been earlier, were it included.

The suggestion that the native language of a child influences their acquisition of mental verbs is in keep with the fact that Mandarin-speaking children start to refer to desire at an earlier age than both English-speaking and Dutch-speaking children. Both differences seem to be due to the differences in mental verbs that exist in Mandarin, English and Dutch, and the way these verbs are used.

5.2 Functions of desire and belief verbs

Earlier studies into theory of mind mostly discarded non-referential uses of mental verbs as irrelevant. This study looked at both referential and non-referential uses of mental verbs. The patterns that emerge are dissimilar for desire and belief. Children refer to desire as soon as they acquire desire verbs, and non-referential uses of desire verbs seem to evolve from referential uses that became more formulaic. For belief, it is

the other way around: children use belief verbs in a non-referential way first, and it takes some time before they use belief verbs in a referential way.

The way children use mental verbs can help us understand why children show these developmental patterns. When looking at desire verbs, we can see that the earliest uses were all either a request or a rejection. They were references to a child's mental state of desire, but they also clearly served a conversational function: telling someone else what you want or don't want. For young children, this is a very important thing, as you still need adults to get you food, clothing, toys, or any other thing you might want or need.

For belief, the earliest utterances containing a belief verb were mostly *weet ik niet* (I don't know) or some variant thereof. The earliest references to belief, however, were made using the verb *vinden* (to think, to find). Shatz et al. (1983) and Bartsch and Wellman (1995) argued that the gap between the emergence and first referential uses of belief verbs is there, because children need more cognitive development before being able to refer to beliefs. After all, why would they not refer to mental states when they have already acquired the verbs needed to refer to them? Based on the Dutch data, however, it seems more likely that *weet ik niet* is only a formulaic expression, of which children don't really understand what the verb *weten* (to know) means. It might thus still be the case that children understand the concept of thought and belief; they just haven't acquired the verb *weten* itself yet, outside the formulaic *weet ik niet*.

The more complicated non-referential conversational functions involving belief verbs, such as mitigating a sentence and longer formulaic constructions, only occurred sometime after referential use of belief verbs was well established. This is similar to the way non-referential uses of desire verbs develop. It might be the case that children learn different non-referential uses of mental verbs in two different ways: learning the formulaic expression as a whole, as seems to be the case with *weet ik niet*, and having the expression evolve from common referential uses to a mental state, as seems to be the case with non-referential uses of desire verbs and more complicated non-referential uses of belief verbs.

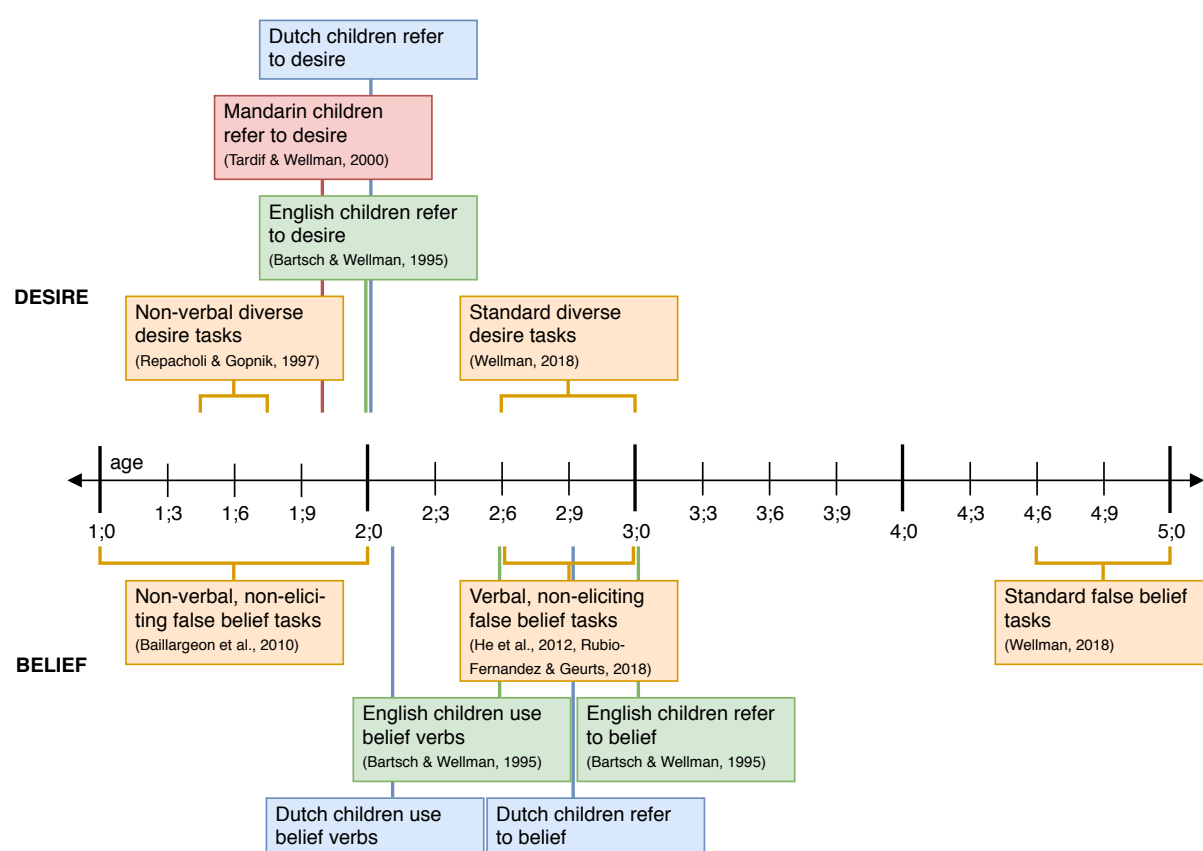
Concerning the referential uses of mental verbs, it is interesting to see that the children used desire and belief verbs in many different ways. This demonstrates that the children understood the meaning of the verbs well, as opposed to only using the verbs in specific contexts or phrases. The children often used the mental verbs to explain actions and requests, both from themselves and from others. This shows that their theory of mind is already well developed.

5.3 Universality of theory of mind development

Figure 5-1 shows the timeline seen in chapter 2, now including the results from this study. Even though Dutch children's mental state language diverges in some ways from the English data, it fits the general timeline well: Dutch children refer to desire from about age 2;0, which is older than the Mandarin children but similar to the Cantonese and English children, and they refer to belief from about age 2;9, which is somewhat earlier than the English children. The most important similarity between the Dutch and English data is that both Dutch and English children refer to states of desire before referring to states of belief. Also, desire verbs and references to desire are more frequent than belief verbs and references to belief, in both the Dutch and English data.

These two similarities are in keep with the consistent order found in the Theory of Mind scale and both support the theory of a universal cognitive system that Bartsch and Wellman (1995) argue for. Especially since there were more belief than desire verbs in the parental input for the children, it is striking that desire verbs are both emerging earlier and occur more frequently. It is also interesting that both Dutch and English children use belief verbs in a non-referential way before using it referentially. It might be the case that children know the verbs before they have the cognitive ability to refer to the mental states corresponding with them. A universal cognitive developmental system would thus explain these patterns. It would also explain why the Mandarin- and Cantonese-speaking children use polysemous verbs to refer to desire before they use them to refer to belief, as seen in Tardif and Wellman (2000).

Figure 5-1: timeline based visualization of theory of mind literature, including results from this study



There are, however, other possible explanations for this as well. In section 5.2 for example, we already discussed that the earliest non-referential uses of belief verbs might be purely formulaic expressions, of which the children don't know what the verbs they involve exactly mean. That might explain why children use belief verbs in a non-referential way before using them in a referential way. With regards to the order of desire and belief, one important possible explanation is noted by Tardif and Wellman:

It is also possible that other child factors besides a universal basis for a theory of mind are responsible for the progression from desire to thought and belief. One of these might have to do with the general pragmatics of being and interacting with a young child. Because toddlers are still unable to care for themselves in most respects, it is possible that they talk about desires early simply because they need assistance

from a caregiver in order to fulfill these desires. Such a pragmatic explanation is also consistent with children's referring to their own desires before they refer to those of others (...). (Tardif & Wellman, 2000, p. 37)

This pragmatic explanation is consistent with many of the results seen in this thesis. It explains why children refer to states of desire as soon as they acquire desire verbs and why the earliest referential uses of desire verbs are all requests and rejections. It is in keep with the differences between the three Dutch corpora, that seem to be due to the pragmatic context of the conversations. It is consistent with the suggestion that Dutch children acquire *vinden* early because evaluating things is pragmatically important for young children, thereby referring to belief at a younger age than the English children. It is, of course, also in line with the criticism on the Theory of Mind Scale from Baillargeon (2010), Westra and Carruthers (2017), He et al. (2012) and Rubio-Fernández and Geurts (2013), as described in chapter 1. These researchers all argued that the pragmatic context of an experimental situation influences the child's performance on the Theory of Mind Scale tasks. It might even be the case that Korean children are early in their acquisition of epistemic markers (Choi, 1991) because of pragmatic reasons.

These different factors are not mutually exclusive. It seems most likely that cognitive development, pragmatic context and native language all play an important role in children's developing theory of mind and their mental language. Ideally, future research into theory of mind will be able to encompass all factors, in order to see which factors are the most important and how the factors influence each other.

5.4 Limitations and suggestions for future research

Although this study used all available Dutch longitudinal corpora containing natural language, the amount of children studied was quite small. Of the 20 children for whom recordings were available, four were excluded because they barely used mental verbs, leaving data from 16 children to look at frequency and age of emergence. Of these 16, four more had so few mental state utterances that their data might not be representative. The analysis of the way mental verbs were used was done using the data of only six children, all of which were boys. In particular, research considering more children will be necessary to see whether the order of acquisition of desire and belief verbs is indeed unclear for Dutch children, as there seems to be no good reason why Dutch children would not hold to that pattern.

There are many possible directions for further research, concerning the influence of native language, concerning the influence of pragmatics, and looking further into the different uses of mental state verbs. Regarding the influence of native language, one of the subjects that need further research concerns the difference in frequency of mental state verbs between the Dutch and English children. A starting point would be the frequency of mental verbs in adult speech from both languages, both in child directed speech and natural conversation between adults. Another subject related to the influence of native language concerns the difference in meaning of mental verbs in different languages. Dutch children might have acquired *vinden* early because its evaluative meaning. It would be interesting to see whether the age of first reference to belief in English children would be different if verbs as *to like* were included in the research. It is also interesting in itself that the Dutch children used *vinden* and *denken* in a different way, although on first sight the verbs are very similar and both are

translatable with *to think*. Further research might look into the more nuanced meanings of different mental state verbs in different languages, studying whether they even can be translated directly. This could create an important basis for further cross-linguistic research into theory of mind.

Concerning pragmatics, further research will be needed to study the influence of pragmatic contexts on mental state language, and whether this is indeed the factor that differentiates the three Dutch corpora. It would also be interesting to see whether it is a universal pattern that the earliest uses of desire verbs are used for requests and rejections. Concerning conversational uses, further research might look into the different kinds of formulaic expressions identified in this study, and see whether it is indeed the case that early expressions like *weet ik niet* are acquired in a different way than the expressions evolving from referential uses of mental verbs. Related to this point, it would be interesting to see whether *weet ik niet* always precedes children's referential use of belief verbs. If that is indeed the case, that would suggest that expressions like these act as a gateway into the referential use of belief verbs.

Ideally, future research would incorporate all aspects of theory of mind discussed in this thesis: early experimental research involving non-eliciting, non-verbal tasks; parental questionnaires to capture the earliest uses of mental verbs; corpus research targeting multiple pragmatic contexts; and conventional experimental research at a later age. Ideally, this would not only include belief and desire, but also the other tasks from the Theory of Mind scale and verbs of evaluation and emotion. It is important to conduct future research in many different languages and cultures, since even the Dutch and English data were divergent, even though both the languages and the cultures are more similar than many other languages and cultures on earth. It is also most important to always keep the pragmatic context of an experimental situation or a natural conversation in mind, as multiple factors point to the importance of pragmatics. We might then be able to disentangle which parts of theory of mind development are universal, which parts are dependent on native language and pragmatic context, and how all these different factors influence each other.

5.5 Conclusion

This thesis contained the first study into Dutch children's mental language. It considered the children's use of desire and belief verbs from different perspectives, looking at both quantitative and qualitative matters. Even though the study involved few children and was exploratory in its nature, it has shown that both language-specific features and pragmatic context of conversation can influence early mental state language. Further research is needed to see to which extent language-specific features and pragmatic context influence children's mental language compared with children's cognitive development, and whether they influence other aspects of children's theory of mind as well.

References

- Apperly, I. A., & Butterfill, S. A. (2009). Do humans have two systems to track beliefs and belief-like states? *Psychological Review*, 116(4), 953–970.
<https://doi.org/10.1037/a0016923>
- Astington, J. W., & Gopnik, A. (1991). Theoretical explanations of children's understanding of the mind. *British Journal of Developmental Psychology*, 9(1), 7–31.
<https://doi.org/10.1111/j.2044-835X.1991.tb00859.x>
- Baillargeon, R., Scott, R. M., & He, Z. (2010). False-belief understanding in infants. *Trends in Cognitive Sciences*, 14(3), 110–118. <https://doi.org/10.1016/j.tics.2009.12.006>
- Bartsch, K., & Wellman, H. M. (1995). *Children Talk About the Mind* (First Edition edition). New York: Oxford University Press.
- Bretherton, I., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. *Developmental Psychology*, 18(6), 906–921.
<https://doi.org/10.1037/0012-1649.18.6.906>
- Bretherton, I., McNew, S., & Beeghly-Smith, M. (1981). Early person knowledge as expressed in gestural and verbal communication: When do infants acquire a 'theory of mind'? In M. E. Lamb & L. R. Sherrod (Eds.), *Infant social cognition: Empirical and Theoretical Considerations*. Hillsdale, N.J.: Earlbaum.
- Calero, C. I., Salles, A., Semelman, M., & Sigman, M. (2013). Age and gender dependent development of Theory of Mind in 6- to 8-years old children. *Frontiers in Human Neuroscience*, 7. <https://doi.org/10.3389/fnhum.2013.00281>
- Charman, T., Ruffman, T., & Clements, W. (2002). Is there a Gender Difference in False Belief Development? *Social Development*, 11(1), 1–10.
<https://doi.org/10.1111/1467-9507.00183>
- Choi, S. (1991). Early acquisition of epistemic meanings in Korean: A study of sentence-ending suffixes in the spontaneous speech of three children. *First Language*, 11(31), 93–119. <https://doi.org/10.1177/014272379101103105>
- Clements, W. A., & Perner, J. (1994). Implicit understanding of belief. *Cognitive Development*, 9(4), 377–395. [https://doi.org/10.1016/0885-2014\(94\)90012-4](https://doi.org/10.1016/0885-2014(94)90012-4)
- Davidson, D. (1963). Actions, reasons and causes. *Journal of Philosophy*, 60, 685–700.
- De Bruin, L. C., & Newen, A. (2012). An association account of false belief understanding. *Cognition*, 123(2), 240–259. <https://doi.org/10.1016/j.cognition.2011.12.016>
- Fikkert, P. (1994). On the Acquisition of Prosodic Structure. In *Leiden: HIL Dissertations in Linguistics* (Vol. 6). The Hague: Holland Academic Graphics.
- Flavell, J. H., Flavell, E. R., Green, F. L., & Moses, L. J. (1990). Young Children's Understanding of Fact Beliefs versus Value Beliefs. *Child Development*, 61(4), 915–928. <https://doi.org/10.1111/j.1467-8624.1990.tb02831.x>
- He, Z., Bolz, M., & Baillargeon, R. (2012). 2.5-year-olds succeed at a verbal anticipatory-looking false-belief task. *British Journal of Developmental Psychology*, 30(1), 14–29. <https://doi.org/10.1111/j.2044-835X.2011.02070.x>
- Kristen, S., Chiarella, S., Sodian, B., Aureli, T., Genco, M., & Poulin-Dubois, D. (2014). Crosslinguistic Developmental Consistency in the Composition of Toddlers'

- Internal State Vocabulary: Evidence from Four Languages.
<https://doi.org/10.1155/2014/575142>
- Levelt, C. (1994). On the Acquisition of Place. In *Leiden: HIL Dissertations in Linguistics* (Vol. 6). The Hague: Holland Academic Graphics.
- Limber, J. (1973). The Genesis of Complex Sentences. In T. E. Moore (Ed.), *Cognitive Development and Acquisition of Language* (pp. 169–185).
<https://doi.org/10.1016/B978-0-12-505850-6.50013-X>
- Pascual, B., Aguado, G., Sotillo, M., & Masdeu, J. C. (2008). Acquisition of mental state language in Spanish children: A longitudinal study of the relationship between the production of mental verbs and linguistic development. *Developmental Science*, 11(4), 454–466. <https://doi.org/10.1111/j.1467-7687.2008.00691.x>
- Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, 1(4), 515–526.
<https://doi.org/10.1017/S0140525X00076512>
- Repacholi, B. M., & Gopnik, A. (1997). Early Reasoning About Desires: Evidence from 14- and 18-Month-Olds. *Developmental Psychology*, 33(4), 12–21.
- Rice, S., & Newman, J. (2018). A Corpus Investigation of English Cognition Verbs and their Effect on the Incipient Epistemization of Physical Activity Verbs. *Russian Journal of Linguistics*, 22(3), 560–580. <https://doi.org/10.22363/2312-9182-2018-22-3-560-580>
- Searle, J. R. (1983). *Intentionality: An Essay in the Philosophy of Mind*. Cambridge University Press.
- Shatz, M., Wellman, H. M., & Silber, S. (1983). The acquisition of mental verbs: A systematic investigation of the first reference to mental state. *Cognition*, 14(3), 301–321. [https://doi.org/10.1016/0010-0277\(83\)90008-2](https://doi.org/10.1016/0010-0277(83)90008-2)
- Tardif, T., & Wellman, H. M. (2000). Acquisition of mental state language in Mandarin- and Cantonese-speaking children. *Developmental Psychology*, 36(1), 25–43.
<https://doi.org/10.1037/0012-1649.36.1.25>
- van Kampen, J. (2009). The non-biological evolution of grammar: Wh-question formation in Germanic. *Biolinguistics*, 3(2–3), 154–185.
- Wellman, H. M. (1992). *The child's theory of mind*. Cambridge, MA, US: The MIT Press.
- Wellman, H. M. (2018). Theory of mind: The state of the art. *European Journal of Developmental Psychology*, 15(6), 728–755.
<https://doi.org/10.1080/17405629.2018.1435413>
- Wellman, H. M., & Liu, D. (2004). Scaling of Theory-of-Mind Tasks. *Child Development*, 75(2), 523–541. <https://doi.org/10.1111/j.1467-8624.2004.00691.x>
- Westra, E., & Carruthers, P. (2017). Pragmatic development explains the Theory-of-Mind Scale. *Cognition*, 158, 165–176. <https://doi.org/10.1016/j.cognition.2016.10.021>
- Wijnen, F., & Bol, G. (1993). The escape from the optional infinitive stage. In A. de Boer, J. de Jong, & R. Landeweerd (Eds.), *Language and Cognition* (Vol. 3). University of Groningen, Dept. of Linguistics.

Appendices

Appendix A: tables from previous natural language literature

Table 5-1: Mental words used by Abe, derived from Shatz et al. Table 1 (1983, p. 306)

	Total number of occurrences	Age of first occurrence of word	Age of third occurrence of word	Age of first mental state function
Verbs				
Know	709 (440)*	2;4	2;5	2;10
Think	405	2;8	2;8	2;8
Mean	79	2;8	2;11	3;2
Forget	58	2;4	3;0	3;3
Remember	45	2;9	2;10	2;9
Guess	35	2;8	2;11	3;1
Pretend	32	2;10	3;1	2;10
Dream	26	3;0	3;2	3;0
Bet	26	2;9	3;3	3;4
Hope	22	2;7	2;7	-
Trick	13	2;10	3;0	3;8
Wonder	11	2;9	2;11	2;9
Wish	9	2;10	3;2	-
Figure	6	2;5	2;6	3;5
Believe	4	2;8	2;8	2;11
Understand	2	2;11	-	-
Suppose**	1	3;4	-	-
Nouns				
Idea	36			
Dream	10			
Trick	16			
Adjective				
Pretend				

* 38% of all uses of *know* occurred in the phrase *I Don't Know*. The figure in parentheses gives the occurrences of the verb *know* excluding instances of *I Don't Know*.

** Use of *suppose* in passive form as a synonym of the modal form *should* was excluded from consideration

Table 5-2: Total occurrences of desire and belief verbs by age, derived from Bartsch and Wellman Table 2.5 (1995, p. 28)

Child		1;6- 2;1	2;1- 2;5	2;5- 2;9	2;9- 3;1	3;1- 3;5	3;5- 3;9	3;9- 4;1	4;1- 4;5	4;5- 4;9	4;9- 5;1	5;1- 6;0	Total
Abe	Desire		8	394	581	225	293	152	83	75	88		1.899
	Belief		1	50	176	370	230	276	184	163	108		1.558
Adam	Desire		5	146	326	393	129	135	142	157	100	67	1.600
	Belief		5	19	68	93	103	201	161	109	111	39	909
Allison	Desire	0	49		22								71
	Belief	0	0		14								14
Eve	Desire	67	161										228
	Belief	14	6										20
Mark	Desire	1	1	11	6		46	41	21				127
	Belief	0	0	2	1		30	63	2				98
Naomi	Desire	131	139	54	77	88	46			47			582
	Belief	0	1	29	19	31	29			25			134
Nathaniel	Desire			146	10	71	12	4					243
	Belief			27	21	29	10	1					88
Peter	Desire	6	86	423	200	42							757
	Belief	1	20	43	59	49							172
Ross	Desire			86	215	154	159	64	96	62		129	965
	Belief			6	38	64	100	58	118	97		207	688
Sarah	Desire		21	14	282	169	116	113	108	143	62	7	1.035
	Belief		0	15	31	37	122	51	102	156	136	21	671
Total Desire		205	470	1.274	1.719	1.142	801	509	450	484	250	203	7.507
Total Belief		15	33	191	427	673	624	650	567	550	355	267	4.352

Table 5-3: age at first occurrence of Mandarin target verbs, derived from Tardif and Wellman Table 1 (p. 29)

Child	<i>yao4</i> (want)	<i>xiang3</i> (want/think)	<i>hui4</i> (know how)	<i>neng2</i> (is able)	<i>zhi1dao4</i> (know that)
B.B.	1;10*	-	2;0	2;2	1;11
C.X.X.	1;10	2;0	2;0	-	-
H.Y.	1;9*	1;10	1;10	2;1	-
L.C.	1;11	2;0	2;0	2;1	-
L.L.	1;9*	1;11	1;11	1;11	-
L.X.B.	1;9*	1;11	1;10	1;11	1;10
T.T.	1;10	-	-	2;0	-
W.W.	1;11*	1;11*	2;0	2;3	2;1
W.X.	1;10*	2;1	2;1	2;0	1;11
Y.Y.	1;11*	2;2	1;11*	2;0	1;11*

* the verb was produced in the first available transcript for that child.

Table 5-4: age at first occurrence of Cantonese target verbs, derived from Tardif and Wellman Table 5 (p. 35)

Child	<i>jui3</i> (want)	<i>soeng2</i> (want/think)	<i>sik1</i> (know how)	<i>zi1</i> (know that)	<i>nam5</i> (think)
C.C.C.	2;3	2;9	2;4	2;4	-
C.G.K.	1;11*	1;11*	1;11*	1;11*	-
C.K.T.	1;8	2;5	1;11	1;8	-
H.H.C.	2;5	2;8	2;10	2;5	3;0
L.L.Y.	2;9*	3;1	2;9	2;9	3;4
L.T.F.	2;2*	2;5	2;2*	2;3	2;11
M.H.Z.	1;11	2;4	2;2	1;8*	-
W.B.H.	2;4*	2;4*	2;4	2;9	3;4

* the verb was produced in the first available transcript for that child.

Appendix B: Dutch desire and belief verbs

Table 5-5: Dutch verbs expressing desire

Desire verb	Translation
<i>Afkeuren</i>	To disapprove, to reject
<i>Afwijzen</i>	To reject
<i>Bang zijn dat</i>	To fear
<i>Begeren</i>	To desire
<i>Dromen (van)</i>	To dream of
<i>Hopen</i>	To hope
<i>Hunkeren</i>	To crave, to hunger
<i>(zich) interesseren (in)</i>	To be interested (in)
<i>Niet hoeven</i>	To not care for something (e.g. food)
<i>Nodig hebben</i>	To need
<i>Smachten</i>	To yearn, to pine
<i>Snakken</i>	To crave
<i>Uitkijken (naar)</i>	To look forward to
<i>Uitzien (naar)</i>	To look forward to
<i>Verlangen</i>	To long for
<i>Vrezen</i>	To fear
<i>Wensen</i>	To wish
<i>Willen</i>	To want
<i>Zin hebben in</i>	To feel like, to fancy

Table 5-6: Dutch verbs expressing belief or thought

Belief verb	Translation
<i>Aannemen</i>	To assume
<i>Afvragen</i>	To wonder
<i>Bedoelen</i>	To mean
<i>(In/ver)beelden</i>	To imagine
<i>Begrijpen</i>	To understand
<i>Beschouwen</i>	To regard
<i>Beseffen</i>	To realize
<i>Bevroeden</i>	To suppose
<i>(be/na/in/over)-denken</i>	To think
<i>Doen alsof</i>	To pretend
<i>Erkennen</i>	To acknowledge
<i>Fantaseren</i>	To fantasize
<i>Geloven</i>	To believe
<i>Gissen</i>	To guess
<i>Herinneren</i>	To remember
<i>Inzien</i>	To realize, to see
<i>Kennen</i>	To know
<i>Kunnen</i>	To be able to
<i>Menen</i>	To think
<i>Mijmeren</i>	To muse
<i>Onthouden</i>	To remember
<i>Oordelen</i>	To judge
<i>(Over)peinzen</i>	To ponder
<i>Overwegen</i>	To consider
<i>Piekeren</i>	To worry
<i>Raden</i>	To guess
<i>Realiseren</i>	To realize
<i>Rekenen (op)</i>	To count on, wager on
<i>Snappen</i>	To understand
<i>Tobben</i>	To worry, to fret
<i>(Be)twijfelen</i>	To doubt
<i>(Be)vatten</i>	To get, to understand
<i>Vergeeten</i>	To forget
<i>Vergissen</i>	To be mistaken, to err
<i>Vermoeden</i>	To suspect
<i>Veronderstellen</i>	To assume
<i>Verstaan</i>	To get, to understand
<i>Verwachten</i>	To expect
<i>(iets) verwarren (met)</i>	To confuse
<i>Verzinnen</i>	To think up, to make up
<i>Vinden</i>	To think
<i>Voorstellen</i>	To imagine
<i>Weten</i>	To know

Appendix C: List of glosses

Table 5-7: glosses used in this thesis

DIM	Diminutive
INF	Infinitive
INTJ	Interjection
POS	Positive
PRFX	Prefix
PTCP	Participle
SG	Singular
1SG	First person singular
3SG	Third person singular

Appendix D: Full coding scheme

Main coding:

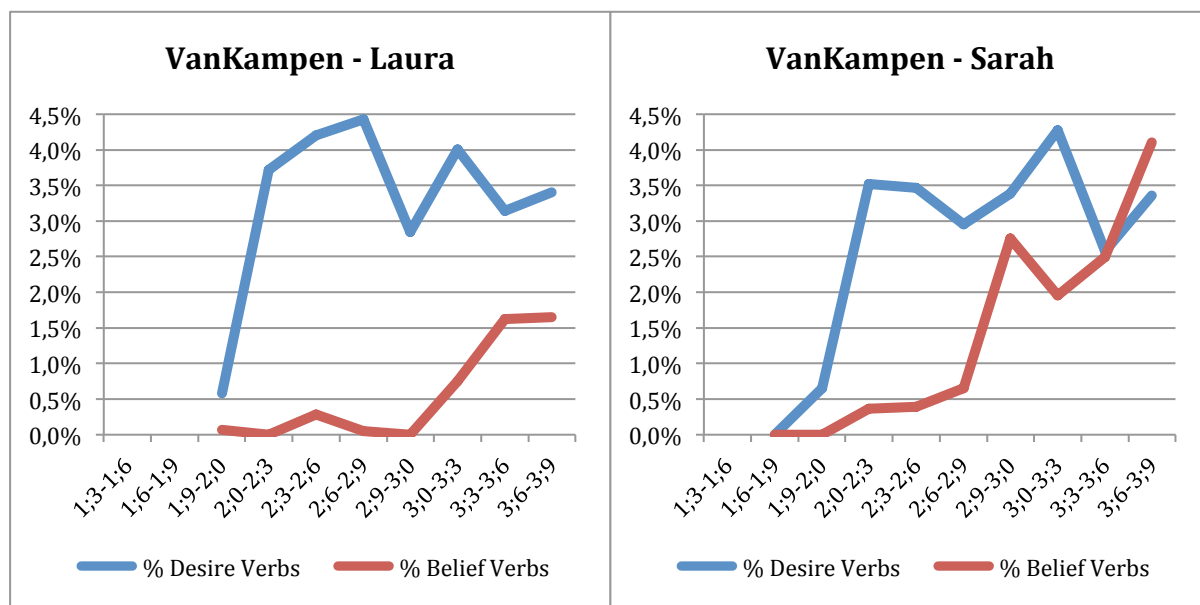
- Referential use
 - An utterance is coded as referential use if the verb is judged, with regard to its context, to refer to a propositional attitude of the speaker, listener or a third person.
- Unclear (to be included in frequency counts, but excluded from in depth analysis)
 - unclear; it is not possible to say whether something is a genuine reference or a conversational utterance, because of a lack of context or because the child uses the verb in a strange way.
 - fragment; the part of the utterance in which the target verb is used is unfinished, e.g. "<ik weet> [/ /] ik heb ik heb xxx gemaakt ."
- Exclude
 - Reported speech
 - Read story or memorized song or rhyme
 - Non-target meaning: wrong meaning of polysemous verb (e.g. "vinden" in the sense of location instead of having an opinion), also non-mental meaning of verb
 - *Willen*: exclude *wil niet* (doesn't want) when referring to an object, e.g. meaning "it doesn't fit"
 - *Hoeven*: only include when paraphrasable with "I/you/he (don't) want", exclude when paraphrasable with "(don't) have to"
 - *Vinden*: exclude any location-related meaning.
 - *Kennen*: is often used by children to mean *kunnen* (being able to), in that case, exclude.

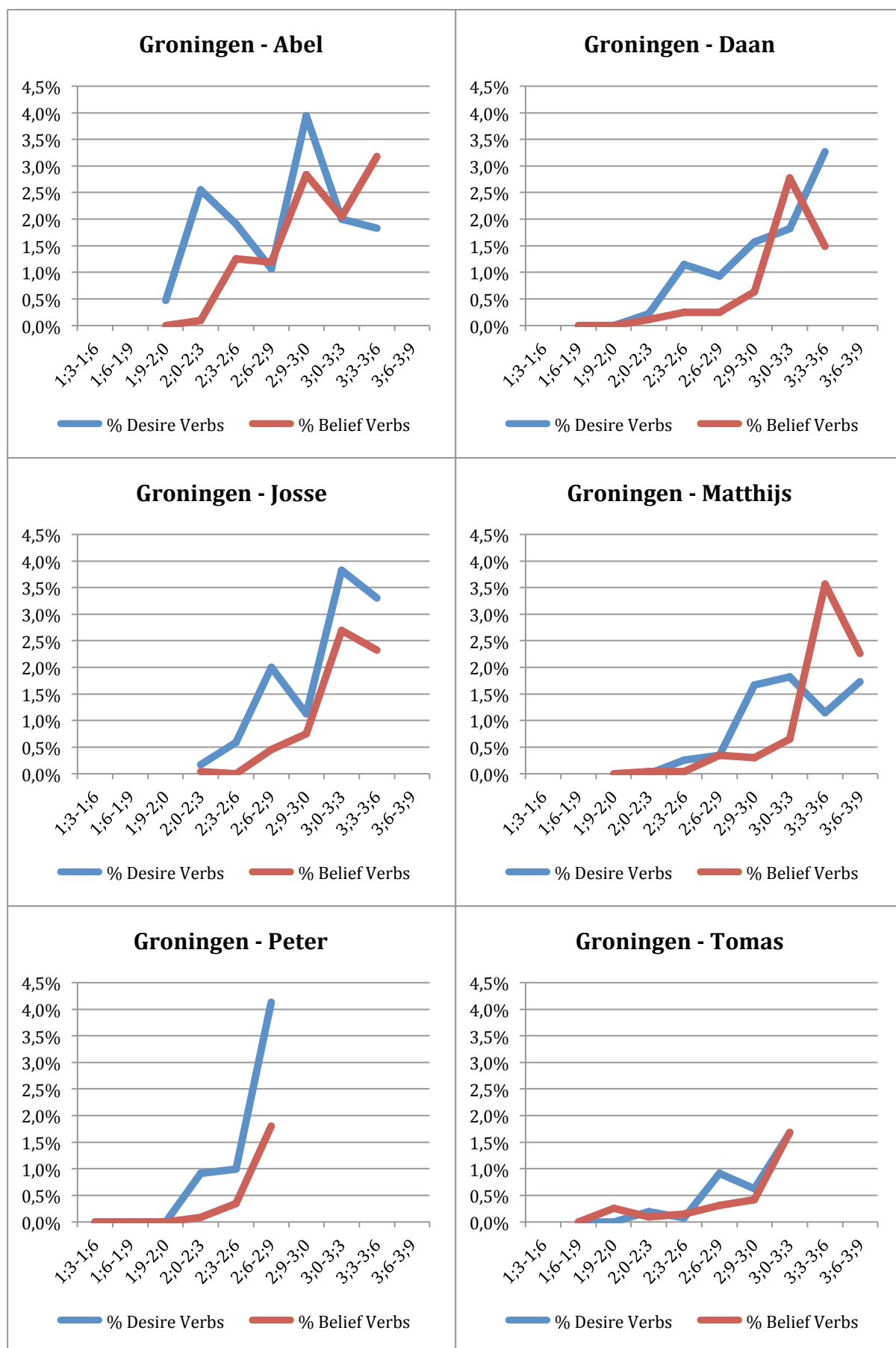
Extra coding:

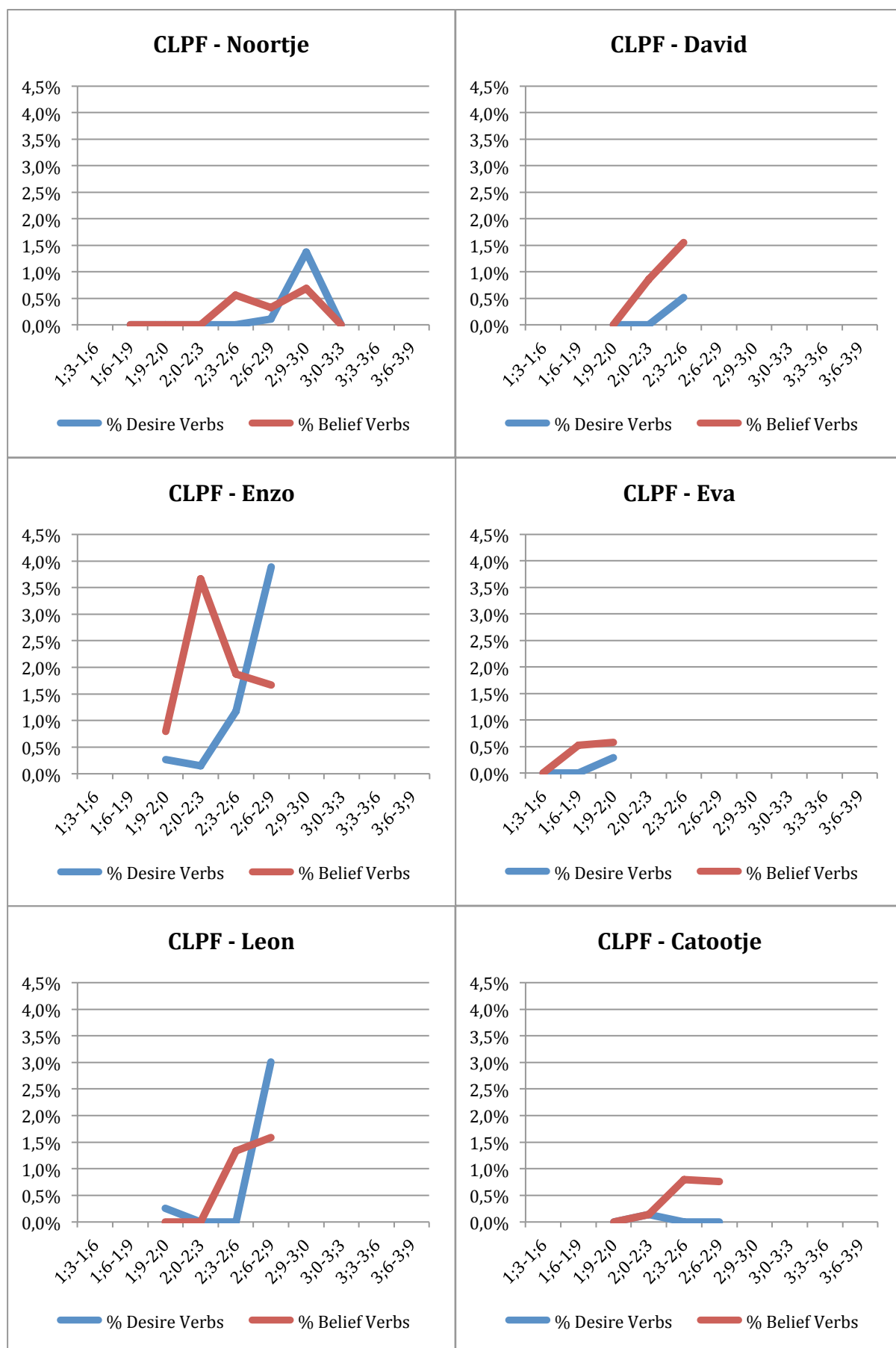
- Conversational function
 - directing the interaction, e.g. *weet je* (do you know) to get someone's attention;
 - requesting an object, action or something else, e.g. *ik wil dat koekje* (I want that cookie);
 - rejecting an object, action, suggestion or idea, e.g. *nee, ik wil niet!* (No, I don't wanna!);
 - evading the question, e.g. using *weet ik niet* (I don't know) as a formulaic response to a question;
 - evaluation, e.g. *ik vind dat leuk* (I like that);
 - imitation of earlier utterance of self or other;
 - fixed expression, such as an interjection, filler, stop word, proverb, or idiom;
 - other.
- Person: person to which the mental state applies: self, other or unclear
- S-type: mark if question or directive
- Complexity: mark if utterance contains multiple verbs
- Negation: mark if utterance contains negation

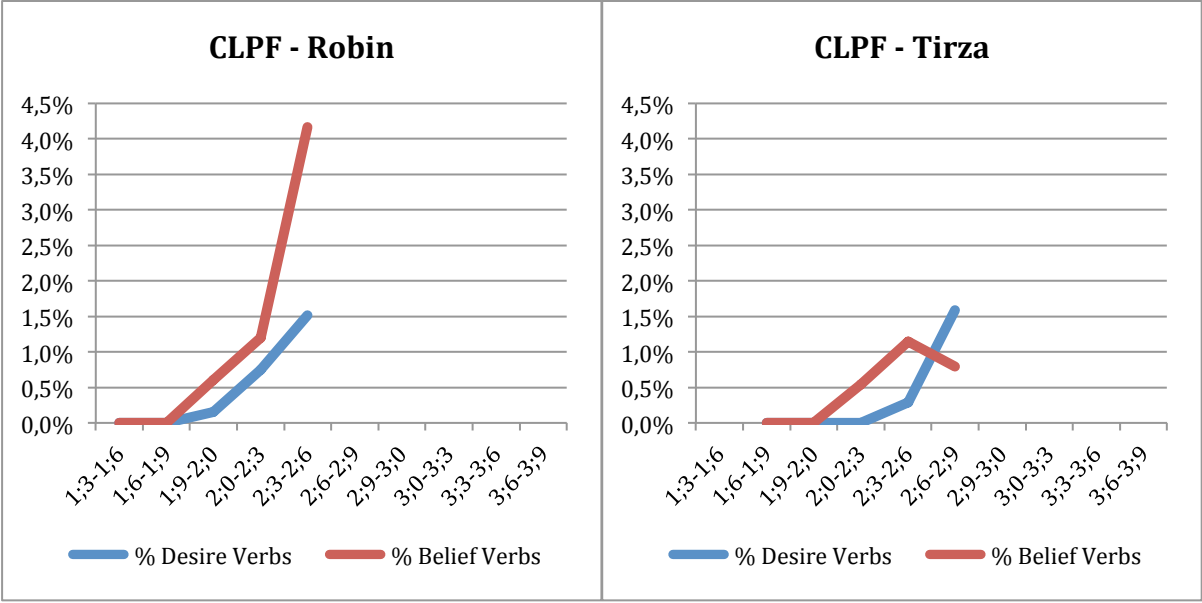
Appendix E: Figures for individual children

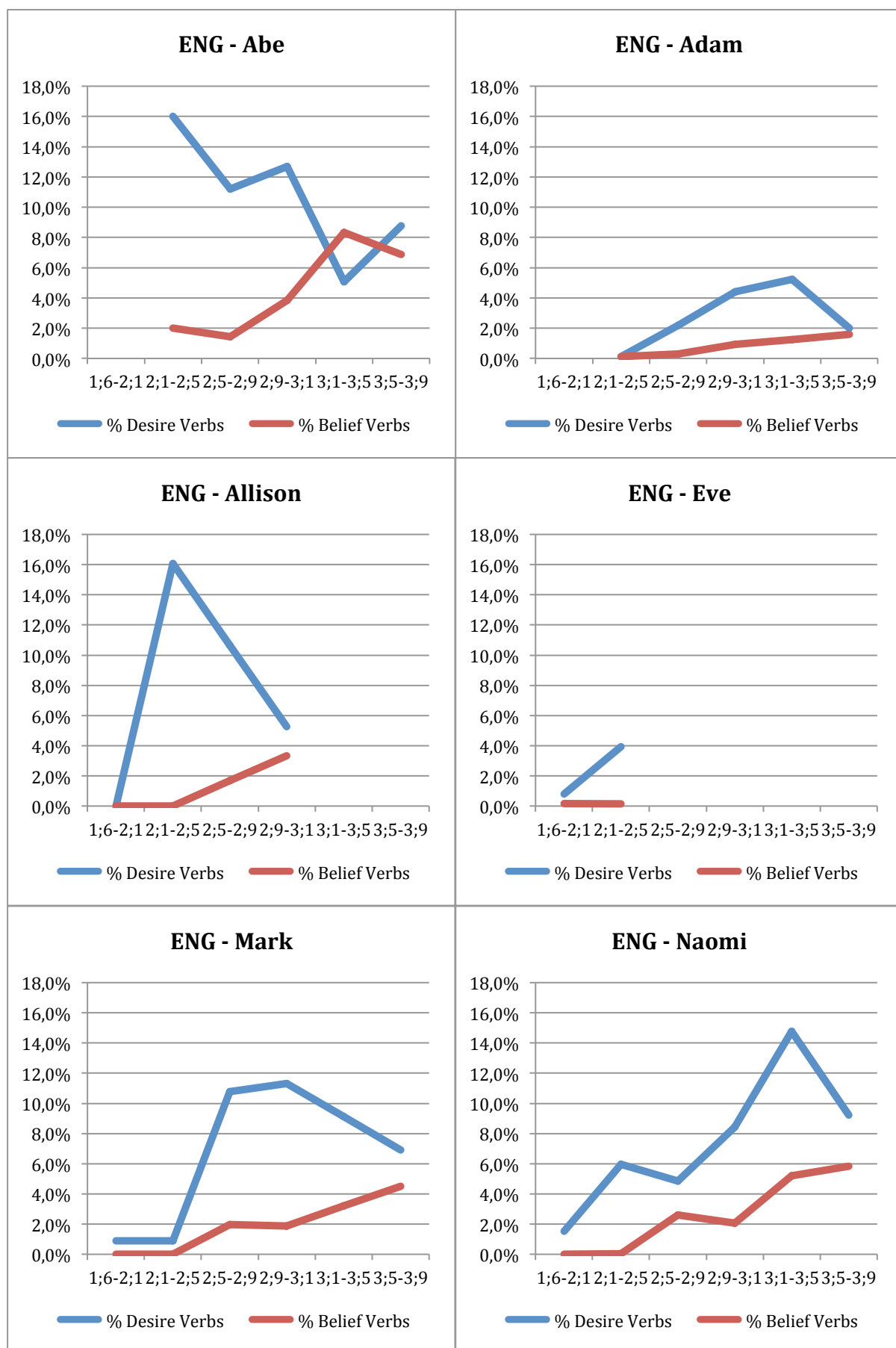
The next few pages show the frequency of mental verbs for the individual children in the corpora. The corpora all start on a new page. Please note that for the English children the y-axis goes up to 18% instead of 4.5%, to accommodate for the higher peak frequencies.

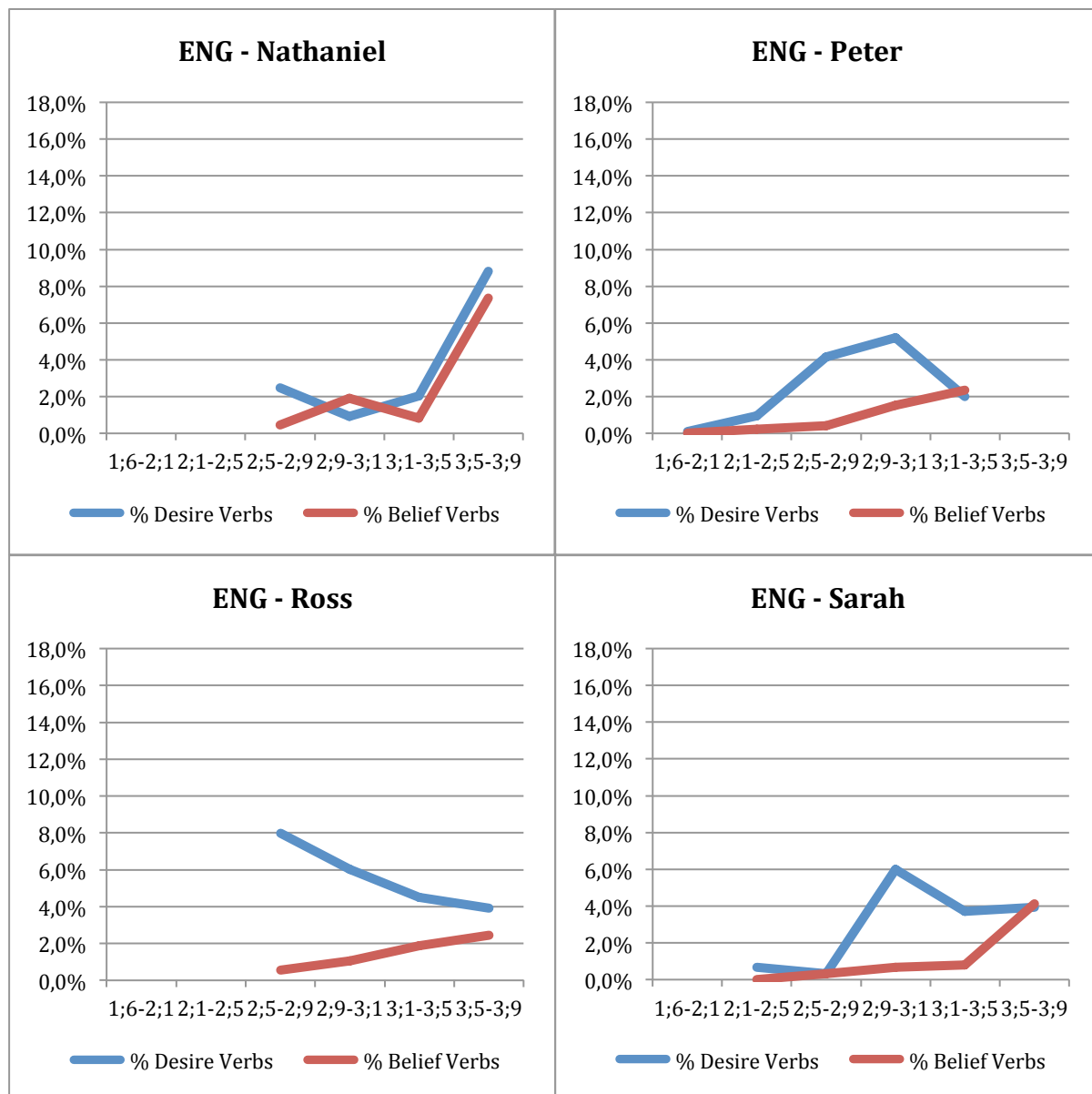












Appendix F: Mental verbs in the input of the Groningen corpus

Table 5-8: mental verbs in the input for each child of the Groningen corpus

	Frequency of mental verbs in the parental input						Total
	Abel	Daan	Josse	Matthijs	Peter	Tomas	
<i>Denken</i>	215	205	140	495	175	202	1.432
<i>Bedoelen</i>	42	38	37	61	69	22	269
<i>Begrijpen</i>	10	5	9	7	18	1	50
<i>Geloven</i>	26	28	60	83	67	18	282
<i>Kennen</i>	28	20	44	41	26	26	185
<i>Menen</i>	2	2	0	0	4	3	11
<i>Snappen</i>	10	15	10	29	14	17	95
<i>Vergeten</i>	18	8	14	39	13	12	104
<i>Verzinnen</i>	13	2	4	12	5	5	41
<i>Vinden</i>	233	251	199	510	217	230	1.640
<i>Weten</i>	279	249	253	409	238	256	1.684
<i>Willen</i>	293	448	335	656	424	381	2.537
<i>Zin hebben</i>	19	10	8	43	29	15	124
<i>Hoeven</i>	34	48	44	101	34	37	298
Total adult utterances	22544	25419	21018	45576	29073	21197	164.827
Total belief verbs	876 (3.9%)	823 (3.2%)	770 (3.7%)	1.686 (3.7%)	846 (2.9%)	792 (3.7%)	5.793 (3.5%)
Total desire verbs	346 (1.5%)	506 (2.0%)	387 (1.8%)	800 (1.8%)	487 (1.7%)	433 (2.0%)	2.959 (1.8%)