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On the relationship between Theory of Mind and language: a criticism of linguistic determinism

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Contents

1 Introduction

The rapid development of new, groundbreaking technologies in the last few decades and the merging of and interaction between different disciplines like linguistics, philosophy, biology, brain sciences, psychology, behavioral and social sciences gave rise to the interdisciplinary research field summed up as cognitive sciences. As for linguistics an interesting research topic arose in the early 1990ies: the relationship between language and Theory of Mind (ToM), the cognitive capacity to understand and reason about mental states and interpreting them as causes and drives for behavior (see *2.1* ff for an exhaustive definition). The theme of language and thinking being causally related in one way or the other was not new to the linguistic world, but the way in which it was done this time around was different nonetheless. Jill de Villiers and colleagues stumbled upon intriguing patterns when investigating children's understanding and interpretation of WH-questions such as (1):

(1) a. Who did Big Bert forget that he invited?
b. Who did Big Bert forget to invite?

(Roeper & de Villiers 1994: 384)

The authors' finding was that children did not understand the difference between these two questions and therefore treated them the same way. After investigating the issue closer from both linguistic and cognitive angles (see *3.4*) the foundation for a new theory was laid. What de Villiers et al. claim from that moment on is that language causally determines ToM in child development.

1.1 Topic

The major claim in linguistic determinism is that children can only develop false belief (FB) reasoning, one of the more complex instances of ToM, if they acquire the linguistic structures that are used to express (false) beliefs, i.e. the acquisition of the syntactic structure of sentential complementation is considered to be the necessary prerequisite for the development of FB competence. The sentence in (2) shows an example for this special syntactic structure that supposedly is a child's only key to FB reasoning:

(2) The girl thought (that) she saw a pink frog. (de Villiers 2000)

This configuration consists of a matrix sentence "The girl thought" and an embedded sentential complement "(that) she saw a pink frog" and is indeed a rather special one as it is very complex with regards to its syntactic build-up and rather rare as it only occurs with very special types of verbs: communication and mental state verbs. To assume that FB reasoning depends on this syntactic structure means that it is temporally dependent on its acquisition (i.e. FB reasoning comes necessarily later in development) and that the mind's means to represent FBs are linguistic and not a different language-independent representational device. To make a link between this special structure and ToM does not seem to be far-fetched, but the claim has implications that are not innocent; accepting a strong hypothesis like this also determines a range of other theoretical stances like the general structuredness of the brain, the build-up and development or innateness of cognitive abilities, the dependency (or independence) of language and of ToM, the build-up of the linguistic system, its acquisition etc. The framework foots its hypotheses on various elements of evidence: correlations between ToM and language were tested in normally developing preschoolers and children with language or ToM delays, loss or impairments, training studies were conducted to look for positive evidence of language's influence on ToM and so on. The list of studies and evidence is long and varied; linguistic determinism built up a strong base in the past 15 years.

There are other frameworks that examine ToM in children that do not believe in the causal relationship between FB reasoning and language (acquisition). A prominent stance is taken by Josef Perner who claims that ToM is language-independent in its acquisition and rather depends on a general-cognitive developmental progression. By now a lot of data and arguments against the claims of linguistic determinism pose challenges to the framework and cause discussions, changes and new research questions for the field. Criticism that penetrated linguistic determinism so far were some cross-linguistic studies like Perner and his colleagues' work on German (Perner, Sprung, Zauner & Haider 2003) where they show that certain cases of sentential complementation in child language don't contribute to the development of FB reasoning and don't even show temporal co-occurrence, Tardif & Wellman (2000)'s study on Chinese, conceptual criticism that was directed towards linguistic determinism's weaknesses in mental verb understanding, preciseness of linguistic analysis and similar issues, but there is a huge range of evidence and criticism threatening linguistic determinism that has not found its way into the discussion. The issues that can be found are quite diverse:

- Experiment design: the setting in which children are tested, the structural build-up of the tests and experiments (like duration, materials used etc.) and most of all the linguistic performance demands of experiments are criticized heavily for both the FB reasoning tests and the language competence tests. An important dimension of the last aspect is that linguistic determinism tries to measure the correlation between a linguistic ability and a non-

linguistic one while using highly linguistic tests and tasks to assess the two measures which should be assessed independently and neatly teased apart.

- Early ToM: both in experiments and in spontaneous speech different instances of ToM (including FB reasoning) could be found earlier than claimed by linguistic determinism (i.e. earlier than 4 years). Recent research with infants even brought forward evidence for ToM being existent pre-linguistically, i.e. in infants.
- Deviant populations: several experiments with children with SLI show that their shortcomings in complementation syntax do not keep them from developing FB reasoning and that in fact their performance on FB tests is only weak when the task demands have a high linguistic level.
- Other syntactic structures: studies have shown that other syntactic structures that are explicitly excluded by linguistic determinism can also correlate significantly with FB reasoning if they are chosen carefully: double event relative clauses were proven to have the same effect as sentential complementation in a study by Smith, Apperly & White (2003).
- Theoretical shortcomings: the linguistic background that is used for linguistic determinism is insufficient from a linguistic point of view. On a general note the assumption that an instance of thinking relies completely on language in development and on-line use is considered as highly problematic and unlikely. Also concerning the details in linguistic determinism argumentation there are a lot of contradictions, inaccuracies and questionable claims about syntactic structures and the linguistic expression of FB and ToM.

1.1.1 Restrictions

ToM. ToM has been a "hot topic" in cognitive science for the past 40 years and as a result literature, opinions and research exist in vast amounts. It will not be possible in this thesis to give an exhaustive and up-to-date in-depth analysis of ToM research. As this is a linguistics thesis concentrating on certain aspects of the relationship between language and ToM not every detail of ToM research will be elaborated on.

Linguistic determinism. Linguistic determinism as a scientific term existed long before de Villiers used it for her framework. One important representative of earlier accounts of a linguistic relativity is for instance Wilhelm von Humboldt who worked on how language influences the way we see the world (the so-called "Weltansicht") and how it shapes our thinking, developing the concept of the inner speech-form ("Innere Sprachform"). A lot of other scholars thought and worked along Humboldt's line e.g. Leo Weisgerber with his concept of "sprachliches Weltbild", Edward Sapir and especially Benjamin Whorf claimed that grammar, lexicon and semantic structure of one's native

language form this language community's way of thinking. These concepts and scholars should be mentioned here not to elaborate on their ideas but to explicitly point out that there are structural differences between the general meaning of the term "linguistic determinism" that encompasses all kinds of interpretations and connotations of the term and can be applied to theories by Humboldt, Sapir, Whorf and many others compared to de Villiers and colleagues' quite specified use of this term. When the former group formulates general principles concerning the influence the whole linguistic system has on the entireness of humans' thinking and their culture, the latter deliberately pinpoint the relationship between language and thinking down to one specific concrete element of each area and connect them in theoretical and empirical analyses, looking for actual correlations and associations; they explicitly do not expand their specific claims to an overall determination or relationship. So this thesis is examining an empirically approachable issue rather than a general language-philosophical question.

1.2 Outline

1.2.1 Aim

The core focus of this thesis will be to analyze and criticize linguistic determinism and tease apart the current discussion's matters such that it becomes clearer where possible weaknesses lie, especially from a linguistic point of view. The already existent criticism that remained unheard until now will be incorporated in the broad analysis. Eventually we will find an answer to the question if linguistic determinism is a valid theory considering the facts and arguments laid out in this thesis. The second aim of this thesis is to give an exhaustive overview of linguistic determinism and sum up the most important cornerstones of the framework: the source and beginnings of linguistic determinism, its development and influences over time, the evidence and studies that are used to corroborate the theoretical basis and of course the core ideas and arguments that constitute linguistic determinism.

Considering that one major flaw of linguistic determinism seems to be that the performance demands of both FB and language tasks seem to be of a linguistic nature and therefore might have a major impact on the measures and test results we will try to both decompose and analyze the relevant linguistic elements (e.g. sentential complementation and usage of mental verbs) that are used for theoretical claims in the literature and tease apart the linguistic and non-linguistic aspects of experiments made with children to assess FB and linguistic competence.

1.2.2 Structure

In order to fulfill the two aims of this thesis it is necessary to give a sufficient introduction to ToM which is done in *Chapter 2*. *Chapter 3* contains a detailed account of the linguistic determinism framework and its development over the past 15 years; this chapter illustrates evidence, arguments and frameworks that support and oppose linguistic determinism. *Chapter 4* can be seen as the argumentative core of this thesis, consequently it contains the criticism of linguistic determinism which will be presented in three sections: first we will look at issues that arise from empirical evidence that contradicts the claims of linguistic determinism. Secondly, the methodology and experiment design of studies in linguistic determinism will be analyzed and potential weaknesses and mistakes will be pointed out. The third section is concerned with conceptual and theoretical arguments that pose threats to linguistic determinism. All three sections present both existing data and arguments from the literature and new aspects on the different topics. *Chapter 5* provides a summary and the final conclusions based on what this thesis explored and argued for.

2 Theory of Mind

2.1 A short introduction to Theory of Mind

2.1.1 General Remarks

Understanding human action and behavior has always been of main interest in human thinking and science. Different scholars approached the question of how to explain and interpret human behavior, searched for philosophical, psychological, biological and other drives for behavior and tried to find patterns in it. But regardless of philosophical and psychological reasoning mankind has been equipped with its own universal and naïve interpretational device that enables a "commonsense explanation of human action" (Perner & Wimmer 1985: 437). This mental device enables human beings to understand, explain and predict their peers' behavior by attributing mental states (such as feelings, intentions, desires, attitudes, knowledge, perspectives and beliefs) to them and interpreting behavior as a causal consequence of these mental states. The term Theory of Mind indicates that this device is assumed to be a folk psychological "theory" in humans that is naïve (therefore also referred to as "naïve Theory of Mind") meaning that it neither depends on intelligence or conscious acquisition of knowledge nor that conscious (i.e. overt) forms of reasoning are necessary when ToM is applied – a functioning adult ToM works subconsciously, effortlessly and fast (Györi 2007).

Since the mid 1970ies cognitive scientists try to solve the particular question how children acquire the understanding that humans are equipped with a mind that thinks and reasons, can bear knowledge, beliefs, attitudes, desires and many other mental states that are individual. Furthermore scientists want to find out when and how children start and learn to think and reason about, abstract from, interpret and understand the human mind in themselves as well as in others and how they come to understand that minds are independent, i.e. their contents may differ from each other and also from reality. In the grown-up world it is common knowledge that human individuals can bear intentions, desires, beliefs and knowledge that stand in relation with both reality and other mental states and moreover that human individuals' mental states can differ in quality. What one person desires is highly undesirable or uninteresting for someone else, what one person knows is unknown to another person, what one believes to be true is represented differently in someone else's mind and might therefore also differ from reality. Mental states are no mere reflections or imprints of reality but rather the individual representations of and attitudes towards it.

2.1.2 Definition

Theory of Mind is the human capacity to understand, explain and predict various agents' behavior by attributing mental states to them and interpreting behavior as a causal consequence of the assigned mental states. In other words ToM is a term for the human ability of "mind-reading" (see Carston 2002: 43) which is part of the human cognitive system. It is based on hypothetical and abstract concepts (see *2.1.3*) and a cognitive device that allows for a causal explanation of action. The conceptual basis for ToM is a representational-functional conception of mind. Some important general features of it are (according to Györi 2007):

- ToM is a cognitive capacity that is highly complex and exclusive to humans[1] (and it is universal in humankind).
- ToM is crucial in social cognition and communication and has been shown to be absent or impaired in populations with problems in these fields (e.g. populations with autism spectrum syndrome). ToM as "the ability to impute mental states to oneself and to others" (Baron-Cohen, Leslie & Frith 1985: 39) is a crucial component of human social skills. ToM is important for a child's socialization as it is an important social skill (Gale, de Villiers, de Villiers & Pyers 1996).
- Developing a concept of "self" and "other" is another cognitive aspect that ToM is relevant for. ToM is entangled with perspective taking, differentiation of individual representations, states and so on.
- ToM is based on a knowledge system that is of a theoretical and abstract nature although it is naïve and not necessarily manifest explicitly.
- First aspects of ToM can be found early in child development (i.e. within the first year of life).
- ToM seems to be domain-specific and furthermore to a certain extent innate (this is matter to discussion as it depends on general assumptions about cognition and the human mind).

Astington & Baird (2005: 4) claim that the term "Theory of Mind" can refer to three different meanings:

a) an area of research investigating the development of these abilities
b) a cognitive structure leading to certain abilities
c) a theoretical perspective explaining this development

[1] The question whether primates have ToM, too, has been subject to discussion; one of the first pieces on ToM actually deals with ToM in chimpanzees (Premack & Woodruff 1978). It is doubtful that primates have a fully-fledged ToM at command (see e.g. Povinelli 1999) which has lead to different research and discussions (e.g. Segal (1998) and Smith (1996) against ToM without language (i.e. in primates) and e.g. Byrne & Whiten (1991) for ToM in primates, etc.). This thesis acts on the assumption that ToM abilities are existent in primates maximally up to a very basic and restricted level, if they posses any ToM at all.

Considering that these three meanings are closely interrelated they find it especially important to bear in mind that ToM is a multi-faceted term which is often used in a fuzzy way. In this thesis we will especially concentrate on the dimension of the term "Theory of Mind" indicated under b): an actual cognitive structure that is active in the human brain and is used for cognitive processes by humans in their everyday life for social interaction of different kinds.

Why "Theory"? As mentioned above it is assumed that ToM is a folk-psychological theory about the fact that human cognition exists and how it works. The implicit claim that it is a fully fledged "theory" we are talking about cannot be taken for granted, i.e. this issue is subject to discussion. This thesis grounds on the assumption that a human mind indeed develops a theory about human cognition, no matter if this theory stays unconscious. ToM generally refers to a more or less complex folk psychological theory (hence "Theory") about a human ability (hence "mind"). Premack & Woodruff for instance put it that way: "An individual has a theory of mind if he imputes mental states to himself and others. A system of inferences of this kind is properly viewed as a theory because such states are not directly observable and the system can be used to make predictions about behavior of others." (1978: 515). It should not remain unmentioned that that there are scholars completely negating the overall concept of ToM at least concerning child cognition, e.g. Hobson (1991) and Nelson (1998) argue against any attribution of a concept like ToM to young children and the way they deal with the social world as they do not accept that children as young as three years develop a theory-like mental device.

2.1.3 Basics in Theory of Mind research

The human mind and its drives and functions conjure up a plentitude of terms and concepts used in cognitive research. This section will cover the most basic and important concepts of the cognitive base of ToM research, so the concepts of the mental setup that either allow for or call for a ToM.

- ***Mind.*** The mind is the center for everything that is cognitive and conscious in the human brain. All instances of thought, memory, emotion, perception, will and imagination are located in the human mind either consciously or unconsciously. In the current context "mind" refers to the human capacity of individual cognitive activity which is psychologically real in each and every person's brain. In a manner of speaking the mind is the "location" where individual representations are "made" and "kept".
- ***Behavior.*** The human behavior that is relevant in this thesis' context is nonverbal and driven by certain intentions that are triggered by certain states the agent of the behavior is in.

- ***Mental states.*** The human ToM is based on the assumption that human beings (oneself as well as everyone else) have mental states that can be ascribed as a matter of reasoning. Mental states and the reasoning about them are unique to humans as they can (consciously) think and feel. A mental state is an inner (mental) implementation of thought or feeling, the most important mental state concepts being desire and belief. It is commonly known that desires and beliefs can differ from one person to the other, so mental states are always of an individual and subjective quality. Desires and beliefs lead to actions in their holder.
- ***Intention.*** Humans are intentional beings whose behavior is triggered and driven by intention. Intention comes into being when a certain behavior needs to be triggered in order to change certain states the human is in: a desire, a belief, an urge or other (mental) states.
- ***Desire.*** A desire is a mental state that aims at something which is not true fulfilled at a given point in time but wished to become true. A desire grounds on reality (because reality is the state that is not fulfilling in the relevant aspect and therefore triggering the desire) but it aims at a secondary representation of reality, in other words: an imagined reality that would fulfill the desire. In language desires manifest themselves through verbs like *want* and *like* and expressions of references ahead of speaking time. The syntax of desires will be discussed below.
- ***Belief.*** The concept of belief has a broader range than the concept of desire. It is, too, a mental state and is a mental entity that stands in a special relation to reality. A belief usually has a certain objective truth value: either it is true or false. This truth value cannot render a belief invalid though; the holder of a belief is not necessarily aware of its "objective" truth value. All kinds of different nuances of mental states are summed up under the term "belief": attitudes on the one hand (e.g. *I think that Britney Spears is better than her reputation.*) which do not necessarily fall into a true and false distinction as they merely reflect opinions or taste, and actual beliefs on the other hand (e.g. *I think that it is raining outside.*) which do make a claim about truth and objective reality. For our matter the latter type of belief is relevant although one must bear in mind that especially in acquisition we cannot automatically expect for these two types to be independent. The concept of false belief (FB) is based on the fact that different people have different relations and attitudes towards a certain proposition or make different predictions about reality. The FB is an assumption about the world resp. reality that is wrong meaning that the "protagonist" of a given situation represents a certain proposition such that it collides with reality without him or her knowing it. This mental state as such becomes crucial for ToM when it leads to behavior that is not adequate for reality but only if the FB is considered.

- ***(Mental) representations.*** It is assumed that reality is not imprinted in a human's brain 1:1 like a photograph but rather that it is filtered through perception, priorities, attitudes etc. These filters create representations in its holder's mind that are private and discrete to him and that stand in a certain relationship to reality and (to representations in) other minds. It is assumed that representations are psychologically real structures that have to develop in a human's mind. It is not agreed upon the status of representations in development (i.e. if they are innate or if they are to be developed), furthermore the question if language and other cognitive domains use the same representational means or if representations in different domains work and develop independently. This applies to simplex representations (i.e. representations of some real entity); complex representations (i.e. meta-representations or in other words: representations of representations) are considered to be more derived than simplex ones meaning that meta-representations can only be mentally mastered by children from a certain point of time onwards (see e.g. Perner 1991). It is not yet clear though if this is due to an "awareness factor" which could for instance mean that children are born with full representational system(s) but need time to realize that in the course of development.

The list above does not include any drives for ToM, and that is for a good reason. The speculations about drives for the development and usage of ToM from an ontogenetic point of view are not matter to elaborate discussion. The only real drives for ToM usage I can formulate are two: one in the social area where we would assume that it is a human urge to understand others better in order to be able to improve interaction, reaction and understanding (at the very least to improve social regulation processes), the other "drive" being an urge to understand oneself better meaning that by observation and interpretation of behavior of others a human being might be able to understand himself or herself better. The discussion about hypothetical drives for emergence of ToM from a phylogenetic point of view is way too speculative and half-baked to elaborate on it within this thesis, for an overview of options see e.g. Malle (2001)

According to Swoboda (2006) the core concepts of ToM are beliefs, desires and actions, where desires and beliefs are the mental states that drive humans to actions and behavior. Human behavior is determined by individual mental representations which are by definition "not necessarily congruent with the real state of the world" (Swoboda 2006: 65)[2]. Swoboda claims that ToM is an essential basis for social interaction, because our actions do not comply with real situations but with individual mental representations of the world. She emphasizes that the other person is identified as "other" with his or her own assumptions and beliefs, so ToM has a high priority in regulating social life (see Swoboda 2006: 65). Only if we can interpret and understand others' intentions and beliefs we can know how to react to these "others".

[2] "Mentale Repräsentationen sind nicht notwendig kongruent mit dem realen Zustand der Welt."

2.1.4 Overview of Theory of Mind research

Letting aside the fact that the thinking about thinking and mind has been subject to scholars for thousands of years, the term and concept of "Theory of Mind" as we know and use it nowadays entered science in the 1970ies via at least two ways (cf. Astington & Baird 2005: 5):

- Wellman (1979;1985) was working in the area of meta-cognition and referred to the child's conception of human cognition with the term "theory of mind"

- Premack & Woodruff (1978) investigated cognition in primates and tried to find answers to the question "Does the chimpanzee have a theory of mind?"

What Astington & Baird do not mention but is well documented in other literature (e.g. Hale & Tager-Flusberg 2003: 346) is that the first scholar to actually bring the term up in the 1970ies was someone else. The first use of "Theory of Mind" in today's sense can probably be ascribed to Dennett (1978) who inspired people like Premack & Woodruff (1978) and also Wellman (1979) to do more specified investigations on this topic from a developmental point of view as Dennett himself comes from a philosophical background. Dennett argued that "the ability to acknowledge that people hold beliefs of a simple, factual nature is an appropriate criterion for measuring theory of mind because this acknowledgment evidences a conception of another's mind as holding a certain belief" (cf. Hale & Tager-Flusberg 2003: 346) and that this also dissociates belief from reality. Subsequently also Wimmer & Perner (1983) were inspired to work on ToM (assumingly inspired by both Dennett and Premack & Woodruff) and pioneered in the field of ToM development in young children.

A substantial question that should be discussed more in ToM research can be found in Premack and Woodruff (1978). It is this paper where we can find one of the first mentions of the concept and the question they investigate is whether chimpanzees possess a ToM as a capacity to consider properties of mental states and adapt to situations and environment. The crucial aspect here is that the ability to attend to mental states and the ability to adapt to environment could be quite different in their cognitive complexity. Reacting instinctively to a situation and to the environment probably does not need a conscious postulation of mental states. We expect that the observer is either surprised or not depending on his understanding of the situation through the attendance of mental states – so in order to find the minimal activity of ToM what we should look at is the reaction of the observer. In cognitive research the observation of reactions (especially in small children) is done e.g. via habituation-dishabituation tests where attendance times, looking times and frequency and other measures are taken and analyzed. This "instinctive" understanding might be much simpler cognitively than attending mental states overtly (i.e. to draw conclusions and construct own behavior according to it and also talk about them) for a young child. The question is if these two facets of ToM are in fact

two different steps of development or even two different pairs of shoes – but we will come to that later when implicit and explicit ToM are handled (see section *4.3.1.3*).

As mentioned above the first occurrences of ToM in the literature focus on primates but this should change quickly. Being interested in the questions of how and when children acquire the ability to reason about the human mind Wimmer and Perner (1983) were the ones to set two standards for ToM research which are still valid nowadays: for one they designed a test for assessing children's ToM abilities: the "Unseen displacement" task which is used to test the understanding of FB in children (see *3.3.1*). The other standard Wimmer and Perner set was the finding that children are able to pass this kind of FB task around the age of 4 years, their claim is that this is the age where a major change in ToM development and therefore cognitive development takes place. Up to today this claim is vastly accepted and well proven in relevant literature (cf. Hale & Tager-Flusberg 2003; seeWellman, Cross & Watson 2001). The influential work of Wimmer and Perner inspired many scholars to do likewise and from the early 1980ies on we can find a lot of research on ToM in children (and also adults and primates).

The frameworks explaining and examining ToM can be roughly divided into two camps (cf. Hale & Tager-Flusberg 2003): the theory-theory on the one hand and performance based approaches on the other hand. This distinction is particularly relevant in the question of acquisition: the first approach assumes a maturing and/or developing ToM and the latter approach assumes a ToM that is (to a certain extent) innate and therefore successful performance is only impeded by external factors. A third somewhat different account disregarded by Hale & Tager-Flusberg is the simulation-theory of mind (especially developed and represented by Harris, see e.g. Harris 1992;1996;2005 etc.) which shares some aspects with the theory-theory approaches but otherwise does not necessarily negate one or the other camp and is not crucially defined by its stance towards innateness.

Performance based approaches assume that ToM does not have to develop over time but that other, ToM-external factors limit children's performance on ToM tasks. One approach is the nativist modular theory where it is assumed that much younger children (younger than 4) already have a concept of belief but that they are limited by other cognitive factors like e.g. they lack computational resources (see e.g. Leslie, Fodor, etc.). Other researchers adopt an executive function theory which basically grounds on the assumption that the supposed "change" is brought about by development of executive function processes such as working memory and inhibitory control. Another performance based account is Leslie's approach. The heart of his account (e.g. 2000) is what he calls a Theory of Mind Mechanism (ToMM) which is a domain-specific instance cooperating with the so called selection processor (a more general cognitive mechanism). ToMM is defined as "a specialized component of social intelligence providing the time-pressured, on-line intentional interpretations of

behavior that are necessary for an agent to take part effectively in conversations and other real-time social interactions" (Leslie 2000: 7). Leslie believes that neither representational nor conceptual limits keep children from passing ToM tasks but performance factors like conversational skills (see Siegal & Beattie 1991, Surian & Leslie 1999), inhibitory control (e.g. Leslie & Polizzi 1998) and memory (e.g. Freeman & Lacohée 1995). Training studies for these factors have shown improvement on ToM tasks in young children (cf. Hale & Tager-Flusberg 2003) which supports the assumption of a relationship between ToM performance and executive function (see e.g. Carlson & Moses 2001).

In the framework of ***simulation ToM*** the main assumption is that the other person will behave just as the observer would if he was in the same situation – so simulation ToM claims that the observer simulates the thoughts and feelings the other person might have considering the observable situation in himself and then assigns the simulated mental states to the person who actually is in the situation. The observer adopts the attitude or position of the actor and simulates his or her mental states. Perner (1999) notes that this theory of simulation is based on introspection which does not apply to the theory-theory (or other frameworks). From a developmental point of view the simulation theory claims that children become aware of mental states in themselves and transfer those onto others. The ability to simulate is a genetically determined device that develops through learning processes. Considering this the simulation ToM is closer to the theory-theory because according to it ToM as such still has to develop after birth in contrast to fully nativist theories. In simulation ToM predecessors of a fully-fledged ToM are pretend play, hypothetical assuming and the adoption of someone's attitudes. Children understand their own FBs before they can understand others' FBs. Swoboda (2006) integrates the simulation theory into theory-theory by claiming that a child might switch to simulation if she doesn't have a theory at her hands, meaning that she simply ascribes states to the protagonist that she might have herself because the child is able to fall back on familiar patterns. If this process Swoboda assumes can be seen as "simpler" than the theory-theory of mind is not explained further and might be an oversimplification of the misleading term "simulation" – it is not proven that introspection and subsequent assigning is simpler than developing and applying an unconscious theory. Swoboda merely states that theories are harder to obtain because they have to be true. Non-introspective views in the simulation ToM paradigm like the one by Gordon (e.g. 1996) claim that it is not the mental events we simulate in ourselves in order to project them onto others but that we simply see the situations from the other person's perspective, so there is no transfer from the self to the other person.

The theory-theory camp (represented by e.g. Fodor 1992; Perner 1991, Gopnik & Meltzoff 1997 and others) claims that the changes in ToM mastery in early childhood are brought about by actual cognitive development, especially by conceptual change which is conceived in terms of theory

formation. The cognitive concepts theory-theorists refer to are organized in intuitive theories: they are interdefined and mutually supportive and they are coherent and domainspecific. The development of the assumed theory in the child's brain is triggered by theory-internal factors like the need to incorporate new and contradictory evidence. Studies have been carried out to show that the change of performance takes place as a result of exposure to new information (so triggered externally) in contrast to simple maturation (internal). The hypothesis in the theory-theory framework is that a child's representational ToM is an intuitive theory rather than a set of isolated concepts (see Slaughter & Gopnik 1996 for evidence) that works in its own cognitive module. In a training study by Slaughter (1998) performance on and understanding of pictorial and mental representations were compared and the results showed that there were no transfer effects from pictorial to mental representation training (or vice versa) but only module-internal improvement. The theory-theory of mind stands for the assumption that children develop knowledge about mental states via hypotheses that are constantly revised and adapted.

Mental events are covert (not directly observable) and in order to understand them humans have to construct explanations for human actions. The group of researchers assuming a meta-representational development in children claims that there is an innate module (see Fodor 1992) or a predisposition for a ToM (see Perner 1991). Children's ability for perspective taking and switching starts developing in the first year of life, Roeper & de Villiers (2004) claim that there is a close relationship between the understanding of Point of View and the development of a ToM. The developmental path towards a meta-representation is from "real copies" of states in a child's mind to interpretation of states which enables them to realize that their assumptions can differ from reality. The understanding of others' mental states (or in other words: the self-other-distinction in terms of mental states) emerges around the age of four. Perner (1991) sees the development of the understanding of representations as a cumulative process that happens in phases. This understanding works in the sense of a theory in every stage. Perner stresses that social interactions are crucial in order to check and revise knowledge. Adults and parents intuitively mediate emotional and terminological structures of the socio-cultural, physic and psychic world (see also Dunn & Brophy 2005). Perner defines two main phases in the course of this cognitive development: the phase of primary representations (such as direct perception and reality) and the phase of secondary representations (which are deviant from reality). At the age of two years children start noticing that other people don't always have the same perspective as they themselves. A mentalistic interpretation of behavior is possible at this early age (like in picture perspective tasks where children have to move a picture such that their opponent can see it correctly) but this beginning mental understanding does not yet indicate that children that young have mental representations about people having different interpretations of situations, actions, desires etc. The child rather

retrieves past experiences that pattern together with the current situation and makes hypothetical assumptions. This is what Perner calls the age where children are "situational theorists": in this stage children assume that people perceive the same things in shared situations as they themselves do. Around the age of four children turn into "representational theorists" where they become aware of the relativity of representations, i.e. they develop the understanding that people can perceive, interpret and last but not least represent situations differently. This is where children need to be able to imagine for something to be real that is not real in the given situation (e.g. imagine that there are actually smarties in the smarties tube even if the child just found out that there are crayons in the smarties tube). After the situational and the representational theories the next phase is where children start recognizing metarepresentations, i.e. where they understand representations and mental activity in an individual as such.

Looking at this plentitude of theories and explanations it is hard to extract the facts that are most likely to be robust and universal. Flavell (2004) calls for a standardization of ToM theories and suggests the following minimals (or primitives):

- ToM is an innate or early developing mentalistic ability
- the knowledge about mental processes is an informal theory
- language and information processing abilities support the development of ToM

Up to the mid 1990ies the theory-theory and performance based accounts dominated research on ToM development but then a group of researchers started investigating a potential relationship between language and ToM where the question was: does language have a (decisive) role in bringing about the observed changes and developments in children's ToM, especially their ability to reason about (true and false) beliefs? This issue should create a subculture in ToM research discussing heatedly which parts of language (syntax, semantics, mental vocabulary, discourse about mental states, parental input etc.) influence ToM development in which way. A framework called "linguistic determinism" emerged from this discussion. The main person in linguistic determinism, Jill de Villiers, together with her colleagues could – in various studies – isolate a specific syntactic construction as the crucial bit in the ToM development-puzzle that is responsible for FB reasoning development: sentential complementation. The path that led scientists to assume a relationship between language and ToM is described in *2.3* and a detailed description and analysis of the language approach to ToM follows in *chapter 3*.

2.2 Acquisition of Theory of Mind

In the debate around the acquisition or development of ToM (if it isn't an approach that assumes a fully fledged innate ToM, see *2.1.4:* performance based accounts) one important issue is from which stage or ability on ToM can be assumed to be acquired and which stages are still only precursors. For instance joint attention behaviors are widely assumed to be precursors of ToM understanding in children whereas FB reasoning is accepted to be the developmental stage where ToM is acquired at least in its basic form. This section will present a rough overview of the certain stages and theoretical claims about them and the precursors and acquisitional specifics of ToM. Following work by Gopnik & Wellman (1994), Astington & Baird (2005: 5) define ToM very accurately from a developmental point of view:

> "In the most precise use, theory of mind is a domain-specific, psychologically real structure, composed of an integrated set of mental state concepts employed to explain and predict people's actions and interactions that is reorganized over time when faced with counterevidence to its predictions"

Swoboda (2006) describes two different tasks that children have to master when acquiring a ToM:

1) the discovery that humans have thinking at their command
2) the discovery how thinking works

Another relevant task (especially for scenarios where different states of mind are included) is disregarded here: the discovery that thinking is individual (even if this is not solely a matter of ToM but also needed in other, more general cognitive developments like self-other-distinction and perspective taking). Different researchers define two rough phases that children have to go through. Perner speaks of a course of development that leads from the phase of primary representations (as in direct perception, (copies of) reality) to a phase of secondary representations deviating from reality. A similar differentiation comes from Wellman (1990) who claims that the crucial basis for developing a ToM is to develop the ability to differentiate between mental and real world.

2.2.1 Implementations of Theory of Mind

ToM is a complex cognitive capacity that probably develops its different forms and stages over the first years of life (see e.g. Perner 1988). Generally speaking the term "Theory of Mind" sums up a whole range of phenomena. As ToM seems to emerge in a fixed sequence we will attempt a chronological ordering of the instances of ToM here. On a different level we will also assess an increase of complexity between the different stages and implementations. At this point it is important to emphasize that how we know and assess a child's grasp of the following

implementations is not at all an innocent question to ask. Researchers can only do as much; they can observe children's talk about these mental concepts, they can play games, act out stories and ask follow-up questions, they can analyze children's reactions and measure their reaction times, but still we lack the means of assessment to be absolutely sure. Furthermore it is not completely clear what it means that a child "grasps" something, and this is not only due to lack of precise definitions. To grasp something (e.g. the concept of belief) probably relies on certain precursors and is presumably a gradual process in child development (and therefore has "pre-grasp" stages and then a final state where the child actually grasps the full concept); furthermore, the difference between active and passive – or implicit and explicit – knowledge is relevant. So the following explanations sketch different stages and implementations of ToM in general and from a developmental point of view, but in the course of upcoming chapters the issues just mentioned will play major roles. The most straightforward way to determine whether a child has an understanding for (certain) mental states comes from indirect evidence: the child's behavior (even if this might not be the most unambiguous of indicators). As soon as a child e.g. is able to consciously deceive someone, the child must have at least some understanding of mental states and how to manipulate them, but the pure ToM "algorithm", namely the device that helps us understand behavior, is hard to assess.

- ***Intention understanding.*** The child's recognition of intention in others shows through behavior like establishing shared reference and focus (which is possible through e.g. eye gaze tracking). The first phenomena in child development that are assumed to be ToM (or at least precursors of it) are Joint Attention Behaviors (JABs). These behavioral procedures establish a "triangulation" (de Villiers 2007: 1860) between the speaker, the listener and the object, or in a non-verbal context between the agent, the observer and the object. Amongst these early implementations of ToM the key feature is recognition and reading of intention which manifests itself in practices like eye gaze tracking (the child is able to "interpret" another person's eye gaze as intentional and non-coincidental[3] and follows with its own eye gaze), usage of, understanding of and reacting to reaching, pointing respectively showing and similar procedures to establish joint focus. Children have proven to be able to take part in JABs as early as in their first year of life. In a study by Tomasello and Haberl (Tomasello & Haberl 2003) it was shown that children as young as 18 months can take into account the experience of an adult participating in the experiments: the child monitored which toy out of three was the one the adult hasn't seen yet although the child herself has seen all three.

[3] the status of an infant's eye gaze being mental and intentional rather than merely perceptual is disputed in the literature, see de Villiers, J. 2007: 1860; Tomasello et al. 2005, etc.).

- ***Desire understanding.*** The basic understanding for desire descents directly from JABs (especially in connection with the verb *want*) where children can observe their opponent reaching for something, struggling to get hold of something, looking at something etc. *Want* is one of the most common first 50 words in English (cf. the communicative development inventory , Fenson, Dale, Reznick, Thal et al. 1993) and also found in the input frequently (cf. Bartsch & Wellman 1995). The more complex level of desires is when the wish, desire etc. refers to something "invisible" (an event or an object) that is away from the actual situation temporally and/or spatially. The child is exposed to this level of desire almost solely via language, as it is not manifest in observable behavior (letting aside the fact that the child – at least subconsciously – is always exposed to her own desires). On this level the objects of desires are *irrealis* (see J. de Villiers 2005) and refers to something in the future.
- ***Belief understanding.*** Beliefs and other instances of thinking are private and internal; beliefs are not directly observable and do not become manifest in directly linked behavior (cf. physical struggle to reach a desired object). A belief is a representation of (a situation, event, state, etc. in) the world. This is not relevant for ToM when beliefs match reality and / or one's own beliefs, but when a belief mismatches either one's own belief or reality belief understanding becomes crucial. For a child to understand (false) beliefs it is necessary to have an (however subconscious, naïve or simple) understanding that a) that humans think (i.e. have a mind) b) that thinking is not a reflection of reality in ourselves (i.e. that it is representational) and c) that this thinking can be wrong or deviant with respect to the world (i.e. thinking is individual). So indeed, belief understanding is the most complex instance of ToM.

These general stages of understanding show themselves in behavior like JABs, deception, teasing, pretense, FB reasoning etc. as they all require considering mental states of others.

On an abstract level there are different forms of considering mental states. We are confronted with three mental processes that are different in their complexity, their time reference and their aims which might play a role in ToM development. These three processes are:

1 Understanding: this mental process is probably the most unconscious one as it does not ask for an explanation or a conscious preoccupation with the given situation. As soon as the (remember: fast, unconscious and effortless device of) ToM works in the child's mind it will be able to understand observed situations that require appliance of ToM. In other words, if the child is not puzzled, outraged, surprised or anything alike in a FB situation she has a working "comprehension ToM".

2 Explaining: another ToM process is the explanation of states that require conscious attendance of past events and furthermore requires basic causal argumentation and understanding devices in the child that also need to be available consciously. As soon as children can answer the "Why?"-questions in ToM test batteries one can assume that they possess an "explanatory ToM".

3 Predicting: the most complex instance of ToM appliance is prediction of behavior. It was Bartsch and Wellman (1989) who claimed that prediction is harder than explanation because in prediction children are always confronted with and misled by reality (and an uncertain outcome) whereas in explaining they can overrule their bias towards reality easier: they have already observed the behavior caused by the FB. Furthermore it requires the child to be able to grasp future concepts (i.e. that a future exists, that it is infinite, uncertain, speculative, etc.), the child must also be able to plan, anticipate and check feasibility of predictions and subsequently he or she must understand the causal relationship between a mental state at time X and a future behavior at time Y even before that behavior actually happens.

On a general note, the process of understanding is "online" meaning that it deals only with the present situation whereas explaining and predicting are rather similar as they both refer to a point in time other than present.

Swoboda formulates three "Phases of ToM development" (Swoboda 2006: 82) that might reflect the idea of three ToM processes that differ in complexity within the ToM capacity presented above:

*A) "up to 3 years: **Situational ToM** including joint attention, social referencing, pretend play, simple deception, understanding for perception (cf. "situational theorists" by Perner)*

*B) 3-5 years: **Representational ToM** including desire and desire-belief, false belief, counterfactual situations, emotions, knowledge, meta-representations, understanding for intention, desires and needs*

*C) from 5 years onwards: **Interpretative ToM** including second order beliefs"*

An even more important and straightforward explanation this complexity scale offers is for the so called "implicit ToM" (see *chapter 4*).

2.2.2 External Influences on Theory of Mind development

Kern (2005) defines several aspects that the development of ToM is or might be influenced by:

- executive function
- language competence
- linguistic socialization through and in the family

- socio-cultural factors and
- (probably) the existence of older siblings

The interaction with (older) siblings apparently is an important influential factor in ToM development for a child, for instance in Perner, Ruffman & Leekam (1994) a significant influence on the mastery of FB tasks was shown. In Ruffman, Perner & Parkin (1999) results show that parents, siblings and especially the order of the siblings have a meaningful influence on the ToM development (see also e.g. Dunn, Brown, Slomkowski, Tesla et al. 1991, Jenkins & Astington 1996). The way mental processes and states are talked and reflected about amongst peers or family members are influential (see Astington & Baird 2005, Dunn & Brophy 2005). Lohmann, Tomasello & Meyer (2005) show that the parental "discourse behavior" is an important factor and sensitizing and supporting the child's understanding of mental states.

An important question though is whether the factors listed above are actually crucial in a child's development of mental understanding. The effect found by the numerous researchers might have a rather simple and superficial explanation: children are sensitive to training in the ToM domain (which is also shown by several training studies, see e.g. Lohmann & Tomasello 2003, Hale & Tager-Flusberg 2003, etc.) and if they are "trained" by the people who are closest to them and who they see the most (i.e. parents and siblings) it is probably not surprising that the training effect is extraordinarily good. A stimulating environment stimulates development, an axiom that is not only intuitively true but also shown in many different fields of child development. For this reason this thesis will not elaborate on the role of parental or similar environmental influence on a development of ToM, even if there might be interesting and even crucial effects that should not be explicitly ruled out here.

Other effects and influences come from the following instances and abilities:

- pretend play (it boosts the production of cognitive concepts about real and imaginary things)
- talk about past events (this can be seen as talk about de-contextualized events and highlights their existence, see Swoboda 2006)
- talk about different perspectives and possible actions (this language input leads children to language of the mind)

By the age of five children usually are able to understand that their mental representations of the world can differ from reality and from other people's representations and that human beings construct their knowledge based on perception.

2.2.3 Developmental precursors of Theory of Mind

ToM consists of a lot of different phenomena that differ in (cognitive, social and linguistic) complexity, time of emergence, the type of mental reference etc. A domain-specific view on ToM development predicts that there are precursors for it in early development and that a child's understanding becomes more and more complex over time. This is what makes ToM a very multi-faceted concept that is difficult to grasp. Swoboda (2006: 74ff) gives the following overview of the chronological stages in development that are widely accepted across researchers:

- 9-18 months: children acquire the ability to understand intentions behind actions of other people (e.g. the intentional aspect of an adult utterance). A parallel development is the felicitous establishing of a joint focus; at this stage children comprehend real copies of the world (which is the stage of primary representations following Leslie 1988).
- 12 months: children make active use of eye-gaze-tracking (interpreting eye gaze as intentional and following it), e.g. they understand someone will pick up what they look at.
- 18 months: children put themselves in the position of others and understand that they can have differing desires and needs (cf. stage of secondary representations in Leslie 1988), Woodward (1998) did experiments with children where the experimenter preferred food the children rejected compared to something more desirable – they were already able to feed the experimenter with what he liked best despite their own preferences.
- 2 years: children have means of an intentional understanding of causality and they develop elementary concepts for *want, believe* (cf. Scholl & Leslie 2001)
- 3 years: children are able to
    - distinguish real and imagined objects
    - predict behavior based on present events (will he laugh or cry now that he fell)
    - assign and relate moods
    - formulate others' expectations
    - actively use their first mental verbs (especially *want*)
- end of 4th year: children are able to
    - detect and understand FBs and actions based on them
    - start to consciously deceive others
    - think about others' thoughts and knowledge, recognize differences in mental states
- 5 years:
    - the child's causal understanding develops into an understanding of causality
    - children start to actively take perspectives in conversations and narrations
    - illusions (e.g. optical illusions like clear water in a dyed drinking glass) are recognized

2.2.3.1 Pretend Play as an important precursor of Theory of Mind

Pretend play is being tipped as one of the crucial precursors for FB understanding as it needs the child to be capable of contra-factual thinking ("If the stone were a car…"). For pretend play to be felicitous the child needs to hold two representations: a real and a fictional representation of the object, the protagonist, the situation or whatever is part of the pretense. Models of reality can be consulted for hypothetical situations. As mentioned before, Perner distinguishes two main steps in the child's theory development. In the first phase the child is a "situational theorist" where he or she has multiple mental models but no conscious use of representations. The child is able to distinguish between reality and fiction but is not using a conscious mental representation to "turn" the stone into a car. Up to the age of 4 children cannot understand representations and misrepresentations. This can be seen in the way children make use of pretend play: by the age of 3 years children imitate voices, clothing styles, movements and other external features if they imitate a person. By the age of 5 years children include different mental states in their imitations (e.g. they imitate their mother scolding about something they themselves like).

Bartsch & Wellman (1995) claim that the mentalistic folk psychology consists of two aspects: belief (like thoughts, ideas, opinions) and desire (as in wishes, needs, likings). According to them the stages of ToM precursors proceed in three steps:

1. 1st step: understand simple causal connection between desire and actions without understanding that mental states (desires) can differ
2. 2nd year of life: differing desires are recognized and talked about
3. 3rd year of life: mentalistic theory about behavior & situations is developed, the differentiation between physical and mental world is active, the prediction of actions based on certain mental states (namely desires) is possible

It seems that the ability to understand what other people *want* (understanding for desires) emerges earlier in child development than what people *think* and *believe*. One purely cognitive explanation might be that the level of abstractness (in comparison to concrete things in the real world) is higher with beliefs than with desires which might lead to a "delay" in the understanding of *think*.

4. 4th year of life: the child's theory changes, he or she starts to understand that thinking is individual representations of individual persons – basic ToM is acquired.

2.3 Language and Theory of Mind

It is not a random coincidence that the human capacity for language and the human capacity for ToM are compared and related to each another to that big an extent. It is important to investigate why this relationship is more straightforward than other potential relationships between language and any other domain of human cognition. The reasons can be found in the ways the two capacities co-exist and co-arise, in their structural and temporal analogies, parallels and potential relations. The following section will explain how these connections are natured and why they are special.

2.3.1 Important analogies

Swoboda (2006) observes parallels between language acquisition and the different stages in the course of meta-representational development: both are innately predispositioned (which is adopted from Perner (e.g. 1991)) and both show interim structures in their development towards the target structure. Certain parallels can be observed between the language domain and the ToM domain, both in their characteristics and their developmental time frame (Györi 2007):

Structural analogies

- ➔ In the cognitive basis:
  in both systems processing seems to be governed by abstract concepts and rules
  both are recursive
  they are based on certain knowledge structures which can be reconstructed as theories in their mature functioning
- ➔ In the mature state:
  both are infinitely productive
  at least in their higher levels of complexity both capacities are exclusively human
  in their default application both cognitive capacities function fast, effortlessly and to a large extent unconsciously

Developmental analogies in observable surface-instances of the two capabilities:

Roughly around **12 months** of age we can observe these developmental co-occurrences:

ToM:	joint-attention behaviors and attribution of intention emerge
Language:	first words emerge, labeling is necessary for that

around **18-24 months** of age we can observe:

ToM:	joint attention behaviors become flexible and productive, flexible understanding of pretend arises
Language:	lexical explosion begins, "telegraphic speech" arises

and finally around **4 years** of age

ToM:	essential properties are acquired
Language:	essential properties are acquired

2.3.2 Associations and Dissociations

The major aspect of this thesis will be to examine the assumed associations between language and FB reasoning in child development (see *chapter 3*). Researchers try to find out if there are associations between ToM development and language acquisition that exceed mere co-occurrence by conducting experiments with both normally developing children and populations with deviations in either of the two domains. Subsequently these considerations potentially allow for conclusions about the modularity of the brain and other general structures of the brain, theories about child development, language acquisition and cognition. The following accounts in this domain put different aspects of language in their focus which provides a classification into different frameworks (cf. Astington & Baird 2005: 7ff):

A) ***Conversation and Pragmatics.*** In Dunn et al. (1991) evidence is presented to show that young children's natural observations of conversations are related to later understanding of other minds. There are researchers working on the relationship between motherly discourse input and ToM development in the child (e.g. Harris 1996, the influence of motherly input is emphasized e.g by Ruffman et al. 2002 etc.), others emphasize the importance of pragmatic development (e.g. O'Neill 2005). Harris (1999) states that conversational exchanges expose children to the fact that people know and don't know different things. He concludes that information exchange highlights the existence of different viewpoints and the fact that people are epistemic subjects. Saxe & Baron-Cohen (2006) present findings that show relationships between affective perspective taking and ToM development.

B) ***Lexical Semantics.*** The claim here, too, is that children acquire concepts of mental states in conversation (see e.g. Bartsch & Wellman 1995, Olson 1988, Peterson & Siegal 2000). They can abstract underlying mental-state concepts out of conversations because language encodes these concepts semantically. Parents use perception-, emotion-, desire- and cognition-terms to describe and explain the child's own and other people's experiences and behavior, which provides a means of mapping own experiences (and mental states) to other people. Nelson (1998) emphasizes that the first use of mental terms in child language does not yet have full mental reference which she takes as an indicator that children acquire the full meaning of these terms through usage.

C) ***Complementation Syntax.*** Another group of researchers points out that merely grasping a mental term might not be enough in order to handle ToM and ToM tasks and therefore put syntactic structures into the spotlight. More precisely these scholars relate those syntactic structures to ToM development that are used with mental terms and also used to express points of view: sentential complements. Children start using these constructions as early as two years (see e.g. Shatz, Wellman & Silber 1983) but supporters of the complement syntax hypothesis argue that these first uses of complementation are "merely formulaic" (e.g. Diessel & Tomasello 2001: 106) or "stereotyped routines" (de Villiers 2000: 96). In their view the full mastery of the complementation structures is acquired 1-2 years later and at this stage children's scores on sentential complements predict later mastery of FB tasks (de Villiers & Pyers 1997;2002). Assuming that the necessary syntactic constructions are developed on the basis of the communication verb *say* (which can also have a false complement just as *think* and other mental verbs), analogy allows for the mental verbs to inherit the structure and can then be the trigger for FB understanding.

D) ***Synergies.*** Astington & Baird (2005: 10f) point out that there have been and still are scholars and frameworks that combine the roles for language we explored above. Just as Astington & Gopnik (1991) said that at some level every single one of these neatly separated accounts must be true, Astington & Baird (2005) also admit that the different roles for language they claim "are not in competition but cohere to give a more complete explanation of why language matters for a Theory of Mind." (Astington & Baird 2005: 10-11). What may sound like the bigger picture and proof for the strength of linguistic determinism rather sounds like a revealing confession: if one examines the different papers and studies and their aims precisely, one thing is always to be found: the "proof" that this and only this linguistic aspect gives rise to ToM, negating all other attempts of linguistic (or no) determinism explicitly.

E) ***Language plays no special role.*** Nativist modularity theorists (like Fodor e.g. 1992) see ToM as an innately specified capacity that only shows explicitly when the linguistic and the cognitive development of the child reach a certain step.

Another point of view in this area is that language only plays a superficial role when it comes to ToM: most of the ToM tasks are verbal and therefore mastery of these tasks also requires a certain level of linguistic ability from the tested subject (e.g. Miller 2004). Others say that language is merely the scaffolding for the crucial information and does not serve any other purpose in ToM development (see Gopnik & Wellman 1994, Perner 2000).

Counterevidence to language-based frameworks comes from different sources; one is (child) populations that show deviant forms of development where either language or ToM is impaired (but not both at the same time) which hints at a dissociation of language and ToM. Dissociations that foot on acquired impairments for instance come from studies with grammatical aphasia where language is impaired at some point in time after its acquisition and ToM nevertheless is preserved (e.g. Apperly, Samson, Carroll, Hussain et al. 2006). In certain cases ToM can be affected by an acquired impairment during development, for instance through certain cases of pre-frontal and right hemisphere damage (see Happé, Brownell & Winner 1999). Cases of developmental dissociations (i.e. dissociations that ground on the loss or impairment of an ability due to genetic reasons or birth complications) can be found in populations with grammatical SLI (specific language impairment) where language is impaired and ToM is acquired. In cases of high functioning autism (hfA) we deal with a very heterogeneous group: people with hfA can have complex mental understanding including FB understanding (cf. Győri, Lukács & Pléh 2004), but even if they do not, their language is not affected. Some of these dissociations are treated in later sections of this thesis, but there is not enough space to discuss all of them.

Within the continuum of frameworks postulating a relationship between language and ToM de Villiers defines two opposing end points: one being a cultural-anthropological viewpoint where a child's task is to learn the culture's discourse about mind in order to get access to related concepts, the other being a cognitive viewpoint where language is a specialized cognitive module of the human mind (e.g. Fodor 1983). In the latter language about the mind needs to be learned and is mapped onto concepts that the child grasps prior to the linguistic terms. A crucial notion is that of "propositional attitudes": to understand human behavior it is necessary to postulate hidden states of desire, emotion, belief etc. When these states are mapped onto reality, propositional attitudes are "created" – a human capable of bearing mental states has a certain mental state towards a proposition; this means that the proposition is represented in a particular way in this human's mind. On the status of representations there are different opinions. For instance, the simulation theory account (e.g. Harris 1996) works without assuming representations of those attitudes; in the representationalist view propositional attitudes need to be supported by mental representations somehow, the discussion being whether the means of representation are innate (e.g. Fodor 1992), acquired (Perner 1991) or maturing (Leslie 1994). The bottom line here is that, for one, there is cultural universality with respect to ToM (all languages possess terms for referring to the mind and those terms have special universal properties, see Gleitman 1990) and secondly that talk about the mind merely reflects the child's development and does not indicate or relate to development in any other module (positively postulating modularity of the mind).

De Villiers discusses Perner's (1991) considerations about Leslie's (1987) claim that pretense and the representational means for it appear significantly earlier in child development than FB competence. Perner states that in pretense the child can map imagined (i.e. different from reality) propositions onto imagined protagonists, so all a 3-year-old has to do is map reality onto reality and imagination onto imagination. In the case of FB the child must map an imagined resp. false proposition onto a real person, i.e. s/he has to recognize a mismatch between two propositional contents, which 3-year-olds cannot yet handle. A 4-year-old on the other hand is able to recognize not only the mismatch between but also the attitudes towards the propositions and the independency of proposition and attitude. The 4-year-old develops a representational ToM which means the child understands that people act upon representations of reality, not necessarily upon reality itself and the child's theory of knowledge is enriched by a causal component. Karmiloff-Smith (1992) argues that socially embedded language is internalized to "serve a cognitive function" (de Villiers 2000: 94) and is representing the view (like Perner and de Villiers, too) that there is a significant change at the age of 4. In Karmiloff-Smith's theory cognitive development progresses from procedural via implicit to explicit knowledge, she considers the acquisition of mental terms as essential as these help the "redescription" processes from one representational format to the next. Karmiloff-Smith sees linguistic representations as a privileged format for encoding propositional attitudes. The fact that 3-year-olds fail at standard FB tasks is caused by the rudimentary symbolic representations which are not strong enough to override experience-based interpretations. De Villiers' own account differs from all those approaches in different ways, especially from Karmiloff-Smith's because for de Villiers language has not only a symbolic function.

2.3.3 The make-up of the relationship

Scholars working on ToM and language of course are not only concerned with the question if there is a relationship between the two capacities but also what this relationship looks like. They investigate the direction of the relationship (bi- or unidirectional) and the "active period" of the relationship (if it is a purely developmental, a purely mature-state or a holistic relationship). The latter issue has more or less been answered over the last 10 years. First of all, work with aphasic patients who lost certain language abilities after they had acquired it normally did not show related loss of ToM (see e.g. Apperly et al. 2006 etc.). Secondly, people who assume a strong relationship between language and ToM have only ever found evidence for developmental facilitation or causality (it seems to be counterintuitive to assume that ToM as a fast, subconscious and effortless cognitive device would underlyingly always depend on on-line and conscious language access). In the issue of directionality it seems that if there is a relationship between ToM and language in child development

at all, it is a heterogeneous one. Apart from the fact that for different stages of development there are different claims about the causality of the relationship (whether it is there at all and if so, whether it is necessary or just facilitative), also the direction of the supposed relationship is unclear and at certain points even contradictory. While JABs seem to have a positive effect on language learning, it is claimed for later steps in development (like FB reasoning) that language is the relevant developmental trigger. Malle (2001) shortly discusses two possible scenarios concerning the direction of the relationship: one where language precedes ToM at all times and one vice versa without coming to a final (i.e. biunique) conclusion for this issue. One would assume that at least for the linguistic determinism camp there is a clear answer to this question: namely that the relation leads from language to ToM and not the other way round, but it is not that simple. While de Villiers (2000) still states that the relevant influence only goes from language to ToM (merely granting the possibility that for linguistic perspective shifting ToM might be of help), she makes this question a more central aspect later where she makes the proposal "that the interface between language and Theory of Mind is bidirectional" (de Villiers 2007: 1858). To this day no clear answer has been found by any of the different frameworks. This leaves the impression that the form of the relationship described by linguistic determinism is a problematic one, at least in its unconditional and causal version.

Chapter 3 will take us to the special case this thesis is dedicated to: the relationship between FB reasoning and language acquisition.

3 False Belief and Language – Linguistic Determinism

3.1 Overview

We will now move away from properties that connect and are shared by language and ToM in general and come to more specific and framework-dependent (framework of cognition, modularity, language and developmental psychology) aspects of this relationship, namely the relationship between the development and acquisition of grammar and the development of FB reasoning in preschoolers (with some exceptions). This particular focus was chosen because of reasons that become apparent in the following section: preschoolers have shown peculiar linguistic behavior with certain question types that are highly relevant for FB reasoning.

The widely accepted fact that children only start understanding FBs around the age of four years (see *chapter 2* for greater detail) made people wonder what brings about this incisive change. It has first been claimed in the 1990ies that there is more to language and ToM than just analogies, Janet W. Astington and Jennifer Jenkins (1995) and Jill de Villiers (1995b) were amongst the first people to present arguments and data that indicated correlations between preschoolers' performance on language tests and FB reasoning tests. These findings should trigger an avalanche of research in both linguistic and psychological work. In order to assess the make-up of this assumed relationship and its conditions, a lot of studies have been carried out with different populations of different ages. Starting out with normally developing children to show a developmental link, soon other populations were covered as researchers wanted to find out if the assumed relationship was a developmental one or holistic and permanent in humans, so adults needed to be tested, too. Furthermore it was unclear when the relationship was active or provable, so populations with different impairments were investigated: deaf people with and without a lag in language development, native sign language users of the first generation (this refers to Jenny Pyers' work, e.g. Pyers 2005, with a population of Nicaraguan signers who made up a new sign language from scratch), populations with SLI (specific language impairment) and others. It was important to find out if the same connections can be shown cross-linguistically and if linguistic training contributes to the development of ToM or not. In short, there was a lot of work to do and this way plenty of evidence and studies were brought about both in favor of this relationship and against it.

3.1.1 Four global hypotheses on language and ToM

According to Lohmann & Tomasello (2003) "there are four global hypotheses" (p. 1131) concerning the specific nature of the role language plays in (developing) FB reasoning:

1) *Language plays no special role, "any and all data are relevant" for children to form theories about other people and minds. This is argued for by frameworks like the theory-theory, see e.g. Gopnik & Wellman 1992, Perner 1991 etc.*
2) *Primarily the acquisition and usage of mental state terms (especially mental state verbs: think, know, believe etc.) play a key role in false belief reasoning development (e.g. Olson 1988, and partly Bartsch & Wellman 1995 and Astington 2000), children acquire the mental concepts via adults using those mental terms to indicate mental states.*
3) *The acquisition of syntactic structures of mental language plays the crucial role in false belief development (de Villiers & de Villiers 2000, Gale et al. 1996) providing the children with the representational format for handling ToM and false beliefs. The open truth value of those constructions leads children to understand epistemic states in others. The mental verbs themselves are given some vague credit (in some accounts more, in some less or none).*
4) *Linguistic interchange is the key to children's understanding of false beliefs (Harris 1996;1999), – children's discourse with other people contains the processes for children to appreciate that people know different things and have different perspectives. (Tomasello 1999 and Siegal 1999 stressed the importance of discourse interaction, too). Evidence comes e.g. from studies with deaf children who engaged in richer discourse interaction and therefore were better in false belief tasks (Peterson & Siegal 2000 etc.)*

The viewpoint negating the relationship between FB reasoning and language development is represented by several frameworks giving counterarguments either from an empirical or a theoretical point of view. Some of those counterarguments have led to improvement and change in linguistic determinism whereas others have not been taken into account by mainstream linguistic determinism. In some cases this is for a good reason: there are threatening data and arguments that are not resolvable by the linguistic determinism camp with the theories they use accounting for the assumed relationship. This issue will be addressed in *chapter 4*.

In this chapter we will take a detailed look at linguistic determinism in Jill de Villiers' meaning of the term and chronologically cover the process of an interdisciplinary framework arising. This overview will cover the standard arguments and the recognized counterstrikes to the framework. Only in *chapter 4* will we cover the criticism and the shortcomings of this framework.

3.2 Core principles of Linguistic Determinism

This thesis is focused on the third type of hypothesis concerning language and ToM: the acquisition of syntactic structures of mental language is responsible for a successful acquisition of FB understanding. This framework is generally referred to as Linguistic Determinism. It developed along a rather neat chronological line taking its origin in the mid 1990ies.

3.2.1 Central claim

The general claim is that the concept of FB can only be contained, acquired and understood if the language used to express it is in place. Let's recapitulate: FB understanding is a ToM competence and is defined as the culmination of ToM abilities (cf. de Villiers 2000). We talk about a "false belief" when somebody has or makes an assumption that does not match with actual reality. The bearer of this assumption represents it as true in his mind and is not aware of the mismatch with reality (i.e. FB is different from pretense or lying). For our purposes FB gets important when it constitutes the mental basis of behavior as it will render certain behavior inadequate with respect to reality and common knowledge. An observer of this behavior who knows the truth (or at least represents a different belief as true) will not be able to understand and interpret this behavior as it will seem inadequate, illogical or mysterious if he or she does not have a command of ToM: in order to understand behavior based on a FB it is vital to know that every human individual can represent the world different from everybody else and therefore can also bear false representations of the world in his or her mind. These representations then can have influence on behavior, for instance: If a woman – who just witnessed the sun come out again after days of pouring rain – watches her boyfriend put on his rubber boots, rain coat and umbrella she will not consider him crazy if she has a full command of ToM; she will rather conclude from his behavior that her boyfriend bears the FB that it is still raining outside.

Generally, the direction of effect between concepts and language expressing them is that concepts develop first and then we find (acquire) the words for them. The assumption presented above clearly violates this general rule – here language would precede the concept in the developmental sequence. De Villiers and Pyers (2002) argue that other schemes have been imagined, such as "the scenario in which the child uses a term without fully knowing what it encodes, and hence is alerted to develop a concept or a conceptual " (p. 1038) and refer to work by Bowerman 1996, Gopnik & Meltzoff 1993 and Nelson 1998. In other words, they indicate the reversal of this direction could apply to the linguistic elements that encode mental states:

Language expressing FB: the linguistic means to express mental states (especially FB) are not only the verbs that encode those states, like *want*, *believe*, *think*, *know*, *remember* etc., a wholesome linguistic containment can only be achieved in combination with the special syntactic configuration that these verbs allow for. Only with a mental verb it is possible to syntactically subordinate a proposition, see (2):

(2) The girl thought (that) she saw a pink frog. (de Villiers 2000)

The syntactic structure in (2) is a complex configuration consisting of a matrix clause "The girl thought" and an embedded clause "(that) she saw a pink frog". The embedded clause is a sentential complement, in other words it is a syntactic entity has all the ingredients of a full-fledged sentence but is syntactically subordinated to another sentence (part). This special configuration renders certain interesting features that will be discussed later. The bottom line is:

The acquisition of the syntactic structure of embedded complementation is the unconditional developmental prerequisite to successfully acquire a) the concept of FB and b) the competence of reasoning about it.

Presenting the framework chronologically hopefully gives the reader insight into how and why things developed the way they did. To make the chronological presentation in this chapter as transparent as possible we will anticipate the basic ideas the framework grounds upon. The main assumptions have been defined around the year 2000 (see de Villiers 2000 resp. *3.4.2*) when enough studies and investigations had been conducted to manifest what linguistic determinism means in this domain of cognitive research. So in order to make the detailed discussion of the framework clear and taut the status quo of linguistic determinism in 2000 was the following:

i) Mental state verbs like *believe* and *think* and crucially the syntactic constructions connected to them (embedded sentential complements) are the only way to express and therefore mentally represent FB adequately, for example the sentence (3):

(3) "Mother thought that father has already left the house."

is a sufficient explanation for a situation like (4)

(4) Mother set the breakfast table only for the children and herself, leaving out father's spot although father was present and wanted to have breakfast with his family.

and is the only way to do so.

ii) The acquisition of the syntactic structure of embedded sentential complements is the necessary (and unconditional) prerequisite for the acquisition of FB competence in children. Complementation under a communication or mental state verb allows for the

embedding of a certain proposition into another proposition. This means that these linguistic structures provide the representational means for FB reasoning.

iii) The crucial and unique property of these structures is the autonomy of the involved propositions' truth values: the truth value of the embedded complement is independent of the truth value of the matrix clause which means that the complement can be false without rendering the matrix clause false and vice versa – only in this construction the truth value of the whole sentence can have a non-conflicting value.

iv) The acquisition of mental state structures comes about via analogy: children acquire the structures of communication verbs first (e.g. *He said that the weather was nice*) and project the acquired structures onto mental state verbs. The most important step in the acquisition is a feature located in the CP that encodes the potential falseness of the complement.

v) Verbs of desire can be excluded from this argumentation as they show crucial differences in their syntactic realization: they take nominal phrases as arguments, refer to future events and states etc., but never temporally embedded, finite or false propositions.

3.3 Testing

Before we start illustrating the framework and its chronological development it is helpful to first get an overview over the most common ways of assessing FB competence in children in order to understand the following argumentations and study outlines better. Also a short overview of the language testing methods will be given. The first FB tests were developed in the late 1970s/early 1980s and are still used today in adapted versions. What we are looking for in preschoolers is the ability to interpret, predict and explain behavior that grounds on certain mental states. The commons ways to assess these abilities are the following:

3.3.1 False belief tests

a. Unexpected contents task (developed by Perner, Leekam & Wimmer 1987.) – a version of it is the Representational change task (Gopnik & Astington 1988)

In this task children usually have to predict future behavior (or reactions) on the basis of a situation they themselves experience.

Test make up: the experimenter presents the child a well known container (e.g. a smarties tube) [optional: and in some cases the experimenter asks the child what s/he thinks is in the container]. After that the container is opened and the actual (unexpected) contents are revealed (e.g. crayons). Then the child is asked

i) what would happen if someone else was exposed to the same scenario (e.g. what will happen if [optional: we close the container again and then] your friend Sally comes into the room and we ask her what she thinks the container holds).

ii) what the child himself/herself had thought or said was in the box before opening it.

Questions:

Usually children are asked the prediction question and a check question ("What did you say before when the container was still closed?" which does not qualify as a mere memory check question because it already refers to mental processes), very often they also get explanation/justification questions ("Why…?").

b. Appearance-reality test

This task is a variation of the unexpected contents task – children have to predict future behavior on the basis of experiencing something as one thing and then as something else and have to be able to integrate themselves as potential bearers of FB.

Test make-up: children are shown an object that looks like one thing (e.g. a rock) and really is something else (e.g. a sponge). They are asked what the object looks like or what they think it is, then what it really is and finally what their (absent) friend would say it was when they first saw it (and sometimes in addition what they themselves thought before what the object was).

c. **Unseen displacement/transfer task, or Change-in-location task (first developed by** Wimmer & Perner 1983), also referred to as "Sally-Anne test"

In this task children have to predict a future behavior on the basis of a(n acted out) story.

Test make-up: the child witnesses a story (usually being acted out with dolls) where two characters, say Sally and Anne, put an object, a marble, in location A, say a basket, together. Both leave the location and later one of the characters, Sally, comes back to transfer the marble from location A (the basket) to some other location B (a box). The second character, Anne, is absent and neither sees it nor knows about it. Sally leaves. Anne returns with the now FB that the marble is still in the basket. When Anne wants to fetch the marble, children are asked where she will look for it.

Questions:

Children will always be asked about the expected action of the bearer of the FB, additionally they can get a justification question ("Why…?") and memory check questions ("Where did Anne put the marble before? Where is it now?")

d. **Explanation of action** (first developed by Bartsch & Wellman 1989)

This test is a variation of the unexpected contents task such that it is applied onto an acted out story, too (the direct involvement of the child is avoided). In this test children usually have to answer an explanation question.

Test make-up:

Here a doll is being tricked resp. deceived. While the doll leaves to take a nap in a different room, a certain object is transferred to another location, e.g. the doll's eggs are taken out of the egg box and hidden in a different, neutral container. When the doll enters the scene again it e.g. feels like having omelet and tries to retrieve the eggs from the egg box. The child then is asked why the doll would look in there.

Questions (e.g. in de Villiers & Pyers 2002):

Explanation question: "Why is he looking in there?"

Justification question: "Why isn't he looking in that (other) box?"

Question types:

- FB questions: Predict

  Prediction questions refer to future reactions or subsequent behavior on the basis of a FB situation, e.g. in the unseen transfer task: "Where is he going to look for it?"
- FB questions: Memory question

  This particular case refers back to an earlier situation like in the memory check questions but it investigates the child about a former (now cancelled) FB. It is used in appearance-reality tasks and unexpected contents tasks: "What did you say before was in the box?"
- Memory check questions / reality questions:

  This question assesses whether the child knows the facts true to the world, e.g. in the change in Location task: "Where is the cake really?" or even in the memory for complements task (see Perner et al. 2003): "What is the child really doing?"
- Explanatory Questions/Justification Questions

  This question assesses whether the child understands behavior (rather than how the child predicts behavior), e.g. "Why did he look there?" in the explanation of action task.

3.3.2 Language tests and measures

a. General language ability

These are the most common tests used to get measures of children's vocabulary, syntax and semantics and their general language competence without focusing on complementation:

i) MLU = mean length of utterance

It is a rough measure of mean syntax length disregarding complexity or categories.

ii) TELD = Test of Early Language Development (by Hresko, Reid & Hammill 1981)

It measures syntactic and semantic skills in expressive and receptive forms that are triggered by questions and pictures.

iii) IPSyn = Index of productive syntax (Scarborough 1990)

The IPSyn, too, is a syntax measure that analyses the range and complexity of the grammatical forms that are used. It is possible to retrieve subscores with the IPSyn that measure e.g. complements only.

iv) PPVT = Peabody Picture Vocabulary Test (Dunn & Dunn 1981)

It is a picture-based test of word knowledge and helps to assess spoken one-word vocabulary comprehension and production.

b. Complements

i) Memory for Complements Task (de Villiers & Pyers 1997)

In this verbal test the child is confronted with a story-question-sequence like in (5):

(5) story: "The Mom said she bought apples, but look, she really bought oranges."
question: " What did the Mom say she bought?"

The test is run with a communication verb (say), so according to the test designers the postulation or understanding of mental processes is not necessary for passing this test. As long-distance WH-movement is only possible in sentence structures with true sentential embeddings (which are the only structure adequate for FBs), the test designers assume that passing proves a full and productive competence in sentential complements.

ii) Medial answers to WH-questions (de Villiers & Pyers 2002)

To test whether children can appropriately subcategorize a complement under a verb, different tests with (long distance) WH-movement have been designed, one of them deals with medial WH-elements and whether children treat them as question words (incorrect) or as complementizers (correct), see de Villiers & Pyers 2002:

(6) story: "This little girl went shopping one afternoon but she was very late going home. She went a short way home over a fence but she ripped her dress on the wire. That night when she was in bed she told her mom, “Look I ripped my dress this afternoon!"
question: "When did the girl say what she ripped?"

iii) Sentential Complements Task (Perner et al. 2003)

In this test the situation is presented non-verbally, the children are presented pictures that show two protagonists simultaneously, where protagonist A says/thinks/wants that protagonist B does something, while protagonist B does something else (usually the opposite), for example:

(7) picture: shows two rooms of a house, parents are sitting in the living room and son Bobby is in his room. Mother thinks / says to father that Bobby is in his bed sleeping. In the other half of the picture we see Bobby playing with his cars.

The follow-up questions are:

Want-question: "What does mother think/say/want Bobby does/to do?"
Reality-question: "What is Bobby really doing?"
See-question: "Can Mom and Dad see what Bobby is doing?"

3.4 How it all started

This relationship was first entered into scientific discussion via two paths: cognitive science on the one and linguistic research on the other hand. The original idea to take a closer look at language in the context of ToM came from a linguistic background: in 1995 Jill de Villiers contributed an article to the Handbook of Language acquisition (de Villiers 1995b) which was concerned with the acquisition of empty categories and complex sentence structures in first language acquisition, especially concentrating on the acquisition and understanding of WH-questions. What made de Villiers suspect a correlation between the acquisition of syntactic structures and the cognitive capacity of FB reasoning was the peculiarities children show in the acquisition of certain question structures, namely their violations of adult language constraints on WH-movement. As already mentioned in earlier work (Roeper & de Villiers 1994) 4- 5 year old children were not able to see the difference in the following two questions and therefore answered them imprecisely:

(1) a. Who did Big Bert forget that he invited?
b. Who did Big Bert forget to invite?

(Roeper & de Villiers 1994: 384)

These questions followed up a story in which Big Bert for one invited his friend Grover to a party (but later forgets that he did that – (1a)) and additionally Big Bert forgot to invite his friend Bert entirely (see (1b)). Another example is medial WH-complementizers that children tend to treat like questions. Peculiarly children tend to answer a question like (8b) with concentrating on the medial WH-word (in this case they would say "her dress!") which actually does not function as a question word here.

(8) a. story: This little girl went shopping one afternoon but she was very late going home. She went a short way home over a fence but she ripped her dress on the wire. That night when she was in bed she told her mom, "Look I ripped my dress this afternoon !"

b. question: When did the girl say what she ripped?

(de Villiers & Pyers 2002: 1044)

Linguistic deviances like this caught de Villiers' attention and made her investigate both the conceptual and semantic contexts and the linguistic configuration more intensely. De Villiers (1995) makes the syntactic structures responsible; embedded clause structures are required relatively late and children are able to understand to-infinitives way earlier than finite (tensed) constructions

introduced by the determiner "that". This is de Villiers' explanation for why children treat question (7a) just like question (7b). As J. de Villiers & P. de Villiers mention in their recent work, "the focus on complementation grew out of work on long distance WH-questions, namely questions that attach to the lower verb in a two-clause sentence such as 'When did the boy say he fell', whether the answer is about when he *fell* not about when he spoke about it" (de Villiers & de Villiers 2009: 2). Also, these question structures have been used in FB tests since the 1980ies, they inherently treat mental contents – not only the structural (syntactic) understanding of them but also the conceptual one. This made de Villiers wonder if there is a closer relationship between the language capturing these mental states and the mental states themselves. The close analysis of these structures made de Villiers take the next step: she wanted to find out if the two capacities were dependent or correlated in any way, so experiments were conducted to define the correlation between FB understanding and linguistic competence in preschoolers.

The other source for the language-ToM-synapse naturally came from a general cognitive angle. Janet Astington and Jennifer Jenkins were working on the development of cognitive abilities in children and were especially involved with ToM. In two papers first presented at the biennial meeting of the Society for Research in Child Development in 1995 (de Villiers 1995a and Astington & Jenkins 1995) linguistic determinism in the strict sense should take its starting point. As a follow-up Jenkins & Astington (1996) conducted the first study to explicitly test 3- 5-year-olds on standard false-belief tests and various standard measures of general language ability (for instance on tests for vocabulary or sentence memory of the Stanford Binet Intelligence Scale and the Test of Early Language Development) and found high correlations between the scores. The first proof that language and FB reasoning competence enhance (if not determine) each another was shown. The assumptions and findings so far suggested that there are significant correlations between theory of mind task performance and language competence in toddlers (up to that point shown by e.g. Cutting & Dunn 1999; Hughes & Dunn 1997; Jenkins & Astington 1996). These momentary results conjured up issues and questions that needed closer investigations, researchers wanted to determine how this relationship was natured. It was not clear if

- both capacities influence each another or if there was an asymmetry, a direction of influence (i.e. only one capacity influences the other and not the other way round)
- the development of the two capacities depended on some other, third factor
- the correlations are unconditional meaning that the development of one or both depend entirely on the other capacity
- etc.

The first results came from cross-sectional studies (so to test a cohort of children exactly one time), but in order to answer the questions above the testing methods needed reconsideration. To get to the bottom of things the following components were necessary for an empirical assessment of the claimed relationships:

- tests that assess children's FB reasoning competence
- tests that measure children's linguistic competence and permit for teasing apart different linguistic measures, in particular competence in complement syntax
- longitudinal studies instead of the hitherto used cross-sectional studies that enable researchers to investigate the development of the two capacities for one, and secondly the direction of influence between language and ToM
- training studies on different ToM- and language competences to show if and how the increase of competence does or does not influence other domains

The studies and tests must be construed such that possible correlations between the results of the FB tests and the language measures can be calculated. The most crucial guideline might be that the FB tests should be as language-independent as possible or at least such that the part language plays can be teased apart from the ToM part. The following section will show that this point is problematic.

3.4.1 Longitudinal Studies

The need for longitudinal studies was met soon, right after the starting year of 1995 two studies were conducted: a longitudinal study by de Villiers and Pyers (1997) over the time-span of one year testing 19 children (starting age ranging from 3;1 to 3;9) three times and a longitudinal study by Astington & Jenkins (1999) over the time-span of 7 months, testing 59 children (2;9 – 3;10 years at the beginning) also three times.

3.4.1.1 Longitudinal study (normally developing children): Astington & Jenkins 1999

The authors wanted to investigate two issues with their longitudinal study: 1) the direction of the relation and 2) the contributions of semantic and syntactic aspects. The authors defined three possible scenarios for the nature of the relation between language and ToM development:

a) ToM depends on language
b) language depends on ToM, or
c) ToM and language are dependent on some other, third factor.

As for a) they emphasize that although FB assessment methods rely heavily on language, nonverbal ToM resp. FB tasks are not easier for children, so Jenkins and Astington do believe that language is crucial for ToM development and test design does not matter all that much. For b) the authors see a Piaget'ian foundation and explain that in this view children would have to first acquire a conceptual understanding of (false) belief and then wait for language to become elaborate enough to reflect this development. By this time it was already shown that adults who lose relevant language capacities do not lose FB understanding (Varley 1998) but Jenkins & Astington do emphasize the possibility of a developmental relationship. In option c) ToM and language would depend on an external factor like e.g. executive function. This still leaves the option for an intertwined definition of the relationship in the "external factor"-approach (see e.g. Shatz 1994 who assumes mutual facilitation via bootstrapping). Having settled on scenario a) Astington and Jenkins define these parts of language as crucial for ToM-development: Pragmatics (by definition) because pragmatic abilities enable one to use and interpret language appropriately in social situations, scores are usually related. Semantics kick in at the level of word meaning, many authors claim that acquisition of and understanding for certain words (especially mental verbs) are the crucial factors for FB understanding (Olson 1988). Syntax is a representational means for ToM and therefore highly relevant. Astington and Jenkins wanted to show that the direction of influence is from language to ToM and that general language ability plays the crucial role in ToM development.

Testing. FB reasoning was tested with an unexpected contents task, an appearance-reality task (deceptive objects) and a change-in-location task. Linguistic competence was assessed with the TELD (Test of Early Language Development, Hresko et al. 1981).

Prediction. The expectation was that the influential capacity would a) emerge earlier and b) significantly predict the success of the other capacity in later rounds.

Results. The rates of failing and passing on both linguistic and theory-of-mind measures were compared and put through hierarchical regression. To make sure that only the "contribution of language to change in theory-of-mind test scores" (Astington & Jenkins 1999: 1315) and vice versa was extracted, age was controlled for. ToM could not predict language competence for any of the analyzed time spans (namely from ToM scores of round 1 to language scores in round 2, ToM in round 2 to language in round 3 and ToM in round 1 to language in round 3), but total language scores did predict ToM scores between phase 1 and phase 2 and between phase 1 and phase 3 (not between phase 2 and phase 3), so language at an earlier point in time predicted theory of mind performance at a later point in time. When considering the subscores of syntax and semantics, "syntax made an independent contribution to the prediction of theory of mind after semantics was entered, but semantics made no additional contribution after syntax was entered" (Astington &

Jenkins 1999: 1316), but also here neither syntax nor semantic scores of time 2 made a contribution to the prediction of ToM at time 3. Only syntax made an independent contribution to the prediction of change in ToM performance.

The authors conclude that the structural features of language are the crucial ones for ToM development because the objects used in the visual experience and in the linguistic representation of a FB test are the same but they differ in their spatial arrangements. Following de Villiers (1995), Astington & Jenkins argue that syntactic (object) complementation provides the format for the representation of FB, but they do not agree with her in the claim that the acquisition of this specific syntactic construction is required in order for a child to develop a FB understanding arguing that object complements can be found in spontaneous toddler speech data (see e.g. Bartsch & Wellman 1995) long before they master FB reasoning. Also the difference between pretend and think speaks against a complementation-only explanation: children pass tasks of the form [person]-[is pretending]-[that x] but not of the form [person]-[thinks]-[that x] (see Astington & Jenkins 1999: 1318 following Custer 1996). The authors admit that they cannot yet rule out option c), namely that both language and ToM rely on some other, third factor as the language tests used and the language data extracted might simply be a better measure of the underlying structure (the third factor) than the theory-of-mind measure. Astington & Jenkins conclude that their data even if not conclusive supports the view that ToM depends on language in child development.

3.4.1.2 Longitudinal study: de Villiers & Pyers (1997)

Jill de Villiers and Jennie Pyers (1997) were the first to filter out two things on the basis of their longitudinal study: for one they claimed that the direction of the correlation is from language development to ToM development in the specific case of syntax and FB reasoning and secondly they found out that only one syntactic measure mattered statistically for the development of FB reasoning: sentential complementation.

They argue that a "rich system of interlocking propositions of the same semantic precision as that found in natural languages" (de Villiers & Pyers 1997: 136) is needed to represent propositional attitudes towards mental states. The authors consider the representation of others' FBs as "parasitic on the linguistic form" (de Villiers & Pyers 1997: 136), so until children haven't acquired the means to represent the grammar and semantics of an embedded complement they also lack the cognitive ability to reason about others' FBs and represent them.

3.4.1.3 Sentential Complementation in linguistic determinism

Sentential complementation is a special case of complex syntax that is different from other cases of complex syntax in several ways. De Villiers and Pyers ruled out every other kind of complex syntax explicitly, saying that "*to*-complements, relative clauses, *if-then* clauses, or conjunctions and adjunctions of other sorts" (de Villiers & Pyers 1997: 136) are not relevant for FB reasoning development – unlike sentential complementation. In a later article de Villiers explicates this claim with examples (taken from de Villiers 2000: 89):

(9) sentential complementation

a. The girl said she saw a pink frog.

b. The girl thought she saw a pink frog.

(10) other complex syntactic structures

a. The girl laughed and **saw a pink frog**.

b. The girl laughed before **she saw a pink frog**.

c. When the girl laughed **she saw a pink frog**.

d. The girl **who saw a pink frog** laughed.

The examples in (9) are cases of sentential complementation: the proposition "she saw a pink frog" is syntactically embedded under the matrix verb (i.e. *said* or *thought*), its special property being that it is false. Now, the propositions in the examples in (10) are also false, we can see a simple conjunction (10a), temporal relative clauses (10b,c), and restrictive relative clauses (10d) which according to de Villiers do not contribute to the development of FB reasoning. The reason why the examples in (9) are relevant for ToM and those in (10) aren't is the following: all sentences presented above contain a false proposition (i.e. its truth value is "false"[4]) but in the examples in (9) the truth value of the embedded proposition does not affect the truth value of its containing matrix clause or the whole sentence. So the truth value of (9a) is "true" if and only if the girl said *x*, in this case *x* being "I saw a pink frog" and this is the case independent of the proposition *x*'s truth value which is not the case for the examples in (10): in all four cases the false proposition *x* ("she/who saw a pink frog") is false and therefore renders the truth value of the whole sentence false, no matter if the other parts of the sentence are true in themselves or not. Back to the study in 1997: de Villiers & Pyers act on the assumption that only "the ability to use mental state verbs with sentential complements that could be false" (p. 137) is the crucial prerequisite to mastery of FBs.

[4] The proposition in question is "false" if we accept one of two scenarios: scenario A) contextual knowledge dictates that there is a pink frog but we know that the girl could not have seen it because she was lying in bed ill all day; scenario B) encyclopedic knowledge dictates that there is no such thing as a pink frog in this world and therefore the girl could not have seen such a thing.

Testing. As mentioned above the study was carried out with 19 preschoolers starting age ranging from 3;1 to 3;9. For assessment of FB competence they used

- an unexpected contents task, asking about: 1) the child's belief before the opening 2) an absent person's expected belief after the unveiling 3) the child's own belief prior to the unveiling.
- an unseen displacement task asking the following questions: 1) Memory check question: Where did X put Y? Where is Y now? 2) FB question: Where will X first look for Y? 3) Explanation question: Why will X look there?
- an explanation of action task in which a puppet is deceived with a familiar container hose contents have been hidden in another container. The questions asked were: 1) Why is he looking in X? 2) Why isn't he looking in Y?

For assessment of language competence they used:

- Memory for complements in described mistakes-task: children were told that the protagonist in a picture story either a) made a mistake b) told a lie or c) had a FB – the child had to report the contents of the mistake, lie or FB after being asked: a) mistake: "What did X think?" b) lie: "What did X say?" c) FB: "What did X think X did?"
- spontaneous speech data which was collected in round 2 and 3 during the testing (i.e. it was transcribed what children said during the test sessions, while playing computer games and watching silent videos). The following measures were extracted: MLU scores and IPSyn scores with the subscores for total Sentence Score (SS), the total complex sentences (total complex IPSyn), the total score for complements (IPSyn comps) and the total complex minus complements (IPSyn complex no comps) which enabled the authors to test the influence of the single subscores separately (other complex sentence forms were considered irrelevant).

Results. Using a Spearman Rank Order for the correlations it showed that the measure for IPSyn Comps significantly correlated with each of the FB measures, the Memory for complements measure correlated significantly only with the FB measures of prediction and contents, MLU with prediction only and IPSyn No Comps did not correlate with one single FB measure. All five competences measured (language: "what think" and "what think x", FB: prediction, contents, explanation) changed and grew within the same time frame indicating a direction of influence from this pattern. What the authors did next was to look at the changes over rounds. Success on one capacity was entered as a function of passing the other capacity. Children who failed the memory for complements task did not make progress on FB tasks, furthermore the passers of FB succeeded on complements and failers on FB did make progress in their linguistic representations. Making use of simple regressions a strong

asymmetry was found, language in round 2 as a predictor variable of FB in round 3 accounted for a significant variance of 32,1% (p<.01), whereas FB measures of round 2 as a predictor of complement syntax in round 3 only accounted for an insignificant variance of 9,5%. The authors concluded that "a certain level of mastery of complements is prerequisite for FB, not vice-versa." (p. 143). Finally a stepwise regression showed that IPSyn-comp of all language measures accounted for 47% of the variance (p<.001) and no other language measure added significantly to that and also as a predictor variable production of sentential complements was the most significant one. Concluding, de Villiers and Pyers point out that their study with normally developing children supports the view that complement syntax is the critical prerequisite for FB reasoning in deaf children (as investigated in Gale et al. 1996) but that they do broaden this claim to the general stance "ToM depends on language", as they see possibilities that some instances of ToM might also lead to new understandings of linguistic tasks like e.g. referential substitution (cf. de Villiers & Fitneva 1996).

3.4.2 De Villiers' "manifesto"

After first evidence supporting the linguistic determinism hypothesis was collected, Jill de Villiers wrote a kind of "manifesto" (de Villiers 2000) elaborating on her views on language and thought in general and language and ToM specifically.

3.4.2.1 Concepts

Contradicting the standard view (e.g. Fodor 1975) that concepts develop before language (i.e. they either are innate or emerge earlier) and all that language does is to pick out certain concepts of the potential ones and label them, de Villiers claims that language precedes thinking and concepts are formed on the basis of language – at least for certain types of concepts. Language learning draws a child's attention towards these concepts and they manifest themselves around a certain term – language is a highlighter or an "anchor" around which single bits of meaning group together to become a concept. Fodor claimed that there is a "language of thought" which is a rich, symbolic and propositional representational medium and which is shared by humans and speech-less beings (animals, children etc.). According to Fodor concepts can neither be learnt by experience nor is it possible for a child to acquire a word without having formed the concept first. De Villiers emphasizes that two different abilities are being mixed up here: on the one hand the ability to distinguish any A from any B, on the other hand the ability to group together all As and all Bs, or in other words: the ability to conceptualize A-ness vs. B-ness. Conceptualizing is a process of summing stimuli up along a certain dimension, not just distinguishing stimuli from each another, so de Villiers agrees with Fodor saying that distinguishing A from B is pre-linguistic, but she doubts that classifying all As and all Bs as coherent groups is language-independent. Evidence from infants' acquisition of basic-level concepts

(e.g. Mandler & McDonough 1993) shows that detecting perceptual similarity alone does not prove conceptual classification. Analyzing examination times of stuffed animals in tests with toddlers (habituation/dishabituation-paradigms), children seem to be able to "see" the perceptual differences between stuffed cats and dogs, but these differences did not incite different behavior. Mandler & McDonough could only find differences in the treatment of animate vs. inanimate things. Basic object level categories are established only on a perceptual level at the end of the first year of life.

Concepts in need of a linguistic basis. To illustrate her hypothesis of language preceding concepts de Villiers presents how different concept types need language for their full development.

Spatial relations: concepts like "tight fit – loose fit" are linguistically realized e.g. in Korean. To prove her point de Villiers confronts the reader with a group of As (tight fit) and a group of several Bs (loose fit) without first announcing their underlying concept, arguing that someone confronted with this list would be able to distinguish the As from the Bs, but not conceptualize Aness and Bness. Though once instructed about the concept, everyone is able to come up with examples of it. Despite of being able to spot the difference, a coherence class is not formed unless the reader is pushed.

Action categories: comparing some event A with some event B (e.g. an act of jumping with an act of running) de Villiers would expect constant different reactions to every kind of jumping or running independent of agent, situation, motive etc. Language is what provides the necessary input via verbs to densify the perceived differences in a symbol for a class of events. On an object level one can observe reactions by infants to basic categories like feeding, showing, sleeping, smiling etc. which are concepts that could, according to de Villiers, emerge prior to labeling. But these pre-linguistic classes are rather limited – if you take for instance a super-ordinate like "fruit" it is unlikely that children show general reactions exceeding the basic object-level, so it is the labels that send the behavioral signal for classifying. Language invites the formation of a super-ordinate class.

Properties: colors for instance are – in the child's natural world – attached to objects; they aren't forming natural classes (i.e. there is no certain reaction triggered by all red objects). Subsequently the only natural grounds that group certain colors together are labels as they offer an alternative way of differentiation, namely that of *property* (in opposition to that of *thing-hood*).

Second-order categories (logical relations): referring to Premack (1983) de Villiers finds further proof that there are concepts genuinely dependent on language. Premack argues that second-order categories like "same" or "different" rely on symbolic mediation for their formation. This means that symbol-less species do not entertain concepts like these and do not understand them. Even though chimpanzees that are especially trained on symbols are able to discriminate different symbols, they are not able to form a coherence class like the second order relationship of 'same' vs. 'different'.

What they are lacking is the ability to detect sameness. Take for instance a matching test for sameness: *"find the match for "AA" – is it "AB" or "BB"?"* The matching counterpart concerning *sameness* for “AA” is “BB” because we are looking for a judgment about the relation between relations. Chimpanzees in this case would pick “AB” as it looks most similar to “AA” – the concept of sameness which would lead to the correct answer is oblivious to species like that. De Villiers concludes that only language is the appropriate symbolic code to form concepts like these. Other examples are negation, relations like "more than", "bigger as", "to the left of", "cause" etc. Assuming Premack is right, de Villiers has a strong argument in favor of language being not only an "invitation" or highlighter for forming (certain) concepts but the only way to do it.

De Villiers admits that there probably are certain basic object-level categories and certain basic human actions that form coherence classes based on behavioral equivalence – these might be prior to labeling and shared with other species. Superordinate object classes though – properties, actions, events, spatial relations and logical dependencies cannot be conceptualized pre-linguistically. "Labelling is usually the mechanism by which the coherence classes get formed, though it is not necessary that language be the mechanism." (de Villiers 2000: 87)

3.4.2.2 Sentential complements

De Villiers elaborates that language is more than a provider of symbols. Thanks to its combinatorial power (with its constituents, grammatical system, recursivity and other mechanisms) it permits for the creation of infinite propositions which is the basis for opening up possible worlds. This combinatorial power also makes it possible to embed one proposition into another by the grammatical means of sentential complementation (under a communication or mental state verb).

i) The relativity of the truth value

As mentioned earlier (see *3.4.1.3*) not only the fact that two propositions can be correlated in one syntactic entity makes this sentence type special, the independence of the truth value of the complement from the matrix clause and vice versa makes this sentence type unique. This is not true for any other sentence type, and no other logical expression (like or, if, then, can, it is not the case that) as they cannot give access to worlds that are or can be true in someone else's mind.

ii) Long Distance WH-movement as a proof for ToM-specific semantic properties

Another crucial argument for de Villiers is the case of long-distance WH-movement, claiming that only in true sentential complementation structures (a full clause/proposition is embedded under a mental state or communication verb) long-distance WH-movement is possible. WH-Movement is a syntactic operation for which it is hypothesized that WH-items (words like when, who, where etc.

which are question words in their default use) are originally (syntactically underlying resp. in-situ) located where they belong according to argument structure in the syntactic constellation. This basically means that the "who" in "Who$_i$ did John meet t_i?" is located right after "meet" (indicated by the trace 't_i') and is then moved to the beginning of the sentence via a syntactic movement operation. In the case of long distance movement we can observe a peculiar asymmetry. Take the following two sentences:

(11) a. The girl thought that the train was leaving tomorrow.
b. The girl saw that the train was leaving tomorrow.

These examples seem to have the same syntactic constellation, but as soon as you turn them into questions you stumble across asymmetries:

(12) a. When did the girl think the train was leaving? → long distance WH-movement
b. When did the girl see the train was leaving? → no long distance WH-movement

We can see that in (12a) the WH-element can refer to '*leaving*' (i.e. long-distance WH-movement) but in (12b) the WH-element can only refer to *'see'* (long distance WH-movement is ungrammatical here, i.e.: "* When$_i$ did the girl see the train was leaving t_i?").

Sentential complementation is special as it is more than mere adjunction to the verb as in (11b). This property is necessary for pointing out the distinction between what really happened and what happened according to someone's mind. Information needs to be integrated across two verbs, not merely one. Language can capture a mind's contents, the relativity of it and therefore has the potential to represent it. De Villiers emphasizes that the class of events that refer to mental states can only be recognized and formed by language: first via the labels for those events (i.e. verbs like *think*, *know*, *believe*) and then via the structures that enable us to represent false propositions embedded in true propositions correctly.

3.4.2.3 Naturalistic evidence for relations between language and ToM

For ***joint attention behaviors*** de Villiers sees a mutual facilitation, e.g. labeling and establishing reference and antecedents are supported by joint attention behaviors and nonverbally perceived intentionality supports early language acquisition. Speech on the other hand might facilitate the acquisition of a notion of intentionality. Concerning ***desires*** de Villiers says that others' desires are consciously perceived from the third year of life onwards and children begin to predict behavior according to these desires. Around the same time mental terms of desire (want, like etc.) enter the child's active lexicon. De Villiers emphasizes that desire verbs do not take full, temporally embedded propositions as arguments but nominal phrases, future events and states (coded by infinitive forms)

or currently true resp. habitual events (coded by gerund forms) and that the arguments are at no time false (i.e. never in conflict with reality). At this stage language is merely a "shortcut" for inferences, it is not necessary to reason about desires felicitously.

Beliefs. Mental verbs like think and know first occur within the 3rd year of life but initially do not have real mental reference yet. De Villiers claims that only at the age of four children are starting to understand the notion of thinking and especially its potentially false contents, as three-year-olds mostly use mental terms in stereotyped routines("I don't know" or "I guess" or to express insecurity "I think it's in here"), self-referentially and in the vast majority with true propositions (cf. Bartsch & Wellman 1995). De Villiers reports of Bartsch and Wellman's study (1995) where spontaneous speech data often contains mental terms early in development, used in contexts of mistakes where they do mark deviation from reality, e.g. "A (2;11): I painted on them. [his hands]" – "B: Why did you?" – "A: I thought my hands are paper." (see de Villiers 2000: 97). Early cases of mental reference have also been found by Shatz, Wellman and Silber (1983) where children aged 2;8 uttered sentences like "I thought there wasn't any socks, but when I looked I saw them" and "The people thought Dracula was mean, but he was nice." (Shatz et al. 1983: 309). These spontaneous speech data show that talk about mental states with genuine mental reference appear quite long before successful performance on standard FB tasks. De Villiers handles this by claiming that performance demands might be responsible for this gap, and she calls on the notion of "skill or productive mastery" meaning that "doing something once in a while, when everything is right and you are in control, is a lot different to summoning the performance successfully every time" (de Villiers 2000: 97). Furthermore the syntactic status of the mental verb's arguments cannot be determined, i.e. we don't know if the complements are real embedded complements with the full syntactic structure.

3.4.2.4 The memory for complements task and the role of communication verbs

For that exact reason de Villiers and Pyers (1997) developed the memory for complements task:

(13) a. The girl said she went to buy oranges. But look, she really bought strawberries!
b. What did the girl say she bought?

De Villiers' claim is that this test shows if the relevant syntactic structures are acquired fully without having to access any mental understanding. Children answering the question in (13b) incorrectly (namely with what the girl really bought) don't have full command of real complementation yet. Situations with communication verbs need the same syntactic structures as mental verbs, according to de Villiers children only have to tease apart speech acts without reflecting on hidden mental processes. Even more so, children in fact only have to "remember" what they were told audibly.

De Villiers concludes that communication verbs play a central role in mental development: the syntax for both communication and mental verbs is the same and furthermore they share the genuine possibility for embedding false complements / propositions. De Villiers' idea is that the syntactic structure of communication verb constructions is acquired first and then in analogously applied to mental verbs. This predicts (and accounts for) a state where children can make use of mental state verb constructions which are overtly correct even if they are not fully understood yet. The relevant complement structures in combination with the acquired mental terms (verbs) provide the basis for the acquisition of representational structures for encoding FB. The last step in the development of FB understanding is the acquisition of a feature located in the CP (complementizer phrase of a syntactic construction[5]). This feature is a marks the potential falseness of the CP resp. the independency of the CP's truth value. This feature is triggered or introduced by the verbs that need it: communication and mental state verbs ("non-factive verbs" cf. de Villiers). She describes this feature as a formal property of the grammar that must be set in order for children to understand non-factivity. In analogy to some linguists assuming a feature for factive verbs (like *know*, *forget*) which signals that their complements are obligatorily true and as the CP site is considered to carry information about properties like quantification, questions, focus, topic, point of view etc. De Villiers sees theoretical grounds for her feature.

Summary. In short, de Villiers' main arguments are:

a) The acquisition of the syntactic structure of embedded sentential complements is the basis for the acquisition of FB competence in child development.
b) Mental-state verbs like *believe* and *think* are the only verbal expressions that are adequate for FBs both structurally and representationally.
c) The acquisition of the syntactic structure that mental-state verbs bear or project happens via analogy of communication verbs' structure, so it is not necessary for the child to understand the concepts before acquiring the according language.
d) The last and crucial step in the linguistic development is the acquisition of an abstract syntactic feature (set in the CP of the sentence) that indicates the potential falseness of the following clause. This feature is projected by communication and mental state verbs only.

All in all these main arguments did not change up to today (see e.g. de Villiers 2007) and still constitute the basis of the linguistic determinism-framework. Shifts in direction and widening or changing of the arguments will be addressed chronologically in the sections below.

[5] i.e. the place where complementizers like *that*, *for*, *if*, *what* are located in syntactic constructions

3.5 Evidence from different populations

In order to find arguments for or against linguistic determinism in child development it is crucial to test both children's language competence and their FB competence and contrasting the scores of normally developing children with children who show impairments in the linguistic domain (like for example oral deaf children with language delay or children with SLI). We will concentrate on the populations of preschoolers investigated closely for arguing for linguistic determinism (so studies where populations were explicitly tested for their language competence in respect to correlating the language measures to the ToM measures). The different sources of evidence supporting the basic framework described above are the following (see J. de Villiers 2005: 189f):

- For normally developing children (for main arguments see e.g. de Villiers & Pyers 1997;2002) it has been shown that only children who pass the crucial language competence tests will successively pass FB reasoning tests. Significant correlations have been found.
- Oral deaf children and ASL-acquiring children who show delays in language acquisition (see e.g. de Villiers & de Villiers 2000) have been proven to show FB competence significantly later than normally developing children. Deaf children of deaf parents (in other words: deaf children who acquire ASL natively from their parents without delays) who don't show delays or deviations in their language development have been control groups for the above (e.g. de Villiers, de Villiers, Schick & Hoffmeister 2000) and as predicted they did not show delays in FB competence.)
- A group of signers of the first generation (i.e. deaf children who are not exposed to any formal well-developed sign language and therefore have to "make one up" from scratch) has been tested, namely a group of first-generation Nicaraguan signers (Pyers 2005). It was shown that these people did not develop sentential complementation (i.e. complex syntactic structures) and hence did never acquire the ability to reason about FBs.
- Training studies of different kinds with training on either language (sentential complementation and the likes) or ToM (FBs, deceptive objects etc.) or both have been conducted to tease apart the intensity of influence on ToM-development (see e.g. Hale & Tager-Flusberg 2003, Lohmann & Tomasello 2003 etc.).

All these studies have brought about evidence supporting the argument that language necessarily and determinatively precedes ToM in child development, for instance by showing that a delay in language acquisition supposedly causes a delay in FB reasoning acquisition. The following section gives an overview of the details and results of those studies.

3.5.1 Studies with normally developing children

Two of the first theory-determining studies were conducted by Jill de Villiers and Jennie Pyers (1997 and 2002). The paper from 1997 is discussed in section *3.4.1.2*. The study in 2002 was also dedicated to investigating the relationship between the language about the mind (especially complementation syntax) and the development of FB understanding. They wanted to find out which ability comes first in development and what the direction of influence is. De Villiers and Pyers (2002) tested two cohorts of preschoolers (28 in total) with starting ages between 3;1 to 3;10 years over the course of a year. Both cohorts were tested in four session blocks, procedures and materials were identical.

Testing. For FB assessment de Villiers and Pyers used three FB tasks:

- Unexpected contents task (featuring a smarties tube, a band-aids tin, a raisins box, a small milk carton, and a Playdoh container), the questions asked were a FB prediction question ("What will Sarah think is in the box?") and a FB memory question ("Before, when you were sitting over there, what did you think was in the box?")
- Unseen displacement task (with stories like the Bobby and daddy buy a cake-story), the questions were a memory check question ("Where did Bobby put the cake? Where is it now?"), a false-belief question ("When he comes in the kitchen, where will Bobby first look for the cake?") and an explanation question ("Why will he look there?")
- Explanation of action task (with stories of the type where a doll is going to sleep and later craves eggs that were moved out of the adequate container), with the following questions: FB explanation question ("Why is he looking in there?") and a FB explanation question ("Why isn't he looking in that (other) box?")

Passing. In the unexpected contents task children at least had to give the correct word (expected answers are "smarties" = correct or "crayons" = wrong) with two possible points, in the unseen displacement task children could score one point for correct prediction and two points for justified prediction (NB: no mental reference was needed for the justification question to be correct, an answer like "because he put it there" sufficed). The third task had the same passing logic as the second. 5 or 6 correct out of 6 possible points counted as a pass.

For language assessment the authors chose the memory for complements in described mistakes-task (half of the stories with communication verbs, half with mental state verbs) as presented in their 1997 paper and they analyzed spontaneous speech data (the utterances children made during the test sessions and while playing computer games, playing with various toys and watching silent videos were recorded and coded in MLU and IPSyn scores with relevant subscores). Besides that they also

investigated how children treat medial WH-words that function as complementizers. As children have the tendency to answer those as if they were questions this is another good test for command of full complementation. For a detailed description see *3.3.2*.

The data showed that scores on both types of memory for complements were continuously higher than on FB. Within FB scores the measure of prediction was relatively high, justified prediction was a better correlate with the other FB measures than prediction alone. All in all round two showed the highest variance on all tasks. The complement-relevant measures (memory for complements mental & communication and the IPSyn score on complementation) showed a strong relationship with the FB measures (only the score of the medial WH-complementizers was too low in round 2 to show a strong relationship). The other syntactic measures showed a weaker relationship with FB scores. Interestingly, the least verbal FB measure – prediction – showed the weakest correlation with complementation. Only very few children failed the memory for complements tasks but managed to pass FB –the other scores of those children revealed though that all of these "outlaws" either gave full-fledged justifications (with mental verb and complement in place) and/or had occurrences of complementation in their spontaneous speech data which de Villiers and Pyers took as good enough proof to their theory.

Predicting FB. General syntax measures such as MLU and IPSyn general and IPSyn w/o complements did not predict a significant percentage of variance in FB. The significant predictors were indeed the complementation measures.

Direction of influence. To find the direction of influence both FB and memory for complements scores of round three were used as dependent variable in regression analyses; for FB in round three neither round two scores of MLU and IPSyn w/o complements nor adding the other two complementation measures had a significant influence on variance. Only memory for complements could successfully (significantly) predict FB performance. The reversal did not show significant correlations: neither IPSyn complements nor memory for complements in round three could be predicted by any FB measure of round two. Prediction (without justification) which apparently was an easier task than the other FB measures could be predicted in round two with the memory for complements score in round one – so even if it is a less complex subtype of FB understanding, it is still correlated with complementation.

The authors argue that language is not only necessary to encode belief states for reporting on them but is needed in order to represent mental states of other people. They argue that their framework does not need to be strongly committed to either the view that children have all syntactic structures available from the start in form of Universal Grammar (explaining problems or lack of

complementation as performance or processing errors) or the view that children have incomplete language competence and therefore fail complementation, because in either case children who are not able to conjure up a full and correct syntactic representation of a complement construction will fail FB understanding because they lack the representational means. Concluding the authors note that a bi-directional effect between the two capacities is not excluded because the understanding of FB renders talking about it more likely. Furthermore, they admit to the possibility that an implicit understanding or expectation of how others' will react to certain situations emerges before the explicit ability to reason about it.

After that it became customary to conduct studies with deviant populations and to have normally developing children integrated as control groups, so there is still data collected from normally developing children but usually in different contexts.

3.5.2 Studies with deaf and signing populations

The linguistic determinism community was very intrigued by the fact that deaf children who do not acquire sign language natively (i.e. do not have deaf resp. signing parents) show delays in their language development. Obviously the prediction of linguistic determinism for a language delayed child would be that theory of mind or, more precisely, FB reasoning, would also show a delay in development that ideally correlates significantly with the delay in language development. As deaf children do not show associated or secondary impairments like for instance children with autism do they are considered particularly good test subjects that ideally allow for teasing out the effects of the developmental language delay on ToM.

3.5.2.1 Orally taught deaf children: de Villiers & de Villiers 2000

The first to investigate this relation were Gale and colleagues (Gale et al. 1996) who found out that the production of complex syntax (in spontaneous speech) of orally taught deaf children was highly correlated with their FB understanding which was three years delayed on average. A representative list of studies that investigated related questions can be found in Pyers (2005: p. 45).

One group investigated by Jill & Peter de Villiers (2000) were orally taught deaf children who are brought up by hearing parents (i.e. no fully developed sign language is used natively in the children's homes) and taught in oral schools for the deaf where auditory and speech training and sometimes lip-reading are the teaching focus. According to de Villiers, "the average six-year-old deaf child

acquiring English as a first language is significantly delayed, both in lexical knowledge and, importantly, in grammar." (de Villiers 2000: 107), whereas the impairment mainly concerns inflectional morphology (like missing plurals, past tense, possessive markers etc.) and syntax (with less reliably marked word order e.g. in agent-action-patient sentences and a particular difficulty with embedded clauses), furthermore their narrative abilities are impoverished. Overall a developmental lag of three to four years can be found in comparison to normally developing children in vocabulary and syntax tests (cf. de Villiers 2000). Nonverbal tests on the other hand are usually mastered in a normal or even above-average time-frame (e.g. tests that include spatial relations, visual sequences etc.); emotionally and socially these children show age-adequate behavior. Because of their language inhibitions[6] standard FB tasks might be problematic testing methods for deaf children, de Villiers & de Villiers rather collected spontaneous speech data and elicited data with nonverbal tests from a group of oral deaf children and a control group of normally developing, hearing children. To obtain spontaneous language data the children were confronted with mute cartoon videos of events that showed different instances of intention, desire and (false) belief. In order to follow the stories children had to postulate intentional states for the characters. The descriptions deaf children gave during and after the videos showed clearly that they had considerable problems to understand and formulate intentional descriptions of the protagonists' actions in comparison to the control group. In fact, the deaf test subjects conceptualized the events in a different way. For eliciting language two nonverbal tests were used that should test the children's FB understanding:

i) **Sticker Test** (following Povinelli & DeBlois 1992): in this test the experimenter hides a sticker in one of two presented boxes. There are two experiment helpers one of which is watching this while the other one is out of sight together with the child (behind a screen). Then the two helpers will each point to one of the boxes and the child has to decide which helper's advice to take in order to find the sticker. De Villiers & de Villiers admit to this test being an ignorance task rather than a FB task, but they consider it fit given that the child needs to act upon the grounds of differing mental contents. This task is passed with minimally 8 correct out of 10. The average passing age in the deaf group was 7;3 years compared to 4;4 years in the control group and performance correlated with the performance on standard verbal ToM tasks. The children's skill to produce explanatory language for actions as results of cognitive states (measures taken from the narratives produced at viewing the silent videotapes) was the best predictor for the performance on the nonverbal ToM task.

[6] see de Villiers 2000 p. 107: a) the children could fail to understand the task as such because of linguistic inhibitions b) as they never/too rarely had language highlight FB events in their development they might not (yet) be able to form the necessary categories to encode and interpret them c) the children might be unable to encode those events in language which might lead to an inability to represent the distinction between someone else's mind's contents and the real world.

ii) **Appropriate Facial Expressions Test** (de Villiers & de Villiers 2000): the test subjects had to pick the final sequence for a cartoon story in which the protagonist experiences an unexpected contents situation. Children had to assign the correct facial expression ("surprised" vs. "not surprised") and could choose between two transparents showing the protagonist's face. This task was harder than standard FB tests for both hearing (average passing age 4.46) and deaf children (average passing age 8;5). Again, the nonverbal task showed that the delay in mastery of FB tests does not depend on external factors but is in fact highly correlated with the language delay of the test subjects. There was a significant contribution to performance by age though.

The data were analyzed for vocabulary (with the PPVT), for MLU and two IPSyn measures: IPSyn complements and IPSyn Sentence Structure w/o complements. The data were then analyzed with regard to the influence of the different language measures and the IPSyn complement score turned out to be the only significant predictor for the standard FB reasoning tasks, for the surprise task both the complement score and age each were significant. Two conclusions have been drawn:

1) FB reasoning is significantly delayed in oral deaf children both in verbal and nonverbal tasks
2) command of complement syntax is a significant predictor for performance on any kind of FB task

3.5.2.2 Emerging sign language in Nicaragua and ToM

An investigation in extremely rare circumstances has been conducted by Jennie Pyers 2001 (published as dissertational thesis in 2005). Pyers investigated the language and ToM abilities of a group of 1st generation signers who were not exposed to any kind of formal (sign) language in early childhood (i.e. in their critical age for language acquisition) and therefore had to develop their very own sign language. In the first generation this language lacks certain formal features and complexities fully-fledged natural languages usually have. This group of signers who were brought together from all over Nicaragua in the late 1970ies to go to the newly found school for the deaf developed the Nicaraguan Sign Language (NSL) which evolved over a period of ca. 15 years (and is still expanding and developing). In the founding years of the school the signers were taught to read lips in Spanish, but they were provided the opportunity to bring their rudimentary home sign[7] systems together which enabled them to start forming their own unified sign language. Populations like that are of course rare, especially in the first generation of the language. The so called first and

[7] The term home sign refers to "a fairly rich repertoire of iconic (pantomimic) gestures, pointing, and simple gesture 'sentences' that they [deaf children] use in the home with hearing parents and siblings, who also use the same 'Home Sign'." (de Villiers 2000: 106)

second cohort show systematic differences along the lines of age of entry and year of entry. Younger children were able to outperform older adolescents linguistically if they entered the school before they reached age six and / or if they entered the school after 1986. This means that the language of the first cohort is systematically poorer (in complexity and variety) than the language of the second cohort although the latter exclusively got their linguistic input from the former. Basically, what Pyers says is that the 30-year old NSL-signers from the first cohort have a language that "is essentially a fossilized record of what the language looked like 15 years ago" (Pyers 2005: 155) because the older signers struggle with taking over rules and structures that are developed by the younger signers – after all, they have not been exposed to NSL in their critical language learning age(s) (note: this is although they live side by side with the younger group members). This way it is possible to track language change in this evolving language; what happened on a general note is that younger cohorts moved away from holistic representations of events (i.e. gestures) by pulling out different information into separate signs and expressing them sequentially – so the second cohort and each cohort following moved the NSL towards the combinatorial and systematic properties of a fully-fledged natural language.

The prediction. With complex structures missing even in adult language the prediction by linguistic determinism was that the first cohort of the Nicaraguan signers would not pass FB tests, not even in adulthood. With a population like that it is not possible to use the standard FB tasks (see Pyers 2005: 51) because of the high linguistic task demands.

Assessing FB: predicting. Pyers developed a nonverbal picture completion version of the change in location task, a "minimally verbal false-belief test" as a first step to assess the signers' FB understanding. The test is a prediction of action task; participants were shown sequences of six pictures where the first five pictures depicted a typical change in location-situation. The children had to pick the sixth picture (2 candidates, 50% chance) for the sequence to be completed. One of the two final cards showed the protagonist looking in the current location (wrong answer), the other showed the protagonist looking in the old location (correct answer). Two training sessions with simple narratives introduced the participants to the test scheme, so little or no language was necessary for the actual testing. 12 deaf adults were tested (6 first cohort, 6 second cohort signers).

The results showed that indeed first cohort signers did not have a command of FB understanding, not even in adulthood. As predicted the older cohort signers all failed the task whereas the signers of the second cohort all passed.

Assessing FB: explaining. In the second step Pyers was interested in the explanation-of-action-competence of the signers. In this test each cohort was represented by eight signers. The method

here was to elicit language by showing six short, silent videos two of which were targeted at desire and the remaining four at FB. In the FB videos the contents were either appearance-reality or change in location scenarios. After viewing each video twice the signers narrated it to a "confederate" ("an American hearing signer of NSL who had been working with the community for more than ten years" p. 78) who had not seen it. If the narrative did not refer to internal states the listener asked two probe questions, first: "Why did the man put the dog on his head?"[8] and, if the explanation still didn't include mental reference, a second question was asked: "Did the man want to put the dog on his head?". In the analysis of the narratives failers were defined conservatively: only participants who failed all four FB tasks were counted as failers. In their explanations the failers only referred to physical and perceptual events that led to the erroneous action. Only one first cohort signer explained the "strange behavior" from a mental viewpoint, all the others did not use any instance of mental reference for explanation. These results give Pyers reason to contradict hypotheses that trace ToM back to biological maturation of inhibitory control because the failers had an average age of 26;6, and furthermore hypotheses like Bartsch and Wellman's (1989) idea that predicting is harder than explaining (because in prediction children are always confronted with and misled by reality whereas in explaining they can overrule their bias towards reality easier because they already observed the behavior caused by the FB). Even though the first cohort showed normal social experience and interactional skills (and are on average ten years older than the second cohort) this could not enable them to understand FB situations, which suggests that lack of (certain) complex language structures leads to a lack of mature FB understanding rather than (lack of) social interaction being responsible for it.

An a related note, first cohort signers were very well able to appreciate the relationship between desires or individual preferences and emotional responses, furthermore they had no difficulty in understanding under which circumstances knowledge about events arises. This means that it is indeed only FB reasoning that is impaired in the first cohort's ToM and ToM-related abilities.

Assessing complementation competence. According to Pyers, understanding sentential complementation is hardly documented for sign language(s), let alone is it a clear case in NSL – on the one hand because it is an emerging and mostly undocumented language and on the other hand because the ways of expressing abstract features are very different from e.g. spoken English, for instance argument structure is expressed via space, a means which older NSL-signers (first cohort) are inconsistent with. What Pyers did in her assessment of complex mental verb syntax was to

[8] The FB story was: "a man puts his hat on a shelf and sits down to read a magazine. A young boy enters the scene and places his stuffed toy dog on the shelf, pushing the hat to the back in the process, all unbeknownst to the man. A few seconds later, after finishing his reading, the man reaches back without looking to get his hat. He grasps the stuffed dog, instead of his hat, and puts that on his head." (Pyers 2005: 78)

analyze the short narrative descriptions elicited in the Explanation-of-Action tasks. Pyers was looking for three different structures: a simple mental verb without complements or full propositions (which would roughly equal "He thinks." in spoken English), mental verbs with adjacent nouns (such as "I'm thinking ice cream.") and a mental verb followed by a proposition including another verb (which should roughly equal "He thinks that the boy has already left."). Two ways are assumed to determine whether a verb is related to an adjacent proposition: one was linguistic – Pyers calls it a "verb sandwich" and its structure looks like the example in (14):

(14) MAN DOESN'T_KNOW BOY HAT SWITCH DOESN'T_KNOW (Pyers 2005: 158)

The fact that the inner proposition is flanked by two instances of the mental verb probably indicates that the complement is subordinate to this verb. A non-manual way of displaying (and detecting) correlation between two entities is e.g. by head positions being carried over from one part to the other; for instance in negation a headshake that is carried over from the mental verb to the proposition can indicate that those two are related.

Passers and failers of the FB test did not differ in stand-alone mental verbs and mental verbs plus noun phrases, but in mental verbs plus subordinated propositions the passers significantly outperformed the failers (only one of the failers produced complex mental utterances at all). These findings, according to Pyers, underline the assumption that FB understanding and complement structures go hand in hand although a causal argument cannot be made with these data (rather they only prove that those competent in FB understanding also use more complex syntax in mental verb environments). Pyers concedes the findings also because they again resulted from mixed data – the language data that was analyzed was used to describe FB situations, so if first cohort signers do not perceive or understand FB at all they might not be urged or motivated to use (complex) mental language at all in this context.

An interesting side-note is that in the NSL-data the majority of the mental verb + complement structures did not feature a false complement but rather a negated mental verb ("doesn't think") embedding a true proposition. Remember that linguistic determinism heavily relies on the acquisition of the falseness feature of embedded complement constructions being the crucial linguistic feature for FB understanding. Analyses looking for false complements, for the behavior of communication verb constructions and other issues could not be performed by Pyers within this dissertation, so they remain open. Also in structures used with desire verbs only a small subgroup of first cohort signers used complex language ("verb sandwiches" as in (14)) to do so although they had n problems with detecting and explaining desires. This means that not all instances of ToM are dependent on (complex) syntactic structures. Pyers concludes that:

"...given that the language of these two groups of signers differs in domains that are unrelated to false-belief understanding, it seems likely that the first cohort's impoverished linguistic output, be it in conversational interaction, expression of mental-state verbs, or production of complex syntax, directly affects their ability to understand that people have thoughts and beliefs that are different from each other's." (Pyers 2005: 171).

Pyers also discusses other accounts in the language-matters group:

i) Conversational accounts of FB development: both cohorts report that they "struggle extensively in communicating with hearing family members, but that they have satisfying conversations with their deaf peers" (Pyers 2005: 139). According to Pyers this contradicts Peterson and Siegal's account (2000) who claim that FB understanding relies on efficient communication in the home because this would mean that both cohorts should be equally impaired in FB understanding.

ii) Mental Verb/Language Accounts: Pyers tested the mental state vocabulary of the subjects separately and found that of the FB task failers only four out of seven signed a mental state term (with a total of 9 tokens), amongst the passers 8 of 9 participants produced mental state terms (with a total of 57 tokens). A correlational analysis showed that the number of mental state terms used was highly correlated with the score on the minimally verbal FB test. This was just a preliminary result as the data came from analyzing elicited language from videos depicting FB, but a relationship between the two factors is indicated.

On the grounds of these results Pyers argues that language is crucial for FB understanding and furthermore that the age at which these abilities are acquired matters. The concrete factors Pyers could single out were mental vocabulary and complement syntax. As the data for this study were collected in 2001, Pyers emphasizes that only after that the second cohort signers were old enough to be interested and active in the Deaf Association in Nicaragua and only then meta-linguistic interests arose for these signers. Pyers suggests that this new intense contact between first and second cohort could potentially change and influence the language of the first cohort which (see *3.8.2*).

3.5.3 Training studies

Another way to try and assess the influence of one cognitive ability on the other is to train those abilities in different settings. In the early 2000s two important training studies have been conducted to get a closer look at the potential influence of language on FB understanding.

3.5.3.1 Training study: Hale & Tager Flusberg (2003)

The first was by Courtney Hale and Helen Tager-Flusberg (2003) who wanted to show that the syntactic and semantic properties of sentential complements in child language facilitate the development of a representational ToM, but with the important difference that they wanted to avoid test questions that contain mental state verbs – something that de Villiers and colleagues have failed to achieve up to that point (see Hale & Tager-Flusberg 2003: 348)[9].

The authors' goal was to test the effect of direct FB training in comparison to the effect of complement sentence training (with communication verbs only) on FB understanding, using a training paradigm that did not include any mental language in the language training (not even in the corrective feedback). Three training groups were formed: one group of preschoolers received **sentential complements training** (with communication verbs only), the second group **FB training** and the third group was a control group trained on **restrictive relative clauses**. Relative clauses are considered examples of complex syntax irrelevant to ToM (see e.g. de Villiers & Pyers 1997). Hale and Tager-Flusberg point out that relative clauses also involve embedded propositions which are – unlike embedded complements – embedded under a noun phrase, not a verb phrase and therefore categorically different. After making sure in language pretests (sentential complements group: 2 complement comprehension tasks; relative clause group: distinguish two similar referents by attending to information given in restricted relative clauses) and FB pretests (one change in location task including one ignorance question and one FB prediction) that the test subjects have not yet acquired the competences to be trained, 60 children between 3;0 and 4;10 were entered into the study. Two training sessions were held within one week and each session had four rounds, so each child ended up being confronted with 8 different scenes.

i) FB Training: A Change of Location story was enacted in front of the child who afterwards was asked to predict where the protagonist was going to look for the moved object. Corrective feedback and re-enactment were given for every incorrect answer, but no mental terms were ever used.

ii) Sentential complements: A boy was shown doing something to another character (e.g. hit him) but falsely claiming later that he had done it to a different character. Children had to report what the boy actually said, urged by asking "What did he say?" or "Who did he say he hit?". Corrective feedback and re-enactment were provided.

iii) Relative Clauses: A character acted out two different actions on a pair of identical twins, children had to report which action was done to which twin by asking "Who did Bert hug?". Corrective feedback was done by re-enactment and explanation.

[9] Criticism of the entanglement of language demands and language measures in test design should only start here.

Three to five days after the training post-tests were conducted. The language post-tests had the same formats as the pre-tests and training tasks, the FB post-tests additionally included an unexpected contents task and an appearance-reality task, so the post-tests were not only controlling for FB but ToM in general in order to see whether there was a general effect on ToM. For relative clause post-tests a story was given where Minnie was washing one plate and breaking another one. Note that children were asked "What did Minnie wash?" which would be felicitously answered with "a plate" and furthermore experimenters did not choose to rather enact something on two objects and then ask the child to hand it one of it over (i.e. avoid direct language).

The analysis of the test scores included a comparison of the training groups from pre- to post-tests. Both the FB and the sentential complement-training led to the same percentage of significant performance increase in ToM post-test measures (change in location, unexpected contents, appearance-reality); There were no significant differences in post-test performance between FB and sentential complement training. Furthermore, for the change in location-task ("Why will she look there?") the FB and sentential complements training groups "gave more appropriate justifications" (Hale & Tager-Flusberg 2003: 353) than the relative clause group. Interestingly performance increase on sentential complementation post-tests was only achieved by the children who received complementation training (they went from 17,5% correct to 74,8% correct), children who received FB training could only increase their complementation score from 20,0% correct to 26,4% correct. Both groups increased their FB score though (around 75% each). On relative clause post-tests only the relative clause training group showed any improvement at all.

The authors conclude that sentential complements are indeed crucial for ToM development which is why specific training on sentential complements leads to improvement on ToM performance while the reverse does not hold (i.e. training on FBs does not increase language performance). They point out that sentential complements are unique in their syntactic properties (embeddedness) and semantic properties (independent truth value), but that they did not tease apart those two aspects in the analysis because "false" complements were used in their sentential complements training; they speculate that "it is the semantic properties that are crucial for providing the child with the means for explicitly representing the embedding of a false statement in the complement construction." (Hale & Tager-Flusberg 2003: 354) also admitting to the possibility of the training effect not coming from linguistic acquisition but merely from exposing the children to statements that are false with respect to events they had witnessed. An important inference is that it cannot be concluded that the acquisition of sentential complements is a necessary prerequisite for ToM development as the FB training made just as big an impact on post-test ToM scores as linguistic training did while it did not

have any effect on post-test language performance. So children could develop a metarepresentational ToM without acquiring the sentential complement structures.

The maintenance of the test results was not controlled for – the whole experiment lasted two weeks. The authors mention that "training serves to make explicit conceptual and linguistic knowledge that was already represented albeit in a more implicit and less accessible way" (Hale & Tager-Flusberg 2003: 355). This once again suggests that ToM competence in children might actually not be a question of development, acquisition or other procedural mechanisms but rather a question of access to existing knowledge and of the level of explicitness of these in situ structures.

3.5.3.2 Training study: Lohmann & Tomasello (2003)

Lohmann & Tomasello argued that in Hale & Tager-Flusberg's study (2003) the language training contained deceptive situations. They hypothesized that it might be the deceptive character of the situations which led children to an increase of FB understanding rather than their linguistic features. Their goal was to test whether the effect language had on ToM in Hale & Tager-Flusberg's study was merely to scaffold the relevant input (and not a contentful ingredient for a successful acquisition of ToM). Lohmann and Tomasello conducted a training study (2003)with 138 German speaking children aged 3;3 to 3;10 in which they wanted to focus on two comparisons:

- compare several training conditions *with* language to a training condition *without* any linguistic commentary during the training (except for exclamative sounds like "Oh!" "Ah!")
- compare the training effect of three different linguistic conditions:
    1) rich perspective shifting discourse, mental state verbs and sentential complementation (the three major factors considered important for ToM)
    2) perspective shifting discourse using language free of mental terms or sentential complements
    3) sentential complement sentences without mental terms and without deceptive experience (in contrast to Hale & Tager-Flusberg 2003)

Pretests secured that only children who had not yet acquired FB understanding and whose linguistic development was within a normal range were chosen for the training. They included a vocabulary test (Kaufman Assessment Battery for Children, Kaufman & Kaufman 1994), a FB test (an representational change task) and two sentential complements tasks (one based on Swettenham 1996 where a story like "This boy thinks that it is sunny outside although it is really and truly raining outside." was followed up by two questions: "Will this boy now put his raincoat on?" and "What was

this boy thinking?", the other test based on Hale & Tager-Flusberg 2003 where the protagonist says that she was doing one thing but really did something else, followed up by "What did the girl say she was [doing]?"). Post-tests included three FB tests (appearance-reality, unexpected contents and change in location) and sentential complement tasks like in the pretests.

In four sessions over 2 weeks children were presented a total amount of 16 deceptive objects. This happened in four different training groups that differed regarding the linguistic level:

1) **Full training group**: the deceptive aspect of the object was visually and verbally highlighted either with mental or communication verb constructions; the experimenter presented the object and said "What do you think/say it is?". After the child examined the object, the real function was highlighted by the experimenter. Then children were asked about their first suspicion and their current knowledge. Then the experimenter provided a verbal summary and asked for a third person's opinion (a hand puppet) who would show a surprised reaction. Children then assisted the puppet to find out the real function. Test measures were divided between *know*/*think* and *say* training but apparently did not lead to different results.
2) **Discourse only training group:** in this group there was neither any use of mental language nor of sentential complements (which lead to results supporting Harris' theory, see *3.1.1*)
3) **No language training group:** for this group the highlighting of the deceptive aspect happened completely nonverbally, also there were no questions asked and no feedback given except for attention getters like "Look!" "But now look!" "Oh!" "Alright!"
4) **Sentential complement only training group:** the deceptive aspect was not highlighted for this group. A puppet interacted with the objects like they were normal objects, the experimenter commented it in mental and communication verb complementation structures (The puppet showed that X, … knows that X, Do you think that the puppet X, etc.).

The authors looked at the effects of the four different training conditions on each FB post-test task separately (an appearance reality task, a representational change task (unexpected contents) and a change in location task) and ANOVAs were run for group comparisons (all FB post-test scores were summed up for that).

Concerning the results on the **FB post-tests** the authors found the following:

i) Representational change task (unexpected contents): For absolute post-test score group was a significant factor, the full training group outperformed all the others with 75% correct; the sentential complement group and the discourse group scored about 40% correct and the no language group only scored 25% correct. The increase of performance from pre- to post-test was significant for all groups except the no-language group.

ii) Location change task: here, too, group difference was a significant factor, although the authors decided to not exclude children who got the control questions wrong as it would remove the effect of group.

iii) Appearance-reality task: there was no significant effect found for group and it seems that any training procedure advanced children's ability to understand appearance-reality objects (which after all were the training objects), so explicit deceptive experience was not mandatory for success (cf. the sentential complements group). The only difference found was for the score of a third person's belief prediction. Full training led to significantly more correct answers than the no language training.

When collapsing the FB tasks into one measure the ANOVA showed that the full training group performed better at posttests and the other groups didn't differ from one another.

Comparisons between the groups on FB posttests showed the following:

i) The full training group outperformed both the discourse only group and the sentential complements group, so the deceptive experience included in the full training (and lacking in the other two conditions) must have been significant.

ii) The complex language group *with* deceptive experience (full training) outperformed the group without it (sentential complements) and the authors conclude that the experience of changing perspectives on deceptive objects is an important factor in the acquisition of FB understanding. Still the sentential complement group showed a significant difference to the no language condition. Combining full and sentential complement training and contrasting it to the combined measure of discourse only and no language training showed that the measures *with* sentential complements outperform those without.

Finally, the results of the sentential complement posttests revealed that sentential complements facilitated FB understanding significantly better than discourse only which is why the authors singled out sentential complements as an important factor for FB understanding development independent of the deceptive and perspective shifting experience. A significant effect of training condition and unsurprisingly the highest improvement was achieved by the sentential complement training group. For the no language group the scores did not change at all which means that linguistic competence is sensitive to training, too. The results showed an asymmetry: the children who improved sentential complement performance also improved their FB scores, whereas the increase on FB performance for the full training group was not reliably connected to linguistic scores, so other factors led to their improvement on FBs.

Concluding the authors claim: both perspective shifting (i.e. discourse about deceptive objects) and training on sentential complements independently had a facilitating effect on children's FB understanding, whereas experiencing deceptive situations alone did not administrate any progress. The combination of those two factors turned out to be the strongest facilitator of FB understanding (which was the case in the full training group).

Lohmann and Tomasello were the first to explicitly show differences between discourse, sentential complements and no language by creating evidence with a training study. The authors refer to Clements et al. (2001) to justify that the minimal linguistic feedback in the so called "no language training group" does not play a role because feedback has to offer new information in order to facilitate the learning process. In the discourse condition (where mainly nouns were used to point out the deceptive nature of the objects, as in "First it is a flower, and now it is a pen.") the effective factor really was the discourse because no mental language was used. The visual experience does not suffice for understanding hidden processes; Evidence from deaf children of hearing parents opposed to deaf children with signing parents corroborate this insight.

This study was the first to have a sentential complements measure free of deceptive resp. perspective shifting experience. Mental state verbs were used in one of the two sentential complement conditions, but the results on posttests were almost identical, so according to Lohmann and Tomasello the use or lack of mental state verbs does not have an influence on the overall effect of language which highlights (syntactic) structure rather than semantics.

This was the first block of evidence that was brought about in favor of linguistic determinism or versions of it. The broad spectrum surely made it clear at the time that linguistic determinism is to be taken seriously in the field of ToM-research, so investigations and theories increased.

3.6 First reactions and counterarguments

Up to this point the data collected in favor of linguistic determinism proved that the acquisition of complement sentences fosters the development of FB understanding in one way or the other. Sentential complements were defined as an independent (and therefore unambiguous) class of syntactic phenomena anchored along one distinctive feature. De Villiers and others singled out the subordinated complement sentence to be the only syntactic structure that was appropriate for and triggered by communication verbs and those mental state verbs that make a claim about the truth of something (e.g. *think* and *believe*) which also meant that this was the only complex syntactic structure that allowed for the embedded proposition to have a truth value independent from the matrix clause's truth value (in other words: the only type of sentence that can felicitously have a false proposition embedded in a true one). For researchers like de Villiers this characterization was sufficient to describe the crucial structures unambiguously for the data they collected, which enabled de Villiers and colleagues to exclude one very important mental verb and its structures from their claims about FB reasoning and language: the desire verb *want*. This is necessary because there is a well-acknowledged gap in children's language development between desire and belief (see e.g. Bartsch & Wellman 1995), i.e. children understand and actively use talk about desires significantly earlier than about beliefs. The desire verb *want* does not take fully tensed complement structures as complements but rather expresses the propositions which are mapped onto the subject via *to + infinitive*-phrases and the embedded proposition in desire constructions does not make a claim about truth. Considering this a valid enough explanation for the belief-desire gap linguistic determinists excluded desire from their considerations. In English indeed only communication verbs and mental state verbs like *think* and *believe* have a) the property of independent truth values and hence b) the embedding construction. Other researchers though started to investigate other languages with respect to the features and the make-up of the complementation construction and the verbs and concepts linked to it in the context of mental concepts, two studies that present threatening data for linguistic determinism are discussed here.

3.6.1 Empirical counterevidence: Mandarin and Cantonese

Intrigued by the findings of ToM-research concerning the correlations between the (assumed) sequence of ToM development from desire psychology to belief psychology and the sequence of complexity increase in children's complements from simple object complements over infinitival complements to complement clauses Tardif and Wellman wanted to undertake a study that would

for the first time look at this relationship in two languages quite different from English. In order to get to the cross-linguistic bottom of the issue they studied Mandarin and Cantonese children (Tardif & Wellman 2000). Chinese languages differ from English in two relevant aspects: Mandarin learning children are more likely to utter a verb for their first word than children acquiring English (in early language acquisition English speaking children acquire relatively few verbs compared to nouns; for Mandarin speaking children the ratio is roughly 50:50). Secondly, the morphology and syntax of propositional complementation in Mandarin and Cantonese is simpler than in English. The difference between sentences like (15a) and (15b) is not obligatorily marked (because finiteness is not grammaticized to the same extent as in English):

(15) a. Who did Big Bert forget that he invited?
b. Who did Big Bert forget to invite? (Roeper & de Villiers 1994: 384)

In other words, even if it is possible to express the difference between these two questions overtly in Chinese (examples (16) and (17) in Mandarin), they usually are expressed with *one* underspecified version of it having either interpretation (example (18)) (from Tardif & Wellman 2000: 28):

(16) Big Bird wang4 le qing3 shei2?
Big Bird forget ASP invite who (Bert)

(17) Big Bird wang4 le qing3 le shei2?
Big Bird forget ASP invite ASP who (Grover)

(18) Big Bird wang4 le qing3 shei2 le?
Big Bird forget ASP invite who ASP/SFP? (Bert/Grover)

Another feature in Chinese is that there are polysemous words; for instance *xiang3* (Mandarin) can mean "*to think*" or "*to want to do something*", "*to believe/feel*", "*to imagine/conceive of*" and "*to miss somebody*", so there is a new level on which desire and belief can be distinguished: the acquisition of the lexical terms and the conceptual understanding can be teased apart. This is not possible in English, desire and belief are uniquely expressed via different verbs.

The expectations towards languages that are like Mandarin or Cantonese go two ways: either children will show the exact same time lag between desire and belief as English children – this would prove that it cannot be syntactic or morphological reasons that lead to the belief-desire gap but rather that we are dealing with a cognitive universality. Or the tested children could lack the lag between desire and belief, meaning that it is linguistic demands rather than the concept formation of belief being dependent on linguistic development. Either way, these languages promised to be a strong test for the universality claim of several findings in ToM and linguistic research.

Participants. Two studies were conducted to assess the use and emergence of mental state terms; this was done by analyzing naturalistic speech data recorded in the toddlers' homes. In the first study 10 Mandarin speaking children (starting age 21 months) were recorded over the time of 6 months for the verbs *yao4* (*want*), *xiang3* (polysemous: *want/think*), *hui4* (*know-how*), *neng2* (*have the ability to*) and *zhildao4* (*know that*). In the second study data from Lee, Wong, Leung, Man et al. 's (1995) corpus of 8 Cantonese speaking children (starting age from 18 to 32 months) were analyzed for the same terms as in study one and additionally for the words *nam5* (*think/consider*) and *sikl* (*know how/ recognize*). Children's use of the terms was correlated with their caregivers' input. The English data for comparison were taken from Bartsch and Wellman's study (1995).

Prediction. As Mandarin/Cantonese speaking children acquire verbs earlier and relatively more of them than English speaking children this should also be true for mental verbs. Furthermore, if ToM universally develops in certain stages this should be true for all toddlers regardless of the language they acquire or the culture they grow up in. For the Chinese verbs this means that the verb *yao4/jiu3* (*want*) should be used before all the other mental verbs even if finiteness and syntax don't matter. For the polysemous verb *xiang3/soeng2* the *want*-sense of the verb should be used (or understood) before the *think*-sense of it. Finally the quality of the caregivers' input should not influence the developmental pattern if the claim that this is a cognitive universal holds water.

Findings. Already at 21 months of age the Mandarin toddlers showed usage of mental state verbs (in roughly 2% of all utterances for 21-month-olds, 5% for 27-month-olds) which is earlier and a higher score than for English children. Of these first mental-state verb usages the verb *yao4* (*want*) constitutes the vast majority and clearly was the earliest mental verb to occur. The other mental state verbs started emerging shortly after 21 months although the mental reference-quality is at first doubtful. The first verbs positively coded to involve *think* occurred from age 2;0 onwards; the polysemous word *xiang3* was only minimally used in its *think*-meaning throughout the whole testing time (it appeared around 24 months of age); if used at all it was more likely to refer to *want*. In the input of caregivers *yao4* (*want*) was only used in 50% of mental state verbs, the other 50% were verbs of *knowing* or *thinking*, although caregivers hardly ever spoke to their children about thinking. The English speaking parents referred to thinking in about 21% of mental state references. Simple repetition can be ruled out as the acquisitional means because of what the authors found out about self vs. other-referencing: while the emerging mental state language in children started out with self-reference, parents were more likely to refer to others (especially the child) in their mental language. So both parents and children were referring to the child which meant a perspective and pronoun shift for children. Again, mere imitation does not seem to be the (acquisitional) pattern.

The second study with data from Cantonese was conducted because *think* in Mandarin is expressed with a polysemous word (*xiang3*) whose *think*-meaning might emerge so late because children prefer one-to-one mapping (cf. the unifunctionality principle in Slobin 1985). Cantonese has, apart from the polysemous verb *soeng2* (*want/think*), a mental state verb that uniquely refers to *think* (*nam5*). The results corroborate what was found for Mandarin (and English) speaking children: the verb for *want* is amongst the earliest mental verbs in child language, and *think* – even though there is a verb uniquely expressing it in Cantonese – emerges significantly later.

Summarizing Tardif and Wellman made two major observations:

i) in Cantonese/Mandarin belief and desire can be expressed by the same grammatical construction, a construction that is syntactically relatively simple and does not equal the complexness of embedded sentential complements and lacks the finiteness of English,

ii) yet desires are talked about earlier and more frequently than belief. These data indicate that the desire-belief gap is a cognitive universality independent of language, culture and parental language input (English parents talked to their children about thinking in 21% of the mental state references, Chinese parents hardly did that), and that belief, even when expressed via simplex syntactic structures, is mastered later than desire.

3.6.2 Empirical counterevidence: German

As a follow-up Perner et al. (2003) conducted a study with German speaking preschoolers. Generally Perner defines language's role in FB reasoning as a minor one: language is merely the scaffolding for the input the child needs for developing FB understanding. Agreeing with de Villiers that around the age of 4 years children undergo a drastic change in their cognitive development (namely the step of FB understanding) he and his colleagues point out that the changes are due to a "conceptual progression" in the child's cognition.

Concerning Tardif & Wellman's (2000) findings Perner et al. point out that even if their results threaten linguistic determinism, they were still compatible with de Villiers' claim that finite complements are crucial for developing a FB understanding because the Chinese and Mandarin data only proved that *simplex* linguistic structures do not contribute to ToM. Therefore Perner et al. intended to prove the reverse, too: they investigated the issue in German speaking children because German provides an interesting deviation from English (and Chinese) in mental language. Unlike English the grammatical structure of sentential complementation is not only used for communication verbs (like *sagen (dass)* = *say (that)*) and belief verbs (like *glauben (dass)* = *believe (that)*), it is also obligatory for a certain type of desire verb construction. This way Perner et al. could investigate the

emergence of the concepts of desire and belief and their relation to complement structures. The distribution of desire structures in German works like this:

i) desires towards the subject of the sentence work just like the English version: the verb takes an infinite *to*-infinitive as its complement:

(19) a. Mother wants to go to bed.
b. Mutter will ins Bett gehen.

ii) desires towards the object of the sentence though obligatorily are expressed by embedding a sentential complement under the desire-verb which is where German (21) differs categorically from English (20):

(20) a. Mother wants Andreas to go to bed.
b. * Mother wants that Andreas goes to bed.

(21) a. * Mutter will Andreas ins Bett gehen.
b. * Mutter will Andreas ins Bett zu gehen.
c. Mutter will, dass Andreas ins Bett geht

Conceptually Perner et al. take on two aspects. For one they claim (in contrast to de Villiers) that *all* propositional attitudes share the feature that their embedded proposition can be false and the embedding matrix sentence can be true – this would include desires, too. The difference is rather that in the case of *believe* and *say* the truth value of the proposition renders the statement or the belief true or false whereas in the case of *want* it determines whether the desire is fulfilled or unfulfilled. Secondly, Perner et al. present two alternative ways of resolving the desire-belief gap. What de Villiers explains via syntactic complexity (i.e. that desire comes earlier because it's syntactically simpler) can be accounted for by an *ecological explanation* that assumes a greater pragmatic value in mastering desires earlier than belief (see Fodor 1992). The other alternative assumes a *conceptual progress* in children's understanding of mental states as representational (see Flavell 1988, Perner 1988;1991), so child development goes from understanding that people relate to either true or false propositions to the understanding that people can also relate to false propositions as true of the world (see Perner et al. 2003: 180). The difference to de Villiers' approach is that her explanation is based on the grammatical structures that the concepts are expressed by in a particular linguistic environment, which ultimately means that children who grow up in a linguistic environment where belief is implemented in simple and early-developing syntax the understanding of belief should emerge earlier. German children would be expected to understand object desires as late as belief because they are both expressed by finite complement structures. On the conceptual level de Villiers argues that it is natural for belief understanding to emerge later: the acquisition of belief syntax and the understanding of false propositions are based analogously on communication

events of misspeaking and lying (see de Villiers 2000); as speaking is overtly observable and directly perceivable it is valid for them to be understood earlier than the hidden and covert events of thinking. Perner et al. retort that desires are just as hidden and covert as beliefs, which means that desires should be understood significantly later than acts of misspeaking, too. Given the data presented above Perner et al. argue against the prediction that a different grammatical environment triggers a different order of concept understanding and test German children on the subject.

Prediction. The prediction was that there is a significant lag between understanding complement structures in desires compared to communication and belief scenarios proving that complementation is not sufficient for the development of FB understanding in preschoolers.

Testing. Two rounds of experiments were conducted, the first one with children aged between 3;6 and 4;8 years, the second one with younger children aged between 2;5 and 4;5 years. The second experiment was necessary because the authors wanted to prove that the differences they found were not just small surface lags but really a substantial developmental difference in understanding mental concepts. For both experiments six memory for complements tasks were conducted to show a difference between verbs of desire, belief and communication (all test stories had a discrepancy with reality), for FB assessment two change of location tasks were used. For language assessment the sentential complement task was used (see *0*). In experiment one children were confronted with sketches of two rooms; in experiment two an acted out version with a speaking doll in front of a cardboard wall was preferred. The three different conditions had three different types of questions followed by two control questions:

i) Want scenario: "What does Mom / the puppet *want* Andy / the rabbit to do?"
"Was *will* die Mutter, *dass* Andreas tut?"

ii) Say scenario: "What did Mom / the puppet *say* that Andy / the rabbit was doing?"
"Was *hat* die Mutter *gesagt*, *dass* Andreas tut?"

iii) Think scenario: "What does Mom / the puppet *think* that Andy / the rabbit is doing?"
"Was *glaubt* die Mutter, *dass* Andreas tut?"

iv) Control Questions:
   a. Reality Question: What is Andy / the rabbit *really* doing?
   b. See question: Can Mom and Dad / Can the puppet *see* what he is doing?

In the *want*-condition the mother/the puppet was asked what Andreas/the rabbit *should* do whereas in the *say* and *think* scenarios the mother/the puppet was asked what Andreas/the rabbit *is doing*. So what was actually said was either "Andreas/The rabbit *should* go to bed" or "Andreas/The rabbit *is* going to bed" which means that the children really had to infer the complement rather than merely remember it.

The FB scenarios were acted out with toy figures in which a book was transferred; when the character returned children were asked a FB question of prediction ("Where will Max look first for his book?") and two memory check questions ("Where did Max put the book in the beginning?" and "Who put it there?").

Results. Children found it much easier to remember what somebody *wanted* than what somebody *said* or *thought*. The complements for events of saying or thinking were about as difficult as mastering FB tasks. In experiment 2 the results showed that the *want*-condition was easier for children of all ages. In contrast to experiment 1 children in experiment 2 found it easier to understand (remember) the *say*-complements which might be due to the fact that acting out the scene with puppets (i.e. having an actual speaker and not merely a report on what somebody said) made it easier to spot what was actually said. Improvement over the age groups was significant for the *think*-condition and the FB tasks, but not for the *want*- and *say*-conditions as children scored high on those right away.

In sum both experiments showed that the *want*-condition in the sentential complements task was substantially easier than the *say*- and *think*-condition although the syntactic constructions are the same. These facts are still compatible with what linguistic determinism says about English speaking children, but the German evidence is bad news for linguistic determinism because the complexity of language is the same for *want* and *think*. De Villiers' bootstrapping theory (i.e. syntactic structures for *think* are acquired via bootstrapping from communication verbs) is also threatened as *want*-complements were easier for children than *say*-complements (although in experiment 2 the lag between *want* and *say* was smaller). Perner et al. conclude that the mastery of mental state syntax cannot be the inevitable prerequisite for acquiring an understanding for mental states because these syntactic structures are mastered by German children significantly earlier than FB are understood. The authors mention the English verb *pretend* because it behaves like *want* in German: it takes a finite *that*-complement in object-directed pretense and is mastered by noticeably earlier than in development *say* and *think*. The data presented here confirm the developmental progression from a "desire psychology" to a "belief-desire psychology" (Wellman 1990) which is compatible with Chinese (Tardif & Wellman 2000) and English (Bartsch & Wellman 1995).

The authors conclude that their approach of a "conceptual progress" in children's understanding of the mind as representational is confirmed: young children understand embedded propositions that refer to existing or non-existing situations; only later they understand embedded propositions that are false with respect to the world but represented to be true in someone's mind. Linguistic determinism has been limited strongly: cross-linguistic grammatical differences leave the developmental schedule for belief and desire unchanged.

3.7 Second Lap – 2005

After ten years of intense research and controversy on the interface between language and ToM the conference "Why language matters for Theory of Mind" was held in Toronto in 2002 (published in book-form in 2005). This led to a kind of "second step" in theoretical discussion which will be represented in this overview by its protagonists, Jill de Villiers and Perner. The third article relevant to this thesis by Peter de Villiers contains only preliminary data of a study by Schick and colleagues (Schick, de Villiers, de Villiers & Hoffmeister 2007) which is why this will be discussed instead.

3.7.1 J. de Villiers 2005

It was de Villiers' turn to deal with the major problem discussed in section *3.6.1*: the belief-desire gap. Her approach, whose central claim was that the acquisition of complementation syntax alone is responsible for developing a FB understanding, could not account for new data from languages like Chinese (because Mandarin and Cantonese have other ways of expressing belief) or German (because complementation emerges significantly earlier in development than FB understanding). De Villiers acknowledged that the structure of sentential complementation in its isolated form cannot be the one and only relevant component for developing FB understanding any more. She theorizes that it must be a combination of the embedding verb (which after all selects the complement sentence) and its class, the syntactic structure it projects and finally the unique semantic intricacies connected to them. In other words, neither mental vocabulary, semantic-conceptual structures nor syntactic configurations are responsible for FB reasoning – it is the combination of the three. To get the full-fledged representation of a verb like *think* a child has to undergo three steps in language acquisition that are interdependent and only their combination unfolds the full nature of the verb (cf. J. de Villiers 2005):

a) The lexical meaning. It refers to a hidden activity or state of mind and does not contain potential cues to its propositional nature yet; at this point it could still be a mere reflection of reality.
b) The syntactic structure, acquired via syntactic bootstrapping (cf. Gleitman 1990) from communication verbs which hints the child that *think* takes propositions as its content.
c) The (abstract) feature indicating potential falseness of the complement is the breakthrough in the mastery of the mental verb acquisition. De Villiers emphasizes that this is not only conceptual development because semantics and syntax are intertwined here and the consequences of this feature are by all means syntactic.

3.7.1.1 The developmental progression of verb acquisition

De Villiers negates that the acquisition of verbs is of pure conceptual nature as different verbs show different syntactic behavior and operations, e.g. the sentences in (22a) and (22b) appear to have identical syntactic structures which would mean that the verbs belong to the same verb class:

(22) a. She **forgot** *that he arrived late.*
b. She **thought** *that he arrived late.*

As soon as syntactic operations are taken into account though we see a different picture:

(23) a. * When$_i$ did she **forget** *that he arrived* t_i?
b. When$_i$ did she **think** *that he arrived* t_i? (J. de Villiers 2005: 194)

Although in their declarative form it seems that sentence (22a) containing a factive verb (here: *forget*, others: *remember, know*) and sentence (22b) containing a non-factive verb (here: *think*, others: *say, believe*) have the same syntactic structure, when syntactic operations are applied (23) the picture changes: long distance WH-movement is only possible with sentence (22b) while it is ungrammatical with sentence (22a). Although they seem to have identical structures on the surface, their underlying syntactic configurations differ. This could potentially mean differences in acquisition and with respect to cognitive effect. De Villiers' hypothesis is that non-factive verbs form their very own verb class and are therefore categorically different from other verbs like *want*. Her claim is that there is a certain developmental progression in verb acquisition: initially all verbs are summed up in one verb class; in the course of development they differentiate and start forming sub-classes.

To define *say* and *think* as a unique verb class, de Villiers refers to the theory of the realis/irrealis dichotomy in Bickerton's (1981) sense. If a sentence is in realis mode it means that it makes a claim to the truth of a proposition. Realis mode is usually expressed via finiteness (e.g. "He said she left") whereas the irrealis mode (when sentences make a claim to a potential situation) is expressed via infinite (e.g. "He wants to go") or modal (*should*, *would*) forms. The realis-irrealis distinction is universal to language and can even be found in Creole languages (cf. J. de Villiers 2005: 195).

Want. It emerges very early in the child's vocabulary (one of the "most common 50 words in English" cf. Fenson et al. 1993). According to de Villiers the acquisition of *want* starts when the child perceives visible and physical struggle to get hold of an object (the a person shows a "yearning" towards an object and is reaching, pointing, struggling to get it and displaying despair, rage at its removal etc.) which leads to the first (partial) mapping onto the lexical item. In the next phase reference to invisible/absent objects becomes apparent which is the first step of *want* silhouetting against other verbs like *kick* and *carry* as it is directed towards a prospective target now. This renders

the verb's object to be irrealis. This irrealis character of want is part of its conceptual make-up and indicates that desires relate to the world in a different way than beliefs do. The most complex type of desire is only mastered at age 3 and is always irrealis. De Villiers mentions that e.g. German and Chinese do not have an overt linguistic means to mark this case of irrealis overtly.

Say. The first context in which children will hear this verb is when it refers to the contents of an event of actual speech. This verb is a special case as it can be both realis (24a) and irrealis (24b):

(24) a. Mom said you liked the movie.
b. Mom said you should clean up. (J. de Villiers 2005)

As speech is observable (what is said and what is happening can be perceived directly) the mapping happens overtly, too. The relevant step is when mismatches between speech and act enter the child's perception. The first false complements that the child is confronted with are found in contexts in which what was said does not match reality. When first responding to sentences like "She said the apple was blue" children will probably simply reject the whole sentence saying 'No', but "with time and exposure" (p. 201) the child starts to understand that the whole sentence is true although it contains something false. This is the crucial step on the developmental path of *say*: the special nature of non-factive complements is understood at some point which is when *say* classifies into its own verb class, a special class of realis verbs with the potential of bearing a false complement.

Think. This verb constitutes a challenge for the child as it is not manifest in behavior, so it is not directly observable. To be able to make inferences about the meaning of the verb behavioral cues like e.g. mistakes are necessary – but slipping on a banana peel won't do because not even grownups "make the effort" to ascribe the faller the FB that the floor was actually clean. Only intentional cause-directed behavior that seems strange or is deviant from expectations makes it necessary to activate and reflect on the contents of beliefs. In child language *think* emerges significantly later than *want* which indicates that its meaning is not as easily deducible. First the child learns the label, the meaning of the verb that refers to something private, internal. Also, the child can observe that *think* behaves like *say* in a lot of ways, e.g. it can be realis as well as irrealis:

(25) a. He thinks you did a good job.
b. He thinks you should go tomorrow.

Due to this syntactic overlap, *think* can be classified to be just like *say* and via analogy the child can have the insight that false complements are possible with *think*, too. In contrast to *say* the verb *think* only occurs in situations without overt utterances which enables the child to conclude that *think* refers to private inner events.

Pretend. As mentioned in Perner et al. (2003) the verb *pretend* behaves like *wollen* (*want*) in German. It occurs significantly earlier in child language than *think* and can take sentential complements. De Villiers points out that treating *pretend* like *think* and *say* would be short-sighted. Although they can all take a finite complement that is false with respect to the world (see (26a-c)):

(26) a. He pretended that the block was a car.
b. He said that the block was a car.
c. He thought that the block was a car.

pretend is not part of the verb class that *say* and *think* form because it allows for infinitivals ("He pretended to be a bunny"), it cannot enter passivized forms ("*He was pretended to be a miser") and it is not combinable with direct complements ("*He pretended: "Come here, you villain!") (p. 203). De Villiers concludes that even if *pretend* shares certain syntactic properties with *say* and *think* these verbs would never be treated alike, not even if the child has not acquired verb meaning, syntactic consequences or verb classifications yet. The developmental path by de Villiers (p. 203-205):

> *"[…]the child begins with all verbs having the same status, as realis connected to ongoing events. This is undoubtedly a brief period, because we know want is an early verb of the irrealis type. Want-NP splits off, and from that branch grow the extensions into propositional forms under want. Slightly later, pretend does the same thing, with the more frequent form pretend to leading to the still irrealis form pretend that. Soon thereafter, the child recognizes the distinction between the irrealis and realis forms of say, and then think. But the realis "say that" splits off, and the form is marked as special, in that false complements are now possible. By analogy, "think that" (realis) also splits off and is absorbed into that verb class."*

3.7.1.2 First evidence for the developmental path

Preliminary evidence from an experiment de Villiers conducted shows that 3-year-old children never treat realis-sentences as irrealis. The questions listed below were used in a Complement Comprehension Task (see J. de Villiers 2005: 206, table 10.1):

A. Mom says, "Tell Bella to play on the computer." while a picture shows that Bella is painting, i.e. in this situation we have an unfulfilled desire.
"Does Mom **want** Bella **to** play on the computer?" → Yes
"Does Mom **think** Bella **should** play on the computer?" → Yes
"Does Mom **want** Bella **to** paint a picture?" → No
"Does Mom **think** Bella **should** paint a picture?" → No

B. Mom says, "I'm so happy because Bella is playing on the computer." while a picture shows that Bella is painting, i.e. in this situation we have a FB.
"Does Mom **want** Bella playing on the computer? → Yes
"Does Mom **think** Bella **is** playing on the computer?" → Yes
"Does Mom **want** Bella painting a picture?" → No
"Does Mom **think** Bella **is** painting a picture? → No

The questions in scenario A are about a desire that Mum expressed, i.e. it is an *irrealis* setting. Scenario B is a FB setting in *realis* mode. The questions "Does Mom **think** Bella **is** playing on the computer?" and "Does Mom **think** Bella **is** painting a picture?" are in realis mode (questions of the type "think… is"), all the other questions are irrealis. If children would be blind towards the realis/irrealis-distinction one of the two assumptions would have to be active:

a) they take a realis position: all questions that mention a currently false situation (i.e. Mum's desire/belief) would be rejected and the ones containing current reality would be accepted
b) they take an irrealis position: all questions are judged irrespective of current reality

The results show that children are sensitive towards the realis/irrealis-distinction: children at the age of 3 didn't experience any problems with the three irrealis scenarios, so they could answer "want…to" "want…that" and "think…should" correctly (3,5 out of 4 were answered correctly). The realis questions with "think…is" on the other hand were difficult for them (only 1,5 out of 4 were answered correctly). This means that children never took "think…is" to mean "think…should", i.e. they never treated the realis case as being irrealis. Because they cannot represent that Mum has a FB and therefore they rather say what Bella is actually doing.

3.7.1.3 The Point of View-marker

The third and last step in acquiring the linguistic means of expressing and understanding FB is the acquisition of an abstract syntactic feature that is located in the embedded CP of the syntactic construction. We already know that this feature is responsible for marking the CP as having an independent truth condition. In other words, the use of a non-factive mental verb in the matrix clause projects a point of view onto everything structurally subordinated to the verb, namely the point of view of the person bearing the mental state. The very general concept of "Point of View" (PoV) that can be found all across linguistic structures is used by de Villiers and colleagues to refer to the relation between a verb and its complement claiming that a complement introduces a different PoV (namely a subject-PoV) based on the verb that chooses the complement:

(27) Peter thinks $_{\text{PoV-subject CP}}$[a unicorn is dancing in the garden]

So here, *think* assigned a subject-Point-of-view on the complement (the "subject" of the matrix clause, "Peter") which accounts for the discrepancy that from our perspective the complement is false (because it was only the mule with an ice cone glued to his head dancing in the garden) and true from Peter's perspective (who actually believes in unicorns and therefore happily mistook the horned mule as a unicorn). This makes the subject-PoV a distinctive feature that is dictated by the *say-think*-class. In the broader sense this means that every clause is associated with a PoV, for the CP of main clauses it's the speaker-PoV, for embedded complements it's the subject-PoV.

This also affects noun phrases within the subordinated CP: a DP (so an NP with a definite article) has its own PoV but a bare noun phrase (NP) inherits the PoV of the CP. We are not entitled to say (28):

(28) Peter thought that a mule was dancing in the garden.

because the NP inherits Peter's view which is: the animal in the garden is a unicorn. Correct is:

(29) $_{\text{PoV-speaker CP}}$ [$_{r}$ Peter thought $_{\text{PoV-subject CP}}$ [that $_{\text{PoV-speaker DP}}$ [$_{r}$ the mule] was dancing in $_{\text{DP}}$ [the garden]]]

Of course when it comes to linguistic principles like c-command these implications and assumptions are endangered quickly (more in *chapter 4*). Summing up, the properties of the PoV-marker are:

i) it is abstract and universal, in contrast to the complementizer *that* it is present in all CPs
ii) the kind of PoV is dictated by the verb that chooses the complement (structure)
iii) it refers either to the speaker or to the subject of the sentence
iv) indefinite NPs inherit the PoV of their nearest CP while definite NPs (=DPs) have their own

De Villiers stresses that this marker has direct syntactic relevance as it only occurs on certain types of phrases and might have effects on WH-extraction. It also helps to overcome "superficially identical complements under *want* and *think*" as in German and Mandarin/Cantonese.

3.7.2 Perner, Zauner & Sprung 2005

After de Villiers' syntactic argument (desire verbs only take infinite complements whereas mental verbs take tensed complements) was proven (partly) wrong by empirical evidence (Tardif & Wellman 2000, Perner et al. 2003), she was trying to enforce the theoretical relevance of the desire-belief gap in child development showing evidence that preschoolers treat *think…is* categorically different from *think…should* and *want…to.* She backs this up by the conceptual distinction of realis and irrealis mode of utterances. This enables de Villiers to make desire categorically different from belief, which is exactly what she needs to prove that *want* can be neglected for investigating the development of FB understanding. In opposition to that, Perner et al. try to emphasize the insuperable link between *want* and *think*. First, they show that both desires and beliefs are propositional attitudes; looking at them as cognitive and conative attitudes their difference can be contained but the necessary link (that is oblivious to the realis-irrealis dichotomy) is also made visible. Secondly they point out a crucial observation in desire complexity: complex desires like wicked and differing desires are just as difficult for young children as beliefs are.

Propositional attitudes. The concept of "propositional attitude" is used whenever a state or an attitude is mapped onto a proposition, i.e. when it is described how something or someone relates to a certain proposition. This usually is encoded by a matrix clause embedding a complement sentence (i.e. sentential complementation), which creates an opaque or intensional context for the embedded sentence (a semantic independence of the matrix sentence). Propositional attitudes are not truth functional; according to de Villiers this is indicated by a syntactic feature (PoV marker) that causes a crucial difference between factive verbs (communication and mental verbs) and desire verbs. Because of this semantic uniqueness de Villiers' claim would have to be that only communication and mental verb constructions are propositional attitudes. Perner et al. argue that desires, too, are propositional attitudes because the truth value of matrix clause and embedded clause are independent of each another in desire constructions and the proposition of a desire can be unfulfilled which is an equivalent of false.

Cognitive and conative attitudes. Following Hilgard (1980) Perner et al. distinguish cognitive from conative attitudes: cognitive attitudes represent the state of the world accurately and therefore make a claim about truth. In theoretical discussion about FB and statements there is a tendency to transfer the falseness of the proposition to the falsehood of the attitude. If de Villiers and de Villiers (2000: 198, cited after Perner et al. 2005: 225) claim that "only complements of mental and communication verbs can be 'false' propositions" they really refer to the falseness of the attitude rather than the falseness of the proposition. The purpose of cognitive attitudes is only fulfilled if their proposition is true, e.g. when someone *says* to own a piece of chocolate this is only true if the proposition "I own a piece of chocolate" is true. Conative attitudes on the other hand are expressed by mental states or statements that stipulate how the world is desired to be. The falseness of the embedded proposition is not translated into a "false desire" but an "unsatisfied desire", so falseness as such is reserved for mental and communication verbs. Conative states are only fulfilled if the world is adapting to those desires. "I want a piece of chocolate" is only fulfilled if "I own a piece of chocolate" is true. (see Perner et al. 2005: 225). So in a manner of speaking, "a piece of chocolate" mapped onto "I" via a desire verb construction is only true if there is a piece of chocolate that is eventually owned by "I". In a sentence like "I want to have a grass-green elephant" an attitude is discrepant with respect to reality or its ability to be fulfilled – yet the statement itself can be true.

So both "He thinks that he owns a piece of chocolate" and "He wants to own a piece of chocolate" can be true statements irrespective of the fact that in both cases the embedded proposition can be false. Both cognitive and conative verbs can bear false propositions, only the falseness of attitudes is exclusive to cognitive verbs. Perner et al. draw the conclusion that the

property of an independent truth value has to be extended to desire verbs and needs further explanation (i.e. de Villiers' PoV-marker would also be relevant for desire verbs).

Differing perspectives – complex desires. Different perspectives can occur in realis but – as Perner et al. point out – also in irrealis situations and sentences, e.g.: "I want myself to win and him to lose while he wants himself to win and me to lose" (Perner et al. 2005: 232). Interestingly, desires like that are only understood by children around the age they start understanding beliefs although there is no cross-linguistic syntactic backup to explain this (no complementation and supposedly no PoV-marker). A perspective difference is constituted by two different representations of one and the same situation or target. When we deal with two different representations, the easiest way to find out if there is a perspective problem according to Perner et al (2005: 233 ff.) is trying to integrate the two representations into one. If this is possible without contradiction ("within the powers of our imagination" p. 234), the representational targets of the two representations are different ones; only when the representational target is one and the same, integration resp. conjunction of two different representations fails and points towards a perspective problem. Simple desires usually don't create a perspective problem, not even when they differ (e.g. if Abe wants a banana and Bea wants an apple, the two desired propositions can simply be conjoined). With incompatible desires, as in e.g. the penny hiding game, this is not possible any more: "you find the penny" and "you do not find the penny" cannot be conjoined without contradiction. Studies have shown that children show competitive behavior (the desire to find the penny, not helping the opponent finding it and disappointment when not finding it resp. when the opponent found it) only rather late – following Gratch (1964) children aged 2;9 did not show any competitive behavior at all, only around the age of 4;6 a bit more than half of the test group did. Only at 6 years of age all children showed competitive behavior. Perner et al. interpret these and similar data like this: younger children are not able to represent what the opponent wants when they themselves want something else. It is not merely an inability "to inhibit their preoccupation with their own desire and own knowledge of the world and that failure makes it difficult to focus on what someone else wants or believes" (p. 234), as this would mean that children should be hypercompetitive in the penny hiding game. The perspective problem cannot be integrated unless points of view ("I want to find the penny and he wants me to not find the penny") are brought in. In Moore et al.'s study (1995) young children, when asked about the opponent's desire, would always answer with their own desire which shows that there is a perspective problem about one particular representational target – otherwise there would be no problem in acknowledging a different desire. Proof for that assumption comes from studies where the representational targets are two different ones: in a study by Daxeder & Feichtinger (2003) children had to play an opponent where two dice and two pegs were used; at the age of 3;8 over 80% of the children were able to correctly answer what color the opponent wants his die to show

and what color they themselves want their die to show ("my die shows blue" and "the other's die shows red" are perfectly integrable). Another aspect in complex desires are wicked desires: when somebody wants an objectively undesirable outcome children have difficulties projecting the correct emotions. Young children understand that happiness is a function of goal satisfaction when dealing with neutral goals, but if the protagonist e.g. wants to hit somebody, children fail to conclude that the protagonist will be happy if he hit the desired target (cf. Yuill, Perner, Pearson, Peerbhoy et al. 1996). Being bodily hurt is "unnegotiably bad […] the protagonist is involved in an 'objectively' undesirable situation and won't be happy" (Perner et al. 2005: 238).

Looking at subjective preferences interesting findings have been made: Bartsch and Wellman (1995) point out that 3 year olds are able to say things like "I don't like shaving cream…Daddy likes shaving cream". In experiments with yucky and yummy food (e.g. broccoli and crackers in Repacholi & Gopnik 1997) children older than 18 months are able to hand the experimenter the food they themselves find undesireable (e.g. broccoli) when the experimenter expressed earlier that he preferred that to the other food (cracker), even when the child's preference was the other way round. Perner et al. explain that this is not a problem for what was claimed earlier: children can capture different individuals being part of situations which can be seen as "objectively" desirable or undesirable – so "Shaving cream applied to daddy" is objectively desirable while "shaving cream applied to my cheeks" is then objectively undesirable. Subsequently this does not require an understanding of point of view or perspectives. For Perner et al. the question remains why this cannot be applied to wicked desires: if children create a combination of "protagonist" + "hitting" and apply it to an objective desirability they should be able to predict the protagonists' happiness. This might be because a third person, a "hittee", is involved.

3.7.3 Deaf children: Schick et al. 2007

Schick et al. (2007) conducted a longitudinal study to assess deaf children's scores on the language and ToM interface more closely. The authors seek to investigate three predictions (p. 381):

1) *"If language skills do not contribute to the understanding of cognitive states, then language-delayed deaf children should not be delayed in ToM as long as the language demands of the tasks are irrelevant.*
2) *If general language skills do matter, then either vocabulary or general grammar should predict how well children do on ToM reasoning, whether the task is low or high verbal.*
3) *If grammar contributes as a representational tool, then complement mastery with communication verbs should predict reasoning about others' beliefs and knowledge states, whether the task is verbal or low-verbal."*

In contrast to previous studies Schick et al. wanted to avoid methodological flaws: in previous studies interpreters with questionable status of fluency were used for the testing; children were required to look at material and watch the interpreter talk at the same time; in most studies only verbal tasks were used to assess ToM abilities which might lead to limited mastery due to language limitations rather than ToM limitations. Previous studies often did not use sophisticated language measures (e.g. only a language proficiency profile was used, filled out by teachers – e.g. Lundy 2002). Schick et al. therefore wanted to examine the possible connection between complement syntax[10] (in ASL) and performance on FB tasks. Although many previous studies have shown to a certain extent that deaf children with language delays are also delayed in FB understanding, none has shown the specific role of language for that delay.

Study Design. Four groups of children between 4 and 7 years of age were tested for measures of nonverbal IQ and memory, ToM measures and language measures – orally taught deaf children of hearing parents (DoH-oral; aged 6.06 on average) and ASL signing children of hearing parents (DoH-ASL; aged 6.11 on average) as both groups usually show significant language delays (Schick et al. 2007: 379); ASL signing children of deaf parents (DoD, "native" signers; aged 6.07 on average) who don't show significant language delays and therefore "provide a natural control for any effects of deafness per se" (p. 379). As a control hearing children were tested on the ToM-tasks only. Deaf children were tested in four to six rounds, hearing children in two rounds.

Nonverbal IQ was assessed with the Pattern Construction subtest of the Differential Ability Scales (DAS; Elliott 1990) and Knox's Cube Test of nonverbal sequence memory (Stone & Wright 1979). For FB assessment the following methods were used:

- 3 unseen-change-in-location tasks in the form of picture sequences (children were asked where the protagonist would "first look" when getting the memory check questions correct)
- 2 unexpected contents tasks (questions: own previous belief and a friend's supposed belief)
- Low verbal ToM tasks: the hidden sticker task and the surprise face game.

Oral deaf children assigned the following language assessment measures:

- Spoken one-word vocabulary comprehension and production was assessed via a picture-based tests of word knowledge (PPVT-R Dunn & Dunn 1981)
- Spoken English syntax comprehension without complement clauses (Clinical Evaluation of Language Function for preschoolers – CELF-Preschool Wiig, Secord & Semel 1992)

[10] In ASL communication and mental verbs can take embedded propositions as their complements which can also be false (but there is no overt complementizer) and there is a distinction between *realis* and *irrealis* form shown by explicit lexical tense markers, lexical modals and nonverbal markers (cf. Schick et al. 2007: 380).

- Comprehension of false complement clauses (Memory for complements task cf. de Villiers & Pyers 2002): A two-sentenced anecdote was accompanied by two photographs in which a character tells a lie or makes a mistake. The question then was "What did s/he tell X?".

The ASL children, too, got tested in the three language competences like the oral deaf children but the tests had to be designed for the occasion as there are no standardized tests for ASL signers:

- Receptive ASL Vocabulary Test (ASLVT) (the PPVT-R couldn't be used because of the iconicity of some signs of the corresponding English version).
- Comprehension of ASL syntax: the experimenter signed a sentence and the child had to pick the correct picture out of three or four. The test "included sentences in which a syntactic object was topicalized and moved to a sentence-initial position […] complex forms of verb agreement, a morphological marker for person, with several participants in a scene." (p. 385)
- Comprehension of false complement clauses could be assessed by translating the communication verb items from English into ASL.

Results. The results showed that for the verbal FB tasks hearing children's scores were indistinguishable from DoD-ASL children, while both groups of DoH scored significantly worse. This rules out that language of instruction and testing (ASL vs. English) matters in this respect. For the low verbal tasks, too, children with normal language development performed equally and significantly outperformed children with language delays (DoH-ASL and DoH-oral). For all children all the language measures were significantly correlated with the verbal FB scores. For the low-verbal score only vocabulary and complementation were significantly related to ToM scores. A regression analysis showed that for the verbal FB score background measures like age were significant predictors and for both ASL native and oral deaf children a significant percentage of ToM variance could be accounted for by language skills (except general syntax). For low verbal tasks again the background measures were significant predictors and also language added significantly to ToM variance, communication verb complementation being the only independent significant predictor. Schick et al. draw the following conclusions:

i) The delay in FB reasoning of deaf children of hearing parents is not due to deafness per se as ASL has proven to be just as well suited to communicate ToM as any spoken language. Prediction one (if language does not contribute to ToM then language delayed children's ToM should not be affected) was disconfirmed as regardless of tasks' language demands deaf children with language delays turned out to also be significantly delayed in FB reasoning and knowledge vs. ignorance understanding, a finding true for deaf children irrespective of their instructional language being English (oral deaf children) or ASL. ASL

natives and hearing children showed no significant differences on the verbal or low-verbal ToM tasks, contrasts between ages 4, 5 and 6 showed no differences.

ii) Failure in traditional FB tasks is not due to general meta-representational problems and also not to the tendency to give reality answers in test questions. Deaf children have a rich understanding of other kinds of mental states in other people like desires and emotions (cf. e.g. Rieffe & Terwogt 2000) (as long as the emotions are not based on FBs). This study has also shown that understanding simple emotions is not predicted by language measures but by age and nonverbal IQ. Deaf children also do not have a problem with physical representations (photographs) that depict a situation differing from present reality (false photography task – see de Villiers & Pyers 2001).

iii) Delays in the inhibitory control features or in working memory being responsible for the deaf children's ToM delay cannot be ruled out completely but performance on Knox's cube task (which has "some loading on at least working memory" p. 391) was not affected by deafness, it has also been shown that deaf children are not delayed on executive function tasks (P. de Villiers 2005).

iv) Prediction 2 (general language fosters ToM) wins over Prediction 3 (complement mastery only fosters ToM): general grammar skills did not predict ToM in this study, so language is **not** "a proxy (like age) for maturation" but necessary for ToM development. This is contradictory to Ruffman et al.'s (2003) findings in their longitudinal study that general language skills are better at predicting FB performance than an embedded clause measure[11]. Schick et al. claim that using communication verbs is a better way of getting the right complements without having to use FB related material, but this argument will not hold water in the discussion section of this thesis.

v) The fact that vocabulary skills was also an independent predictor of ToM but general language wasn't is explained as follows: according to Schick et al. vocabulary acquisition is more directly related to conversation and discourse than general grammatical ability and is therefore a proxy for the exposure to conversation children experience. Of course, also de Villiers' claim that the mental terms are crucial in subsequently acquiring the syntactic structures is a possible explanation for this correlation.

Schick et al. define "the optimal kind of input for a child to learn about others' false beliefs" (p. 392):

1) time with exposure to ordinary life (it is insufficient, but probably necessary)

[11] note that Ruffman et al. (2003) did not make use of embedded complements under a verb but embeddings like "The shoe *that is above the triangle* is red" (Ruffman et al. 2003: 147). They did not use complement clauses as they "entail false belief reasoning" (cf. Schick et al. 2007: 392).

2) language modality is irrelevant: both spoken and signed input foster FB understanding as long as it is complete (native) and the child is exposed to it early enough.
3) sufficient access to language
4) the ability to understand complement syntax

They state that their data is not sufficient to settle the question whether prerequisite 4 – the understanding of complement syntax – is there because language gives access to the evidence about minds or because it bootstraps the necessary representations, but in combination with other evidence (e.g. training studies) the latter seems more plausible to Schick et al.

In their closing paragraph they reveal something rather crucial. Assuming that "hearing full sentences or mental verbs and complements, together with some claim about their truth value, in the presence of a behavioral discrepancy, is the optimum condition for learning" (p. 393) Schick et al. admit that it might be the input of the parents that lacks certain conditions of this optimum – parents might not have the sign language abilities to engage in elaborate mental state talk, they might think it is too difficult for their impaired children, it might be limited due to reasons of time, cultural norms etc. "Without a way to connect the sentence structures to truth values, much of the linguistic input might be uninformative." (p. 393). The claim here should not be that language per se is sufficient without contents, semantics or counterparts in the real world, but this is yet another confession that it is more than syntactic structure that is important for FB reasoning development: semantics (i.e. truth values) and subsequently concepts.

3.8 Recent developments

3.8.1 de Villiers & de Villiers 2009

In this report de Villiers & de Villiers go back to the roots of linguistic determinism (de Villiers 1995b) and sum up the crucial elements of what they call the "complement construct", assuming that every language has complements or at least a syntactically overt way of capturing others' mental states. The elements in which complements differ from all other complex syntactic structures are: *Verb Types* (complements only occur under communication and mental state verbs, which are responsible for syntactic bootstrapping), *Truth* (complements can be false independently of the truth of the matrix sentence), *Reference* (referential opacity is particular in complements as terms used within the complement are relative to the subject and not the speaker, unlike in other complex syntax like adjuncts), *Wh-movement* (only communication and mental state verb complements allow for WH-extraction as they impose a point of view – in contrast to factive complements like e.g. with *forget*) and *Recursion* (complements allow for recursion (one 'X thought that Y' can be embedded in another one etc.) whose meaning cannot be borne by e.g. discourse, so "Bill believed that Mary thought that John was ill" cannot be fully represented by "John was ill. Mary thought that. Bill believed that."). The current stance on the PoV-Marker is that "complements […] introduce a Point-of-View on the clause" (it used to be the mental state verbs that introduce the PoV, cf. J. de Villiers 2005) which renders the truth of the lower clause and the designation of objects in the lower clause relative to the subject. De Villiers and de Villiers rank the feature of Point of View the most crucial one for a representational ToM because it enables the representation of a *false* belief; it can be realized in different forms (for instance voice or pitch in tonal languages or propositions in languages lacking WH-movement; postural role shift in sign language might be another way to mark PoV).

Empirical evidence. The authors sum up the most important evidence in favor of complement mastery fostering ToM development. They claim that is has been positively affirmed for languages with WH-movement like English and ASL, for non-WH-movement languages like Tibetan, furthermore for Turkish, Nicaraguan Sign Language and many more. The exception is Cantonese: Tardif et al. (2007) found that Cantonese speaking children showed correlations between complements and FB but children were generally doing very badly on the complement comprehension test even with 6 years of age. Another newer longitudinal study they mention is Tager-Flusberg & Joseph's (2005) which showed that in autistic children communication verb complement structures were the best predictor for changes in children's FB competence. De Villiers & de Villiers declare the results of the two training studies (Hale & Tager-Flusberg 2003 and Lohmann & Tomasello 2003) the most striking evidence for their case. Interestingly they mention that "the prediction is that mastery of complements open the doors to FB reasoning, but it does not say that

FB reasoning will inevitably follow" (p. 18) because training studies can fail although the theory behind them is correct. As for Perner et al.'s study on German children (2003) the authors acknowledge the point that the development really is conceptual rather than linguistic given the German data (also referring to the idea that memory for complement tasks are nothing but slightly simpler FB tasks cf. Ruffman et al. 2003) but declare the findings with deaf children too striking to be overcome by Perner's arguments. De Villiers & de Villiers argue that the desire-belief complex is polygenic, they think that "understanding desire seems to have no obvious linguistic prerequisites" (p. 20). Deaf children and children with SLI do not show delays on understanding desire and the according language (cf. P. de Villiers 2005) and furthermore the "semantics" of desire and belief sentences are categorically different as "there is no 'truth' index on the clause under want. It is an event that has yet to occur: it is an irrealis clause." (p. 20). Third, the modal interpretation of *think* ("John thinks that she **should** go to bed") is categorically different from *think…did* and more like desires (i.e. *think…should* is also irrealis). Under the light of these observations de Villiers & de Villiers refine the nature of the crucial ingredient (i.e. complements) as "realis tensed complements" which is a concept available in both English and German.

Communication verbs. On the role of communication verbs de Villiers & de Villiers emphasize that it is not enough for children to be exposed to people saying false things – these utterances must be encoded in the crucial syntactic embedding, the grammar enables the processing of the utterance in the situation and finally the understanding. Cross-linguistically the concept of complements varies, so the linguistic route via communication verbs is central in this developmental process. As for Cantonese de Villiers & de Villiers suggest that the children's poor performance on the complement comprehension tasks is due to the fact that the language does not have WH-movement and therefore Cantonese speaking children are prone to answer long distance WH-questions with respect to the lower clause only (in accordance to the locality constraint cf. Chomsky 2008). De Villiers and de Villiers suggest a test with a polar question such as:

(30) Woman say bought apple?

The question arises if this test is not removed from linguistic determinism's purpose completely then: now the only thing that is actually tested is whether the children understood the contents, not if the syntactic structure is available or understood.

As for FB reasoning the authors cover the following points:

Testing methods: the tasks used to assess children's understanding of FBs have been criticized as being "too unnatural" (Nelson 2005), as demanding more than just FB understanding (such as resisting the impulse to answer according to reality, working memory demands and other executive

function-related demands, see Carlson & Moses 2001), but de Villiers & de Villiers see this overruled by the findings in recent studies with deaf children (e.g. P. de Villiers 2005) where it was shown that a) deaf children do not lag behind in executive function tasks like they do in according language and FB tasks and b) high-verbal FB tasks are just as difficult for deaf children as their low-verbal analogues.

Innateness and performance demands: Theories like Leslie's (1994) and Fodor's (1992) and empirical evidence as shown in Onishi and Baillargeon (2005) represent the view that children's innate FB reasoning competence is only clouded by performance demands. Onishi & Baillargeon showed in an eye-tracking study that 15 month old toddlers' expectancies are significantly distorted when protagonists in an unseen displacement task look in the new location of an object although they only witnessed the old location. De Villiers & de Villiers see these results as problematic as they are taken out of any behavioral context. They cite an older study (Clements & Perner 1994) in which children's looking direction was measured in a verbal unexpected transfer task before they were asked the FB reasoning question ("Where will the mouse look for his cheese?") with the result that children not younger than 2;11 looked in the correct direction above chance (but still failed the question itself). This study therefore establishes implicit understanding of FBs as emerging just before the explicit use of the knowledge. Perner and Ruffman (2005) ascribe the findings of Onishi & Baillargeon to primitive event cues: the toddlers form "lower-stimulus associations" between character&object&location and if any parameter is changed the gaze time increases. Then again, de Villiers & de Villiers report that a recent nonverbal version of Perner and Ruffman's (1994) study by Southgate, Senju & Csibra (2007) showed that 24 months old-children's eye gaze predicted correctly where a person would look for an object. The question crucial to de Villiers and de Villiers remains: "But why then does explicit 'deciding' where the person will look then take two more years?" (p. 27)

Primates and FB: The discussion if primates have ToM at their command just as humans do is more or less closed – but with subcategories or neighboring capacities it is still alive in nowadays research. Povinelli & Vonk (2004) found that chimpanzees as well as children form a generalization of social cognition such as "A person seeking an object generally goes back to where they left it" – so a problem solving strategy that does not involve reference to mental states. De Villiers & de Villiers argue though that while these less sophisticated strategies only demand minimal tracking of what someone was watching respectively where someone has been last, their definition of FB reasoning includes true mental state social cognition (the person attends to where they believe for the object to be). The main difference between what Clements & Perner (1994), Onishi & Baillargeon (2005), Southgate et al. (2007) did is that linguistic determinism defines full competence in FB reasoning via a conscious explicit decision on the subject's part - for nonverbal assessment the sticker test by

Povinelli is widely used by linguistic determinists. As the latest studies with language delayed deaf children (P. de Villiers 2005; Schick et al. 2007) showed they are not able to solve this task before they master standard FB tasks although they are older and more socially adept than the normally developing control groups.

New evidence with adults: Recently Newton & de Villiers (2007) made a new attempt at investigating typical adults' FB reasoning performance in connection with language. The subjects were confronted with video scenarios with unseen change in location tasks; the subjects then had to choose the appropriate ending sequence. During watching the video the subjects either had to a) follow varied rhythmic tapping and repeat it with a drumstick or b) repeat a voice telling a story. It turned out that the adults busy with the verbal shadowing chose the video with the true location (i.e. the incorrect answer) and only the adults busy with rhythmic tapping were able to pick the correct ending sequences. So when the brain is busy with language, unconscious FB reasoning is blocked – the blocking does not seem to be due to attention capacity.

In order to reconcile this spectrum of results Carruthers (2007) for instance suggests that there are two different systems at work: system one is "fast, automatic and unconscious processing" and system two is the "slow, reflective and decision-making" instance of ToM. But with Carruthers believing in innateness and in language having a control function rather than a representational function de Villiers and de Villiers eventually are not satisfied. They acknowledge that there must be something to the eye-gaze tracking evidence piling up in favor of early FB understanding, but are very doubtful as to its range; looking time might be the "leading edge" of concept formation, but "any time a decision must be made, however nonverbal, and however simple a response, it looks as if FBs are not 'understood' until later" (p. 32). Furthermore, they doubt that it is only "a function of performance limitations" that cause the gap between implicit and explicit FB understanding, especially as hearing adults have everything fully developed but still cannot master understanding nonverbal FB videos when their language faculty is busy.

3.8.2 Recent developments: Nicaraguan signers

The latest report on Nicaraguan signers and their FB performance (related to their mental language) is by J. Pyers and A. Senghas (2009) comparing two testing periods. The findings Pyers made in 2001 with Nicaraguan signers of the first and second generation (see Pyers 2005, see section *3.5.2.2*) were compared to the developments these signers made over the course of two years –in 2003 a second testing period was held. Having tested the participants for mental language by looking at the production of mental-state verbs ("because it correlates with the acquisition of sentential

complements, increases with general language ability" Pyers & Senghas 2009: 806) and for FB understanding by using a low-verbal picture-completion task based on the unseen displacement task the authors came to the following results. At time 1 (2001) first cohort signers used significantly less mental state terms than their second-cohort equivalents but the authors found no significant difference in use of desire-state verbs (both cohorts used them). In FB tests the second cohort (so the younger participants) significantly outperformed the first cohort participants and additionally all signers of the first cohort who did not sign any mental verbs also failed the FB tests. Interestingly, at testing time two the gap was gone: first cohort participants did no longer produce significantly less mental state verbs than the second cohort (every participant used at least one mental verb) and also the FB understanding improved accordingly. The authors' assumptions were the following: first of all, their findings are yet another proof that FB understanding is dependent on specific linguistic structures and furthermore that this is true also for adults lacking these structures. They conclude that "even 25 years of social experience" cannot compensate this. In no case FB understanding was observed first (i.e. before the respective language mastery) but overall they "do not argue that it [language development] is sufficient to enable this cognitive development" (Pyers & Senghas 2009: 810). The surprising change from time one to time two in first cohort signers (namely that they would go from no FB reasoning and sentence complementation to successful versions of that) is explained by the fact that within those two years that lay between time one and two second cohort signers started socially interacting with first cohort signers and therefore Pyers and Senghas "hypothesize that […] first-cohort signers were exposed to a form of NSL that was richer than their own and that included the new mental-state words produced by their younger peers" (Pyers & Senghas 2009: 810). Pyers' hypothesis (2005) that first cohort signers previously relied on emotion and desire understanding to function socially was proven to be feasible by these new data and findings. The authors rule out that mere information exchange as a social process (cf. Hobson 2004) or observing others making mistakes due to ignorance as sole triggers for cognitive maturation. The authors' central observation is that the first-cohort signers were able to both acquire new linguistic structures and subsequently mature cognitively between ages 26 and 28 – an age which is not usually known for specific cognitive maturation or development. This would also render these language and cognitive structures as time-insensitive regarding their development. An implicit claim that is quite strong.

3.9 Summary

3.9.1 The quintessence of linguistic determinism

Summing up we can say that linguistic determinism nowadays relies on two major factors: theoretically and conceptually it depends on the semantic and syntactic factors of a polygeneous set of linguistic variables: verbs and its meanings, their supposed acquisitional powers (i.e. syntactic bootstrapping), syntactic configurations and again their semantic intricacies. Furthermore, the seemingly radical difference between desires and beliefs in child development (cf. belief-desire gap) cognitively and linguistically seem to corroborate the firmness of linguistic determinism's arguments. Empirically the strongest evidence supporting linguistic determinism on the one hand comes from training studies such as Hale & Tager-Flusberg's (2003) and Lohmann & Tomasello's (2003) and on the other hand from deaf populations with language delays (e.g. Pyers 2005, Schick et al. 2007). The arguments that weaken those two basic arguments come from different directions. The conceptual weaknesses concern general cognitive issues. The belief-desire gap is not as deep as it seems: especially Perner (see Perner et al. 2003, 2005) put a lot of effort into pointing out that desires and beliefs do share conceptual properties (e.g. they both are expressed in propositional attitudes and therefore (can) have the same representational complexity) and especially in their complex forms are equally hard for children to understand. Empirically data that make the clear linguistic difference between beliefs and desire mushy are a serious threat to linguistic determinism (see data from Mandarin and German). Also the fact that different studies find different aspects of language to be the nurturing factor for FB reasoning (Lohmann & Tomasello 2003: discourse and semantics, Astington & Jenkins 1999.: general language ability; Hale & Tager-Flusberg 2003: semantics of complements; and many more) in contrast to complementation syntax alone is also not helping.

3.9.2 Two camps: what they share, where they differ

In this chapter we came across two major "camps" that shared an interactional discourse about language and theory of mind. On the one hand we have linguistic determinism, most prominently represented by Jill de Villiers, and on the other hand representationalist views denying language the crucial status, represented by Josef Perner and his colleagues.

A) Similarities

The two different frameworks that were extensively discussed in this chapter more or less agree on the following points.

a. Age: both de Villiers and Perner assume a drastic change in children's cognitive understanding (ToM) around the age of four – according to them FB reasoning only emerges around this age. In other words both frameworks negate the possibility of ToM being innate; it emerges stepwise in the course of development. Other frameworks claim differently (see above): innativism and early development within the 1st year of life are common theories aside the main linguistic determinism discussion.
b. Domain specificity: both de Villiers and Perner share the view that ToM is not a domain specific module, they deny ToM the module-specific feature of being impenetrable. The substantial changes within a child's ToM can only happen because of "domain general changes in understanding perspective" (see Perner et al. 2005).

B) Differences

The substantial divergence between linguistic determinism and Perner's view is the role of language for Theory of Mind. In short, Perner and his colleagues are convinced that language merely provides the scaffolding for ToM in language input for children and in expressing cognitive progressions. Linguistic determinism on the other hand is known for putting language first, in the chronology of development as well as in the relevance for Tom development.

In *chapter 4* we will attempt a thorough and critical analysis of linguistic determinism. This critical review will contain a closer look at experiment design and conduction in this interface of research, a commentary on complement syntax in general and it will focus on studies and theoretical arguments that were dismissed by linguistic determinism but reveal interesting insights and new perspectives on our issues. Furthermore we will get to see studies that tap ToM abilities in toddlers (from 15 months onwards) which is contradicting both Perner's and de Villiers' claims.

4 Discussion and Criticism

In this chapter we will evaluate linguistic determinism in three blocks: in the first section we will look at data that constitute potential threats to the theory. In the second section we will analyze the methods for ToM and language assessment to see if their design and conception are adequate a) for the test subjects (children) and b) for the competences that were intended to be assessed. The last block will deal with conceptual assumptions that are relevant for linguistic determinism and the related problems that arise or remained unanswered and neglected.

4.1 Empirical Issues – Data

4.1.1 Theory of Mind in young Toddlers and infants – spontaneous response tasks

It is clear that young infants cannot be tested for ToM in a verbal way. Joint attention behaviors are assessed by analyzing behavioral cues and eye gaze, but for FB understanding it has always been assumed that children definitely do not have a command of it as even linguistically advanced children (3 to 4-year-olds) could not master standard tasks. Representatives of the innateness hypothesis of ToM though insist that even FB reasoning is existent in infants in some form. In order to assess FB in infants and toddlers the established testing methods needed to undergo a drastic redesign because the standard tasks are not adequate for infants. This is when spontaneous-response tasks entered the picture: anticipatory looking (AL) and violation-of-expectation tasks were adapted to test infants' mental understanding. In AL tasks children's eye gaze is tracked to see where they expect the agent to look for his object (all the experimenter says is something like "I wonder where he will look"). In violation-of-expectation tasks children are also exposed to transfer tasks but here both the expected as well as the unexpected outcome are enacted and looking times are compared. For both methods it is vital that true and false beliefs resp. expected and unexpected outcomes are compared and investigated because only contrasting the looking times can lead to meaningful results.

4.1.1.1 Beginnings of spontaneous response tasks

The first attempt to assess children's mental understanding completely non-verbally took place relatively early: Clements & Perner (1994) conducted an experiment with toddlers aged 2;11 to 3;7 to see if their AL would give insight into earlier forms of FB understanding than expected (i.e. younger than 4). They found that indeed according to their looking patterns children expected the agent of the story to look in the belief-consistent location, but they nevertheless failed verbal follow-up

questions. The authors assumed that some sort of implicit FB understanding might be active, but concluded that it is not a full-fledged ability. After that the FB understanding assessment in young toddlers was neglected again; only in the early 2000s the issue reappeared: Garnham & Ruffman (2001) wanted to prove that AL is actually a genuine measure for FB understanding and to do so they had to overrule two common alternative interpretations of AL. The first is that AL merely reflects the understanding of the causal relation seeing = knowing, in an unexpected transfer task the child might look to the empty container (i.e. the previous location of the object) because she expects the agent to do the wrong thing (instead of assigning a *think*-state to him). The other assumption the authors had to overcome was the associative strategy hypothesis that says that the child forms an association bundle of agent, location and object and therefore expects this association to reappear as soon as the agent comes back. In their experiment the authors used three instead of two hiding locations for their unexpected transfer task: one location would be the old one (i.e. the agent's one, the FB location), one would be the new location (the actual location the object has been moved to) and the third location would either remain completely neutral or, more importantly, would be a location that the agent interacts with prior to and independent of the object being hidden in a different location. Indeed, their results proved them correct. First of all, no matter if children failed all verbal questions, just the memory or the FB question or no question at all, in all of these subgroups children looked to the correct location way above chance. Garnham & Ruffman ruled out the seeing = knowing hypothesis because children did not look at the third irrelevant location. If seeing = knowing and therefore not seeing = doing the wrong thing applied, children's expectations would be equally distributed between the two empty locations, but children always looked at the location previously containing the object. As for the association bias the same conclusion can be made: as the character interacted with both the irrelevant location and the one first containing the object, the AL afterwards should be equally spread over the two empty locations, but it was not. The authors conclude that AL is indeed an expression of implicit and language-independent understanding of FB.

4.1.1.2 First proof for false belief understanding in infants

Onishi & Baillargeon (2005) undertook a radically new attempt to assess FB understanding in children. The attempt was "radical" in two ways: they explored the options of eye-gaze-tracking as a method of proving FB understanding and they looked for that measure in infants as young as 15 months. The basic principle in eye-gaze tracking is that if a situation takes an unexpected turn the looking time increases significantly. In our field this means that children are expected to look longer if the protagonist of an unseen-displacement scene searches for the object in the new, actual location of the hidden object. Onishi & Baillargeon's assumption that FB understanding exists in infancy already is based on studies like the ones mentioned above (i.e. Clements & Perner 1994; Garnham & Ruffman 2001); they used a violation-of-expectation method and exposed 15-month-olds to a scene

where an actor hides a toy in one of two possible locations (two boxes), then a change that renders the actor's belief either true or false occurred and an retrieving action by the agent followed. The experiment should show whether the infants would adapt their expectancies to the respective belief.

Method. Children sat in front of a scene consisting of two boxes (one green, one yellow) behind which was an opening that was shut with removable panels. Behind the panels was the actor; she would remove the panels or put them back on depending on what was needed for the condition. She was hidden completely when the panels were shut. First the initial location of the object and the actors' urge to retrieve it were established: the actor played with a toy and then put it in the green box. She disappeared; when she came back she would reach into the green box to retrieve the toy. Then in a **single belief induction trial** four conditions of belief were tested: two true belief (TB) and two FB conditions. In the first **TB condition** the object was put in the green box; the yellow box moved a bit towards the green box and then back while the actor was watching. In the second TB condition the actor watched the object move from the green into the yellow box. In the first **FB condition** again the object moved from the green box to the yellow box, but this time the actor was hidden behind the panels throughout the change of location. In the second FB condition the actor watched the object move from the green into the yellow box, but then the panels were closed and the object returned to the green box. After the belief was induced the children experienced **a test trial**; the actor would reach into one of the two boxes. Half of the test trials were carried out with the unexpected behavior, the other half with the expected outcome. The authors expected the children to look reliably longer when the actor's expected belief was violated. The authors tested 56 infants (8 groups á 7 children) in 4 conditions with 2 possible test trials each.

Results. On all four conditions children expected the actor to behave according to her belief and looked reliably longer if the actor searched for the object in the location that violated her belief. So irrespective of whether the belief was true or false, the object was believed to be in the yellow or the green box, the object was actually in the green or yellow box, the actor searched for it in the expected or unexpected location, children's looking times were according to the hiding location, the actor's belief and the actor's retrieval action. These results suggest that infants as young as 15 months already have a representational ToM, even if it is implicit or rudimentary. This extends O'Neill's (2005) findings that 2-year-olds can take into consideration the knowledge or ignorance of their parents when trying to make them retrieve a toy: Onishi & Baillargeon could prove that young children not only take others' ignorance into consideration but even react appropriately when someone is mistaken; this exceeds mere keeping track of others' perceptions. The authors plead for a mental interpretation of their findings: theoretically, this is grounded on the widespread assumption that "children are born with an abstract computational system that guides their interpretation of

others' behavior." (p. 257). In development, children rather learn "which states underlie which actions" (p. 257), not that these states exist at all. Empirically, these findings lead Onishi & Baillargeon to conclude that it is more parsimonious to assume that children assign mental states to others that can be shaped and updated by information rather than they create a huge set of superficial inferences about perceptions linked to actions.

4.1.1.3 Review of studies concerning FB understanding in infants

Baillargeon, Scott & He (2010) reviewed the current situation in research concerning infants' ToM and how the assumption that FB understanding is present in infants is corroborated. For FB about location their own findings (2005) were confirmed by a violation-of-expectation study by Träuble et al. (2010) and by Surian et al.'s (2007) study with 13-month-olds. Song et al. (2008) could prove that 18-month-olds are sensitive towards corrective feedback: if the protagonist of an unexpected transfer task comes back to look for his object, the experimenter would tell him either "The ball is in the cup!" or "I like the cup!". The children were able to detect which utterance would correct the agent's FB. In false perception situations the agent has an erroneous conclusion about the type of object he or she is facing (similar to the appearance-reality tasks). Song & Baillargeon (2008) showed an agent having a preference for a blue-haired doll over a pink stuffed skunk. Both objects were hidden in boxes and the box with the skunk in it misleadingly had blue hair on top. When the agent came back children as young as 14,5 months expected the agent to look for the doll in the box with the blue lock on it. Baillargeon et al. (2010) explain the blatant difference between spontaneous-response tasks and elicited-response tasks with the following reasoning: in the latter the child has to undergo at least three processes (from Baillargeon et al. 2010: 115 f):

i) a FB-representation process

ii) a response-selection process (when asked the test question, children must access their representation of the agent's FB to select a response)

iii) a response-inhibition process (when selecting a response, children must inhibit any prepotent tendency to answer the test question based on their own knowledge)

In contrast Baillargeon et al. claim that spontaneous-response tasks only require the child to undergo a false-belief-representation process. They conclude that elicited-response tasks are more difficult because executing all three demands at the same time overwhelms children's resources; strikingly, neuroscience backs this up: FB-representation is linked to the right temporo-parietal junction while for response-selection processes parts of the anterior cingulate and prefrontal cortex are important; the neural connection between those regions mature later and more slowly than other connections. Startling results could also be found in indirect-elicited-response tasks; Southgate et al. (2010) studied 17-month-old infants: the agent hid two different stuffed animals in two lidded boxes and then left. Then the experimenter swapped the toys; on return the agent pointed to one box and

declared that the toy inside was a 'sefo'. When the child was asked to retrieve the sefo, most children approached the other box – they understood that the agent had a FB about the location of the toys which made them realize that the agent actually intended to refer to the other toy. This is a complex FB situation: the children not only represented the agent's belief correctly, they also used it to infer which goal the agent had in mind and how the FB would influence other FBs.

Perner & Ruffman (2005) account for findings of FB reasoning in infants with primitive event cues (see *3.8.1*): toddlers form "lower-stimulus associations" between character&object&location and if any parameter is changed gaze time increases. But this does not hold water: as long as it is belief-consistent children do not look longer in Onishi & Baillargeon's (2005) task if the agent looks in the yellow box even if she only interacted with the green box before. Secondly, in familiarization events where the agent repeatedly only interacted with object A, children only look longer at the first interaction with object B if it was left aside in all these events – so children react to the agent's preference, not to the new combination of character&object&location. Baillargeon et al. (2010) can also contradict other alternative suggestions to their hypothesis, e.g. an ignorance interpretation would suggest that an ignorant agent either (a) makes the wrong action or (b) is uncertain in his behavior. In an experiment Scott & Baillargeon (2009) showed that children did not expect the agent to look in the wrong location (contradicting error) and were not surprised when the agent approached one of the two containers confidently (contradicting uncertainty).

4.1.2 Impaired language, intact Theory of Mind? Or: the case of SLI

As mentioned before, populations that show deviations in language or ToM development are highly interesting for investigating causality, influence and correlations between ToM and language. Linguistic determinists have already looked into deaf children with and without language delays and claim to have found evidence in favor of their framework. Here we will exemplarily look at specific language impairment (SLI) which is an isolated, language-specific syndrome; this means that SLI is not related to or caused by other cognitive impairments or retardations, neurological impairments, anatomical damages like hearing loss, emotional, social or psychological problems or any other developmental or intellectual disorders (non-linguistic intelligence usually is within the normal range) (cf. Schaner-Wolles 2005: 9). Children with SLI have great difficulty with grammar while semantics and pragmatics are usually not affected that strongly. Different classifications can be made (cf. Kauschke & Siegmüller 2002): either one linguistic area is affected, all linguistic areas are affected equally (and the language equals that of a younger child) or different areas of language are affected in different intensities (asynchronously). Furthermore (cf. Swoboda 2006) there is a difference between purely expressive SLI (children only having problems in language production but managing

language comprehension rather well) or expressive combined with receptive SLI. It is disputed whether SLI is merely delayed language development (parallelism and continuity hypothesis) or it shows deviations in language acquisition that are not part of normal language development.

4.1.2.1 Miller's study: a weak language-first hypothesis (?)

Miller (2001) conducted a study with children with SLI coming from a weak version of the "language-first" hypothesis which claims that language is needed to master FB tasks rather than to develop ToM itself. The study was conducted with three groups of children: the first group consisted of 10 children with SLI, average age 5;6 – their neurological, auditory and social functioning were tested to be in the normal range for their age, their language scores had to be below average significantly to qualify for the study. The other two groups were control groups: one group matched the SLI-children in age (but was otherwise normally developing, i.e. had better language competence, average age 5;6) and the other group matched the SLI children in language competence (but was otherwise normally developing, i.e. was significantly younger than the SLI-group, average age 3;9). Miller tested the children in three rounds, each round containing four different conditions of one type of FB task (an unseen displacement task) that differed in the complexity of language and the vocabulary (see Miller 2001: 76 ff):

1) ***Think-condition:*** *a standard FB task with the FB- question being "Where does [puppet] think the [toy] is?". Urging questions like "Which one?" if the child did not respond were used in all conditions, memory check questions ruled out chance.*
2) ***Look-condition:*** *the FB- question was: "Where will [puppet] look for the [toy]?" which is syntactically less complex (it doesn't involve a sentential embedding) and could potentially be simpler conceptually because the behavior has to be predicted, not a mental state.*
3) ***Show-condition:*** *this condition is different such that it does not rely on a question-and-answer pattern but rather on showing (acting out) what is going to happen. The child receives the puppet and the experimenter says "You be [puppet] now. Show me what he'll do/Show me what happens.". So this condition has minimal linguistic demands.*
4) ***Pretend-condition:*** *as 3-year-olds have a "reality bias" (they tend to answer questions with the truth rather than what the question actually interrogates, see e.g. Saltmarsh, Mitchell & Robinson 1995) Miller (following Cassidy 1998) designed this condition such that the puppet would form a belief about something it pretends about. The child was told e.g. about a block that the puppet liked to pretend for it to be either a racecar or a drum. One was picked and child, puppet and experimenter engaged in pretending it was e.g. a car. Next the puppet left the room saying "Don't change what we're pretending while I'm gone!"; then the experimenter changed the pretense to the other object, i.e. drum. After acting out on the new pretense, the puppet comes back and the experimenter asks "What does [puppet] think we're pretending the [object] is?" (which is more complex than any other condition).*

Analyzing all three testing rounds Miller comes to the following conclusions: the age-matched group performed significantly above chance in all conditions, the SLI-group performed significantly above chance in the *look*- and *show*-conditions only, the language-matched group did not perform above chance in any condition. In the linguistically more demanding conditions (the *think*- and

pretend-conditions) the age-matched group significantly outperformed both the SLI-group and the language-matched group, but in the *show*- and *look*-conditions the SLI-scores grouped together with the age-matched group; both outperformed the language-matched younger children. Miller states that "the children with SLI were conceptually more mature than the NDC group [i.e. language-matched group] but were less able to demonstrate this maturity when the language demands of the task were too great." (p. 81). She legitimately concludes that for children with SLI it seems that the linguistic demands of a FB task determine whether they can master it or not. She sees this finding as corroboration to the weak *language-first hypothesis*, but this conclusion falls one important step short. The results show that children with SLI can master FB situations; their failure does not make a statement about their ToM-competence but their linguistic competence to process complex structures. The conclusion that Miller *should have* drawn is that her data *contradicts* linguistic determinism. De Villiers and others criticized two points with SLI-data:

1) SLI is generally described to be an impairment that mostly affects morphology and other domains of language, but not (complex) syntax, so SLI-children are actually not impaired in the linguistic domain relevant for linguistic determinism
2) Miller did not measure the sentential complementation-competence of her probands

But both these attempts to nullify Miller's findings can be overridden by one very robust finding in Miller's data (which is the most important finding in this study): children with SLI could not master the *think*-condition which means that they have no (full) command of belief-language and even more importantly, of sentential complementation. The fact that they actually passed low-verbal conditions with the same cognitive complexity as the high-verbal condition cannot be accounted for by linguistic determinism. Finally, from my point of view the "weak language-first hypothesis" is in fact not a hypothesis at all: to claim that a verbal test needs linguistic skills in order to pass it is tautological and does not show any theoretical commitment or value. It is indeed mysterious why researchers not only admitting to this fact but even showing data that prove only this language effect and no other linguistic influence on ToM stick to the claim that there is a theoretical hypothesis behind their findings which is what Miller does. After all, we are not trying to find out who is best at the tests we design; we try to design tests that assess the processes in our brain best and most directly.

In a later study Miller (2004) assessed children's competence in sentential complementation and she found that children with SLI all perform poorly on sentential complementation but could still solve the low-verbal FB tasks. Miller analyzed spontaneous language data and added a complement comprehension test to her test battery, but this test again based on representation-reality-discrepancies which are the core of FB understanding and therefore not fit to test language competence independently. Miller did find correlations between FB understanding and linguistic

competence but the main observation (children with SLI and poor complementation competence can pass FB tasks if the linguistic demands aren't too high) remained the same.

4.1.2.2 Swoboda's findings on SLI and Theory of Mind

Swoboda (2006) attempted to shed light on the language-ToM-interface by investigating (Austrian German-speaking) children with SLI and, based on the assumption that SLI is an impairment affecting both language production and perception, wanted to show that success or failure on standard FB tasks is dependent on language *comprehension* (a similar claim was made by Miller 2001). Swoboda claims some relevant linguistic issues children with SLI suffer from:

- Children with SLI generally neglect the prefield of the sentence and therefore have problems with processing question words correctly (especially crucial in probe questions) and matrix sentences of embedded complementation structures.
- They have problems mastering questions and WH-pronouns can be found sentence internally rather than moved to the left sphere of the sentence in SLI children's utterances (e.g. "die kuh **wo** überhaupt hinghört?" the cow **where** actually belong.3sg.present).
- The syntactic operation "move" seems to be problematic for children with SLI, Swoboda refers to Van der Lely & Battell (2003) who established that the movement of sentence constituents is particularly difficult for children with SLI, they only use it occasionally while in normally developing language movement is assumed to be a principle.
- General problems they have with syntactic configurations: Swoboda observed that verbs are often individualized in SLI and the integration of verbs into new contexts goes slowly. Children with SLI have problems and delays in the acquisition of finiteness and temporal markings which leads to morpho-syntactic problems. Conjunctions and subjunctions are acquired considerably later and less reliably, this makes it difficult to represent complex syntactic structures correctly.

The prediction linguistic determinism would have to make is that considering these linguistic limitations children with SLI are not able to master FB reasoning. According to Swoboda studies concerning ToM and language in children with SLI could not present decisive data yet; a study mentioned in Harris (2005) by Van der Lely, Hennessey & Battell (2002, unpublished) apparently provides evidence that children with SLI master FB without the command of complementation. De Villiers, Burns & Pearson (2003) though claim the opposite. To prove that ToM development is not significantly determined by the acquisitions of complementation Swoboda used ToM tests based on Wellman & Liu's (2004) scaling of ToM tasks and several means of language assessment methods. She investigated two hypotheses: 1) SLI children's ToM does not deviate significantly from normally developing children, i.e. linguistic determinism is wrong 2) the acquisition of complement structures is not of direct causal effect for the development of ToM.

Experiment. For language testing Swoboda used a quantitative lexicon assessment test (Aktiver Wortschatz Test für 3-6jährige Kinder, Kiese & Kozielski 1996); a language development test with a subtest for language understanding (SETK 3-5, Grimm, Aktas & Frevert 2001); a screening procedure for phonological and phonetic aspects (SVA, Hacker & Wilgermein 2001); a test for nonverbal intelligence assessment (CMM, Bondy, Cohen, Eggert & Lüer 1975) and finally an extensive elicitation test for sentences with *that*-complements with the verbs *denken* (*think*), *wissen* (*know*), *glauben* (*believe*), *wollen* (*want*), *sagen* (*say*) and *sehen* (*see*) as a control. In this test children are confronted with a leading in of a sentential complementation structure, i.e. the experimenter leads with the matrix clause e.g. "Die Sarah will aber, …" and then the child is urged to finish the sentence, so a) the child does not have to repeat something she heard earlier and b) there is no complementizer in the lead-in, so a full complement is not the only grammatically correct option. Children have different options for answering (Swoboda 2006: 162):

a) *Correct or incorrect with an embedded clause (correct: "Anna denkt, dass die Mama nichts sieht" incorrect "Anna denkt Mama nicht merken")*
b) *Correct or incorrect without an embedded clause (correct: "Anna will ein Zuckerl" incorrect: "Mama glaubt krank")*
c) *No answer*

For ToM testing Swoboda enhanced the scaling developed by Wellman & Liu (2004). She used 7 items with increasing complexity (from Swoboda 2006: 164 ff):

1) ***Diverse desires:*** *"Look, this is Pauli. He is going to kindergarten and takes a snack with him." Own desire question: "What would you prefer? Would you prefer a tomato or a banana?" child e.g. "banana" – "Pauli does not like bananas. He prefers tomatoes." Goal question: "Pauli may choose something, what will he pick?""*
2) ***Diverse beliefs:*** *"Anna is looking for her bunny. The bunny is either hiding in the house or in the garden" Own belief question "What do you think? Where is the bunny? In the garden or in the house?" child e.g. "in the garden" – "Yes, you think that the bunny is in the garden, but Anna thinks the bunny is in the house" Goal question: "Where is Anna going to look for the bunny? In the garden or in the house?"*
3) ***Knowledge Access:*** *a neutral white can is presented "What do you think is in the can?" child guesses something, can is opened and contents are revealed. "Now Anna is coming" Memory check question "Did Anna already take a look inside the can?" Goal Question: "Does Anna know what is in the can?"*
4) ***Contents FB:*** *a familiar box is presented, e.g. chewing gum "Do you know what is in there?" child "chewing gum" – "Open it!" Own belief Question: "What is it? What did you first think? And what is really in there?" Goal Question: "If your sister comes in later and we show her the box what will she think is in there?"*
5) ***Explicit FB:*** *"Pauli is looking for his crayons. They could either be in the schoolbag or in the desk. In reality they are in the desk but Pauli thinks they are in the schoolbag." Goal question: "Where is Pauli going to look for the crayons?" Reality check question: "Where are the crayons actually?"*
6) ***Belief-Emotion:*** *in this task the child is informed about the preference of the protagonist for certain food, then a box that usually contains this is presented but turns out to contain something else; Memory check question: "What does Pezi like so much?" Goal Question: "Is Pezi going to be happy or sad when we give him this box?" and after opening the container "Is Pezi now happy or sad?"*

7) ***Real Emotion:*** *two protagonists (dolls) are competing and the one fails in fulfilling his previous claims to be the faster runner. When he falls, he suppresses his urge to cry/look sad to impress the other character. Goal question "What face will Pauli make when he is hurting after falling?" child chooses between three facial expressions "What face will Pauli make if Anna should not realize that he wants to cry?"*

Results. The data revealed that both children with SLI and normally developing children (NDC) were able to pass ToM tasks up to item 4 (cf. unexpected contents). The scores were: items 1 & 2 were passed by virtually all children, item 3 passed 97% of NDC and 88% of children with SLI. Item 4, contents FB, was passed by 78% of NDC and a significant percentage of 67% with SLI children (remember, the verb used in this task is *think*) and the difference between the scores has no statistical significance which is proof for children with SLI having some command of FB understanding. Item 5 (explicit FB) was passed by 54% of NDC and 16% of children with SLI. Item 6 was passed by half of NDC and still 27% of SLI children, and item 7 by 17% of NDC and 6% of SLI children. Swoboda claims that the problems children with SLI had with the more complex ToM tasks can be lead back to their perceptive language deficiencies. This means that language understanding and especially the understanding and correct interpretation of questions is a crucial prerequisite for mastering ToM tasks. They could not follow the complex stories and the mere amount of questions was too high, their general problems concerning the left sphere of the sentence (see above) and WH-pronouns had an effect, too. The lower the linguistic demands for a task the more likely it is for children with SLI to pass it including full-fledged FB tasks.

As for the language findings, Swoboda found correct forms of sentential complementation in both NDC and children with SLI. This sounds like a confirmation of de Villiers' claims, but a closer look reveals that this is not the case. Children with SLI could only score 22% on "*glauben, dass*" (*believe that*) and 17% on "*denken, dass*" (*think that*); the best score goes to "*sehen, dass*" (*see that*) with 33%. Most striking is that out of 8 children with SLI (18 children with SLI participated in total) who did not form a single correct *that*-complement 5 children mastered item 4 of the ToM task (contents FB including *think*); 3 NDC had bad scores on complementation but were able to pass item 4, too. 3 NDC had good scores on complementation but did not pass item 4 (contents FB) or any other FB task. Moreover, children with SLI only scored 11% on "*sagen, dass*" which contradicts de Villiers' bootstrapping theory (de Villiers 2000; J. de Villiers 2005) because the score on both *think, that* (and *believe, that*) and *know, that* are higher, so the idea that the syntax for *think* is acquired in analogy to the structure of *say* does not hold water. All in all children with SLI did not get higher scores on *that*-complements than 33% (with "*sehen, dass*") which stands in stark contrast to a passing score of 67% on the FB task item 4. (It is important to point out though that Swoboda uses elicited data from sentence lead-ins that grammatically allowed for structures without any complementation. These percentages do not reflect children's mastery of *that*-complementation in a direct or strict sense. Still the distribution of the different complementation types is interesting.) Another observation

Swoboda makes (p. 244) is that children with SLI have no problems with the verb last-position but they struggle with verb second. Unfortunately she fails to make the conclusions that a) this confirms generative grammarians claiming that the underlying (in-situ) position of the verb is verb-last and that children who acquire verb-second-languages (like German) have to learn the movement from verb last to verb second in matrix clauses (which causes verb second to come later in development, see e.g. Rothweiler 1993) and b) based on observation a) she has another piece of evidence for SLI to show delayed language development rather than deviant development.

Swoboda concludes that her data indicate a parallel development of language and ToM. Language and cognition-specific capacities can emerge simultaneously, they can at times correlate and have reciprocal influences (like e.g. with mental representations), but this does not prove a determining relationship. Swoboda states that children with SLI have deficient grammar also affecting their syntax. Complementation is often impaired or incomplete, and children use"syntactic minimal structures" like: *"Die Mama hat gesagt, zsammräumen!" (the mother had said tidy-up.INF), "Mama glaubt, krank is" (mother believes ill is), Q: "Was glaubt der Pauli, dass der Wuffi tut?" A: "obn is" (Q: what believes the pauli that the wuffi does? A: above/up is.) "Die Kinder wissen, keks hat" (the children know.1stPersonPlural cookie has)* which are in no way felicitous complement constructions, yet in Swoboda's study children with SLI mastered a contents FB task and some even an explicit FB task (item 5). Swoboda concludes that language has a structuring function; it helps to represent, structure and reflect upon cognitive contents and knowledge.

These studies with children with SLI show that performance demands are highly relevant in the investigation of a potential relationship between ToM and language. Both Miller (2001;2004) and Swoboda (2006) found proof that children lacking the full-fledged mastery of complementation syntax which is the unconditional prerequisite for FB understanding according to de Villiers could still pass FB tests if the test design included little linguistic demands.

4.2 Empirical Issues – Experiment Design

4.2.1 What literature tells us

The linguistic (see *4.1.2*) and general demands (e.g. on attention, executive function, working memory, story coherence etc.) of FB tests are most crucial to success or failure in FB understanding in preschoolers. Miller (2001) found that the lower verbal demands are the better children with SLI will score on FB tests although their language impairments affect exactly those linguistic abilities that are considered crucial in linguistic determinism. Swoboda (2006) stripped down FB reasoning tests to their minimum whilst maintaining their conceptual intricacies and complexities. The design of experiments and tests in the ToM-language-interface has been explicitly criticized but linguistic determinism rarely attempted to adapt its test design accordingly. This section will sum up several critical stances on experiment design; the criticism is twofold: on the one hand FB tests are too demanding linguistically which probably is the major reason for the correlations between language and ToM scores. On the other hand the tests for assessing complementation, contain mental references and therefore the prerequisite of mental understanding in order to succeed.

4.2.1.1 The entanglement of linguistic and ToM competences in test design

A compact overview of what might be wrong with experiment design in the ToM-and-language discussion is presented by Adler (2002). She claims that de Villiers' testing methods for complement structures "in fact *rely upon* the child's ToM ability; thus it is neither surprising nor significant that scores […] are correlated" (Adler 2002: 1; her italics) and that scores on ToM tests might be worse than the child's actual understanding due to linguistic limitations. Adler's two major points are that, for one, in spontaneous speech data like presented by Shatz et al. (1983) both cognitively and linguistically complex utterances with real mental reference can be found in very young children (younger than 3 years) e.g. "I thought there wasn't any socks, but when I looked I saw them" and "The people thought Dracula was mean, but he was nice." (Shatz et al. 1983: 309) both uttered by a toddler aged 2;8. This is proof that children are perfectly capable of establishing mental reference more than a year before they start passing standard FB tasks above chance. Secondly, the test design of both language and FB assessment methods is criticized. Complementation tasks have two flaws: they very often make use of mental state verbs (*think* or *believe*) and they "require[d] that the child mentally manipulate a representation of reality." (Adler 2002: 5). In a footnote she mentions a fact that I want to stress: "Even in the test cases using *say*, the child must be able to represent and manipulate two incompatible versions of reality, a skill which arguably draws upon the same meta-representational capacity as theory of mind." (Adler 2002: page 5). This, according to Adler, is a straightforward explanation as to why the score on memory for complements task is neatly

correlated with the score on FB tasks. The scores on FB tasks in de Villiers & Pyers (2002) not being highly correlated Adler takes to be a hint that these tests might not test the same ability.

4.2.1.2 Manipulating test questions

Adler found proof for the assumption that wording and linguistic demands of test questions are also crucial for FB tests in several sources: Lewis & Osborne (1990) experimented with different formulations of test questions and found that integrating "before" into questions in unexpected contents tasks enabled children as young as 3 years to pass the task reliably. The authors pointed out that a question like "Where will [name of protagonist] look for the object?" (p. 1515) is underdetermined concerning its temporal reference; they emphasize that the challenge is the spatiotemporal sequence of events because the task here is "the understanding of being in the wrong place at the right time" (p. 1515, cf. Chandler 1988). They claim that the question only entails implicitly that the child has to judge the protagonist's belief about here and now (e.g. before being informed about the actual unexpected contents of a container). This is why the authors paid particular attention to the temporal contexts they would use for their FB questions and in which syntactic configuration they would present them to three different test groups (from Lewis & Osborne 1990: 1516):

(31) a. **Standard FB test group:**

"What do you/did you think is inside the box?"

"What will [name of friend] think is in the box?"

b. **"When"-group:**

"What did you think was in the box when the top was still on it?"

"What will [name of friend] think is in the box when the top is still on it?"

c. **"Before"-group:**

"What did you think was in the box before I took the top off?"

"What will [name of friend] think is in the box before I take the top off?"

The test subjects were divided in three age groups; the results showed that on both the self and other question children did significantly better in the *before*-condition; they performed significantly above chance in the second age group (3;6-4 years) and also in the youngest age group more children scored correctly than incorrectly which was not the case for the standard and *when*-condition children. Even more so, the incorrect responses on the other-attribution question of standard- and *when*-group children were significantly above chance. The question type was the crucial factor in these results. Why the *when*-condition was harder than the other conditions is not entirely clear to the authors but they speculate that the temporal adverb *still* in the *when*-condition is difficult for

children and the *when*-question highlights the static container rather than the actions of the experimenter and their effects.

Miller (2001) showed that low verbal FB tasks are easier than highly verbal ones and the choice of words matters, too. Miller confronted the children with the following question types:

(32) a. Where will X look for the toy?
b. Where does X think the toy is?
c. Show me what X will do/what happens (the child manipulates the puppet)

On the *look* and *show me*-conditions children with SLI scored within normally-developing range and only the *think* question was mastered at or below chance although in all three conditions the child has to consider the protagonist's knowledge and belief (more on Miller's study in *4.1.2*).

Another question manipulation got Siegal & Beattie (1991) to achieve better scores with younger children: instead of asking "Where will X look for the toy?" they changed the question to "Where will the person look *first*?" (my italics) because in the first question the intention of the experimenter is not clear: children might interpret this question to mean "Where will X have to look to find the toy?" which would test the child's own knowledge rather than somebody else's wrong mental state. Adler hypothesizes that Siegal & Beattie's finding could mean that children assign the modal *will* a deontic or root interpretation instead of an epistemic one which is a common pattern for children concerning modals (Adler refers this fact back to Hirst & Weil 1982 and Gee 1985). This would mean that a child takes "where will he look" as something that the character needs to obey rather than a guess about what might happen. In other words: the deontic reading of a modal refers to permission and obligation whereas the epistemic reading has an existential interpretation. If children were to take the "will" in FB test questions deontic, this could impact scores on FB testing significantly. Children could take "Where **will** X look for…?" to mean "Where **should** X look for…?" which concurs perfectly with the answers younger children give. Adler points to the assumption that the acquisition of modals might actually depend on the acquisition of ToM but this claim has been revoked by Schmitt (2006). Nevertheless the mix up of deontic and epistemic readings is crucial to the test results but has not been regarded by linguistic determinists so far. Adler suggests reformulating the standard FB question with using the phrase "is going to" instead of will because it does not have the distinction of deontic and epistemic interpretation, it avoids sentential complementation and mental state verbs. On this basis Adler formulates an updated version of an unexpected displacement task in which the story's intrinsic motivation for moving the object is more straightforward and the test question is "Where is Billy going to first look for his toy car?".

Adler also criticizes the status quo of non-verbal tests; she emphasizes how important accessible low- and non-verbal tests would be for investigating ToM. The tests have to be more than merely language-free, they would also have to be significantly simpler. What Adler criticizes with the nonverbal FB tasks (sticker hiding test and appropriate facial expressions test) is that they suffer from an "artificial increase in difficulty as a result of avoiding the use of complex language" (Adler 2002: 12) and generally, that a person might be able to reason about FBs but is not capable of sufficiently communicating what they know due to linguistic limitations. The fact that in de Villiers & Pyers' study (2001) deaf children of deaf parents' scores on FB tasks drop drastically when looking at the results of low-verbal tasks in comparison to their performance on standard verbal FB tasks corroborates Adler's speculation that these tests are actually not equivalent to standard tests.

4.2.1.3 Issues with standard FB tests and their role in ToM assessment

A meta-view on the FB test is provided by Bloom & German (2000)who claim that the standard FB test should be abandoned as a measure of ToM altogether. Their reasoning is that the FB test is inherently too difficult to display the actual ToM competence of children. Following Leslie (1994) they claim that "beliefs are *supposed to be true*. This is *what they are for*" (Bloom & German 2000: B27, their italics) which is why even for a child who understands that a belief can be false it is not trivial to get the answer right. Useful, simple heuristics that help children process and understand the major amount of events in their lives have to be knocked on the head. Their next argument is that 3-year-olds also fail other representational tasks that do not have any mental reference like e.g. the false photograph task. In a study by Riggs et al. (1998) children had to answer a question about an alternative state of a present situation (the whereabouts of an object that would have been placed differently if some event had not happened) at which they perform poorly even though there is no representational content in this task. Older autistic children though pass these kinds of tasks and still fail standard FB-tasks indicating that they actually have specific problems with understanding FBs which is not what is going on with 3-year-olds. Bloom & German argue that "normal 3-year-olds are nothing like older children with autism" (p. B29) in every other social or communicative respect (following Happé 1995). Bloom & German claim that 3-year-olds have a ToM meaning that they have a general understanding of mental states; the poor performance on FB tasks might be due to task demands, the dominance of the main function of beliefs or other related problems. They conclude that failing the FB test is not informative about a child's ToM, but they admit to success on FB tests might be in another context. Bloom & German emphasize that there is plenty of evidence that children can attribute mental states at a very young age, e.g. 2-year-olds can take their parents' knowledge into consideration and accordingly use or omit linguistic cues to get them to retrieve a desired object (O'Neill 1996;2005).

4.2.1.4 The scaling of Theory of Mind-tests by Wellman & Liu

Wellman & Liu (2004) systematized and categorized FB tests because they found that a lot of tests are used synonymously although they actually test different stages of ToM and therefore give an awry view on the child's ToM. The authors worked out 7 items for preschoolers to test their mental understanding. The mental states Wellman & Liu integrated are desires, emotions, knowledge and beliefs. The material in the tasks is pictures in combination with verbal input; the questions consisted of a control question and a goal question. The following order of ToM-test-stages could be established (for test design see Swoboda 2006; here: *4.1.2.2*): 1) Diverse Desires 2) Diverse Beliefs 3) Knowledge access 4) FB contents 5) FB explicit 6) Belief-Emotion 7) Real-Apparent-Emotion. Their study showed that the scaling gave the expected results and supported the claim that ToM development happens in predictable developmental sequences.

4.2.2 Observations and criticism

Assessing children's abilities and cognitive states probably is the toughest empirical context in cognition and linguistics. First of all, it is virtually impossible to engage children in conscious meta-talk about the ability or state in question. In other words it is of no use to ask a child if he or she knows what a sentential complement is or to describe in which way they interpret a sentence like that. Secondly, the most common experimental tool – the question – is not very adequate to assess children's knowledge because the younger a child is the less language she has at command. Third, a child's (linguistic) output is usually ambiguous; what they tell us and the utterances they make are fragmentary and theoretically there is no consensus yet what a child's language system actually looks like. A child's knowledge and abilities are most implicit and normally children are not aware of what they know or are capable of. This means that we need to make use of alternative ways of assessing children's brains, take for instance studies that track the child's eye gaze, analyze habituation and dishabituation patterns, display and interpret brain activity etc. But still, even these methods leave a lot of space for speculation and the majority of researchers looking into cognitive development still stick with verbal methods. This is why experiments have to be designed carefully and small mistakes can cause serious problems for the credibility of the results, correlations and the conclusions that are drawn. In our particular field of research the linguistic aspect is especially delicate: language is not merely an error-prone methodological crutch we use for investigating our test subjects, on a different level it is also what we actually have to assess independently of the supposedly correlated measure. The fact that the experimental methods might be designed such that the assumed correlations are circular casts doubt upon that the correlations and relationships that were pointed out for language and ToM. Consider the following sequence of inferences linguistic determinism:

(33) a. Children only master FB understanding once they have command of complement syntax

b. These complex mental states can only be expressed in complex linguistic structures (see J. de Villiers 2005: 187: "[…] the reasoning we engage in around the contents of other minds must have the same degree and precision of propositional complexity as is contained in our natural language descriptions of such events. Anything less precise won't fit the bill, that is, it will not allow us to predict behavior.")

c. Questions that are aimed at these complex mental conditions can therefore only be asked and answered in complex linguistic constructions

This is the methodological basis de Villiers and colleagues work with and in step c) it is obvious that there are methodological entanglements that potentially have a major influence on the results. One major difficulty in linguistic research often is that the target of research is identical with the means of scientific investigation and description, so it is necessary to seek largest independence possible. In the ToM-and-language interface this translates as: the argumentative basis equals a performance demand (i.e. complementation syntax). To be able to make claims about this correlation at all it is mandatory to assess FB nonverbally and assess both measures independently. In this section we will look at the potential problems in the experiment situation and its conditions, at the make-up of the linguistic tests and what they actually measure and at FB tests.

4.2.2.1 Experiment situations: potential problems

As mentioned above investigating infants' and toddlers' cognition is a tricky task. Swoboda (2006) for instance sums up the most prominent problems for the experiment situation as follows:

1) children in their 4th year of life are easily overstrained with verbal perception
2) they rarely manage to realize more than 1 part of the question
3) young children tend to concentrate on objects and persons rather than stories or processes

Considering that in the standard FB task a child has to process long stories (especially in the unexpected transfer task), that test questions usually consist of syntactically complex, multilayered linguistic utterances and that FB reasoning is genuinely based on a sequence of events that are interrelated Swoboda's claims constitute profound problems for the average FB task . Some issues in the general experiment design of standard FB tests are the following:

a) Expressing ToM overtly, consciously and linguistically contradicts core ToM because it is effortless, fast and unconscious. Obviously there is a difference between the average 3-year-old and the average 5-year-old as the latter is capable of passing standard FB tests and the

former is not, but it is crucial to establish what is actually measured here. The discussion in this chapter shows that it most probably is not the core functioning of ToM.

b) Young children are most likely to report their knowledge, especially if they have just learnt something new, in the literature this is called a "reality bias" (Mitchell & Lacohée (1991), Russell et al. (1991), Saltmarsh et al. (1995) etc.): children are prone to answer questions true to fact (reality) and will try and find the hidden object. This is a problem because in FB tasks the correct answer is the one contradicting current reality or knowledge.

c) At the age at which children are tested for FB reasoning, i.e. around 3 years of life, their everyday life relies heavily on routines and rituals and these routines are determined by their social environment. Children (at home and e.g. in kindergarten) are encouraged to report on what they know and what they have learned. They are eager to answer questions correctly and receive positive attention if they do; this is potentially dangerous in FB questions especially as young children have a limited command of language, and question structures and semantic nuances, sequence of time etc. might not be all that obvious to them. It is dangerous to make their answers, behavior, overt reasoning etc. out as biunique. In linguistic research child language data is always evaluated as being very ambiguous and fuzzy, e.g. "Mama dinkn" (Mum drink.INF) in German can mean: Mum should drink. Mum is drinking. Mum wants to drink. Mum is going to drink. Mum, I want to drink. etc.

d) This speculation about routines is even shown by (probably non-significant, but at least observable) tendencies in Schick et al.'s (2007) data: the passing numbers show that hearing children are better on verbal tests than they are on low-verbal tests. ASL natives are better on low-verbal tasks (and can solve them earlier) than verbal tasks.

This is not to say that FB reasoning is dependent on social factors or discourse but it is very important to distinguish what children are used to (which routines they follow), how they interact, what responses they are taught to favor (for instance by positive feedback in the family, from the kindergarten teacher etc.). We have to bear in mind that children do not have self-reflection, meta-knowledge about their knowledge and capabilities and similar tools that help grown-ups overcome their intuitive, unconscious reactions and behavior and reflect upon them.

4.2.2.2 Language assessment: the complement comprehension lie

The central test for assessing the child's command of complementation syntax is the Complement Comprehension task (de Villiers & Pyers 1997). We saw its basic form in (5):

(5) (story) "The Mom said she bought apples, but look, she really bought oranges."
(question) What did the Mom say she bought?

In earlier work de Villiers used communication and belief verbs equally for the memory for complements task because "this task does not require the child to “read” the character’s state of mind, but merely to represent it by holding the sentence in mind and then repeating the relevant piece back." (de Villiers & Pyers 2002: 1043). This assumption was backed up by their data: "We separated the mental and communication verbs in the Memory for Complements task but collapsed across tokens within each type as there were no significant differences." (p. 1045). This means that the later adjustments of this test being reduced to communication verbs only for the reason that only those don't contain any mental reference were a farce. Fact is that even if one "only" uses a communication verb, as long as the proposition embedded under it is false the child must understand that a person can bear an incorrect representation of the world. In *4.2.1* we already encountered this important aspect of criticism in Adler's (2002) comments. The complement comprehension task is most praised by its inventors for exactly one supposed feature: namely its total independence of mental reference. If one takes a closer look at this task though, it is actually very clear that the assumption this test is based on is wrong: Up to today every complement comprehension task consisted of a situation in which somebody says "X" but does "Y" and children had to recall what this somebody actually said. The problems start right here with the verb *say*: In numerous works of linguistic determinists we can literally read that communication verbs and belief verbs together form a special class of verbs that share one thing in particular: the potential to syntactically embed false propositions without being rendered false by it (see J. de Villiers 2005) which is syntactically manifest in the PoV-feature that is set to *subject-PoV* for all non-factive verbs like *say* and *think*. It is considered a fact in linguistic determinism that the last and most important step in FB understanding is when children acquire this PoV-feature. There is even proof from inside the linguistic determinism camp that *say*-complements and *think*-complements are the same: in Lohmann & Tomasello's (2003) training study the sentential complements-only training group was divided into communication verbs and mental verbs only to be collapsed again later because there was no significant difference in the scores.

So, what is wrong the complement comprehension task? In all the different scenarios no one ever used a true statement to test children's ability for complementation; it is always a false statement that needs to be processed by children and this is a major problem: false statements (statements that are contradicted by reality or follow-up behavior) can – according to linguistic determinism theory itself! – only be understood if children have already acquired the PoV-marker. But of course, this discussion is only relevant if we assume the PoV-marker to be real. To put the substantial problem discussed here in more general terms, in the common complement comprehension task a child has to be able to integrate that somebody can say something that is contradictory to reality, or to say it in Adler's words the child has to integrate "incompatible versions

of reality, a skill which arguably draws upon the same metarepresentational capacity as theory of mind." (Adler 2002: 5). Children have to be able to understand that an utterance can be false. In standard linguistic determinism this property of the complement comprehension task is completely ignored, researchers even claim the exact opposite, e.g. Schick et al 2007: "The task in this study never requires the child to represent anything about the content of anyone else's mind." (p. 392)

Furthermore, on a general methodological note, it is not that straightforward that processing a question structure (e.g. long distance WH-question) is direct proof for the complete command of a related, but different structure (i.e. an embedded complement construction) in child language. From a language acquisitional point of view it is mere stipulation that the understanding of one form proves the productive competence of another form, after all we are dealing with two different syntactic operations and linguistic determinism has failed to attend to the need of investigating the relations between these two syntactic structures resp. operations and proving a direct correlation between the two competences. Potentially the questions might be even harder for children to process than the syntactic form they are derived from. de Villiers (1995b) herself dedicated a book chapter to the fact that children have a particularly hard time with long distance WH-questions in comparison with other questions; children tend to treat them like they are short distance.

4.2.2.3 Standard FB tests

We have already discussed many reasons why the tools to assess FB understanding in toddlers should not be language-intensive or probably should not contain any language whatsoever:

1) To be able to investigate the correlations between language competence and cognitive development (e.g. ToM) it is necessary to assess both competences independently and free of each another (for the language tests we have already discussed this aspect at length).
2) Infants and young toddlers (3-year-olds), are still in the process of acquiring language, therefore it is not valid to rely on verbal questioning and answering to access a non-linguistic cognitive domain, especially if the child's understanding of the relevant questions structures is not investigated intensively and could therefore lead to misunderstandings on the child's side that are not present in the adult understanding. Moreover, to prove the "linguistic-ness" of a cognitive domain it is even more important to get language-independent measures. Adler (2002), Lewis & Osborne (1990), Siegal & Beattie (1991), Miller (2001) etc. have suggested and shown that changes in the wording of questions have drastic influence on performance.
3) Even if language is necessary to explicitly communicate explicit ToM-knowledge like it is the case in the standard FB tests it is not granted that this actually makes a statement about the constitution of ToM as such: this might simply be task demand-specific; a basic, if you will

implicit, understanding of FB can nevertheless be existent way earlier. I will suggest later (see section *4.3*) that FB tests actually test an interface ability.

4) Not all FB tests assess the same kind of FB and they differ in their complexity. The scaling of ToM-tasks by Wellman & Liu (2004) and tests with children with SLI show best that not all ToM tasks are the same: there is indeed a chronological order according to which children acquire ToM (see *4.2.1.4*); unexpected contents tasks are mastered by children earlier than explicit FB (cf. unseen transfer) or belief-emotion tasks. In *2.2.1* we have discussed the fact that passive understanding of FB is categorically different from explanation of FB which again differs significantly from predicting behavior based on FB; this is backed up by e.g. Bartsch & Wellman (1989).

It is important to keep one thing in mind: the need for nonverbal assessment methods is crucial. The most important reason for this is that one of the biggest quests in ToM-research is to find out when children master ToM (especially FB reasoning) or if ToM could be an innate capacity. But in order to establish this we will have to test children as young as possible. The linguistic abilities of 4-year-olds are good enough to have conversations like the ones described in standard verbal FB tasks, but the real question is if younger children have the same ToM-competences and if so, when this competence really emerges, and if they are hindered by other factors to score correctly on standard FB tests. We cannot expect 2-year-olds to stand any chance in a standard verbal FB test because the linguistic task demands are simply too high, so with the methodological tools that are currently used we cannot honestly assess the 2-year-old's capabilities in this domain.

4.2.2.4 Nonverbal FB tests

In linguistic determinism not much emphasis was put on non-verbal FB assessment. If it was undertaken at all, it was usually done with the sticker test (cf. Povinelli & DeBlois 1992) that tests ignorance-understanding (the child has to decide whether to trust someone who saw the hiding process or someone who didn't) and the facial expressions tests in which the child has to assign the adequate facial expression in the last scene of a picture story. Several aspects have to be criticized.

Both nonverbal tests are no real FB tests; the sticker test is rather an ignorance test and more importantly there is no *FB* included and actually *no* belief in the strict sense at all; the test is even counter-intuitive: why would the person who did not see where the sticker was hidden have an opinion on where it is at all? And why does this person not follow the knowing person's clue himself? Especially for young children competitive behavior is not active yet which was discussed in *3.7.2*; the facial expression test is rather a test of emotion understanding (the scaling of Wellman & Liu (2004) showed that emotion is understood significantly later than FB). Also passing age expresses this: both

normally developing children and language delayed oral death children passed this test significantly later relative to scores on other FB tests (de Villiers 2000: 113).

A different attempt at nonverbal tasks came from Pyers (2005) who worked with the Nicaraguan 1st generation signers. She also used picture completion tasks but instead of focusing on facial expressions she let the child choose between two possible pictures that showed the protagonist looking in either the old (correct picture) or the new (incorrect picture) location of the hidden object an unseen displacement task. Her second nonverbal method was to expose her probands to silent videos about FB induced behavior and then let them narrate the videos. If the crucial words and linguistic constructions were not included in the narratives, the experimenter tried to elicit them with questions. It is important to emphasize that in this special case Pyers was working with teenagers and adults which changes the prerequisites for test explanation and meta-communication.

The nonverbal tests used are not fit to be equivalents to standard FB tests. If we consider the problems verbal FB tests cause we would expect for the nonverbal tests to be better and more reliable (and less distorted by external effects like language) but as results have shown so far, these tests are harder for children. First of all, as experimenters cannot use language to explain and highlight what is going on, the nonverbal tests are even more complex and take longer. This is probably because what researchers tried was to do the standard tests without verbal explanations. Instead, we would need a new way of assessing the cognitive competence of children. To do this, tests cannot be based on children's answers any more – the alternatives are:

- Spontaneous-response tasks rather than elicited response tasks e.g. observe (track) and analyze children's eye gaze. Onishi & Baillargeon (2005) have already shown how this can be done and conducted full-fledged FB tests devoid of any language, linguistic cues and linguistic answers with 15-months-olds; Garnham & Ruffman (2001) provide evidence that anticipatory looking (AL) is a robust and reliable measure of FB understanding.
- Analyze children's spontaneous behavioral and linguistic reactions – this might only be an option for older children (infants will not show facial expressions for e.g. surprise as clearly as 3-year-olds do) but still this could be an auxiliary method to see what behavior children willingly accept (e.g. looking in the old location of the object because the protagonist has a FB) and what they will protest to or be surprised and puzzled about.
- Triggering spontaneous behavior – like the study by O'Neill (1996) showed it is possible to set up contexts in which children will naturally attend to others' mental states (Children needed their parents' assistance to fetch a stuffed animal from a high shelf. Depending on whether the parent saw before which object is the relevant one and where it is children adapted their requests to the knowledge of their parent.

4.3 Conceptual Issues

4.3.1 Language and Thinking

The question if language and thinking are one and the same thing or if they are at least connected in some way has concerned scholars probably forever. In linguistic research there are famous examples of scientists trying to argue that it is language that determines our thinking; the Sapir-Whorf-hypothesis for instance claims that the categories language provides form people's thoughts and as Pinker (1995) summed it up it relies on oft-quoted factoids collected by Whorf and colleagues, like "the languages that carve the spectrum into color words at different places, the fundamentally different Hopi concept of time, the dozens of Eskimo words for snow" (Pinker 1995: 57). Pinker provides a plentiful of antidotes to being drawn into the magic of Whorf's exotic kaleidoscope of linguistic orchids. He reminds the reader that we all know the feeling of coming to a halt in the middle of writing a sentence because it does not quite express what we wanted to say; that usually we remember the gist of stories or films rather than word-by-word-summaries; that like in Orwell's horror vision of the brainwash by Newspeak politicians use euphemisms on a daily basis but that "once a euphemism is pointed out, people are not so brainwashed that they have trouble understanding the deception" (Pinker 1995: 59); in the end, that translation from one language into another would be virtually impossible if Whorf's hypothesis was correct. Apart from these pieces-of-wisdom Pinker also calls upon some hard facts. The fact that specific colors are labeled differently in different languages and therefore grouped together in different ways (just think of the spectrum between green and blue) was interpreted as proof that language determines our concept-formation. Pinker points out that for physiologists this assumption is null and void because it is not the continuous and boundary-less wavelengths that determine how we perceive colors but it is three different kinds of cones located in our eyes and that "it would seem preposterous to a physiologist that [language] could reach down into the retina and rewire the ganglion cells" (Pinker 1995: 62). Also, when tested for color prototypes and not shades of one part of the spectrum it turns out that all languages differentiate along the same boarders – fire-engine red, grass green and lemon yellow are identified equally in experiments. There are plenty of counterarguments concerning the mysterious time referencing (or lack thereof) by the Hopi, the outrageous Eskimos'-words-for-snow-myth etc. but we don't have the space here to discuss them all. In general what we will try to use from Pinker's insights for our purposes in this thesis is a) his three examples of language-less beings or reasoning and b) his argumentation for why any natural, human language "is hopelessly unsuited to serve as our internal medium of computation" (Pinker 1995: 79). But first we should consider the stance de Villiers' framework takes on linguistic determinism in the bigger picture and which implications are made for language, thinking and the human brain although de Villiers never actually

tried to contribute to the bigger picture. For some reason de Villiers insists on her framework proving a linguistic determinism but fails to integrate her findings and assumptions into a holistic linguistic and/or cognitive and/or neurological understanding. Let's see what this might look like if they did:

- Linguistic determinism claims that language comes first in (ontogenetic) development; language precedes concepts and thinking and determinatively forms them (except for some basic object-level categories, see de Villiers' stance in *3.4.2.1*)

- Thinking and reasoning do not have their own "mentalese" or "language of thought" (cf. e.g. Fodor 1975, Pinker 1995 etc.), i.e. they do not have their own representational system, which ultimately boils down to the conclusion that our thinking and brain do not possess any other representational system or means than language.

- The only relevant way in which competence in FB reasoning is expressed (and therefore proven to be acquired fully) is via conscious (and verbal) reasoning (see *4.3.1.3*).

How can we prove that language is not determining thinking? Ethical reasons make it impossible to conduct experiments that would bereave human beings of language or deprive language-less humans of language, but we can try to assess what is going on in language-less beings; Pinker discusses infants, primates and certain mental processes in human adults that cannot rely on language: 1) infants show understanding of e.g. number in experiments by Karen Wynn (more on mental understanding in infants in section *4.1.1*); 2) primates show understanding of relations like "X is sister-of Y" in an experiment Cheney & Seyfarth with vervet monkeys; when a male monkey of one group attacked the male monkey of another group, a short time later the victim's sister would approach the attacker's sister and revenge the attack; 3) in human adults there is certain relations whose processing would take longer if it was done in language. If adults have to judge if certain depictions of a letter of the alphabet (e.g. "R" and "Я") are the real thing or a mirror image, a slightly lopsided or flipped version of it, test subjects report that they mentally rotate the image to get the correct judgment; their reaction times corroborate this claim. The degree of change to the verbal description of the correct prototypical letter (for this "F" would be something like "an upright spine with one horizontal segment that extends rightwards from the top and another horizontal segment that extends rightwards from the middle") would predict certain versions of the letter to be processed faster than the others but the actual reaction times suggest a different order of difficulty.

Why is language not fit to rule thinking? In order to find out if language could be the only means of thought Pinker assumes thinking to be a processor that creeps over language only able to perform certain automated inferences, e.g. if it finds an "X", a "Y" and an "is a" in-between it would map everything that is true for "X" onto "Y". Pinker found the following problems (Pinker 1995: 78 fff):

- Language is ambiguous. Like in this headline "Drunk Gets Nine Months in Violin Case" language contains ambiguity, but the underlying thoughts are never ambiguous, they always refer to one meaning. "violin case" here is a law suit concerning a violin, not a container for it. The ambiguity lies in language, thought does not suffer from this impreciseness.

- Language lacks logical explicitness. In Pinker's example (cf. Drew McDermott) the two premises lead to conclusions that are not expressed in language:

  (34) Ralph is an elephant. Elephants live in Africa. Elephants have tusks.

  The intelligent reader knows that there is only one Africa that all elephants live in, but that each elephant has its own, discrete tusk. A Turing-like inference-making device could not deduct this from the language given above.

- Linguistic co-reference is not logically well-defined. The fact that we can call one and the same man "a tall blonde man with glasses", "the man" and "him" is possible in language only; the brain has to find a way to treat the three expressions as one and the same thing. A related problem is linguistic deixis, e.g. the indefinite determiner "a" and its definite counterpart "the" can refer to the same thing or two different entities depending on the context. The phrases "killed a policeman" and "killed the policeman" can denote the same but in the right context they refer to two different policemen. Compare (35a) and (35b):

  (35) a. "A policeman's 14-year-old son […] opened fire from his house, *killing a policeman* and wounding three people […]"

  b. "A policeman's 14-year-old son […] opened fire from his house, *killing the policeman* and wounding three people […]" (Pinker 1995: 80)

  Although the policeman in (35a) is not identified precisely it cannot refer to the teenager's father which is the exact opposite of what (35b) denotes. Pinker emphasizes that "a" and "the" don't have a particular meaning in "one's permanent mental database" (Pinker 1995: 80) and are meaningless outside of a particular context; they are "conversation-specific".

- Synonymy is not reflected in thinking. We understand that sentences like (36)

  (36) a. "Sam sprayed paint onto the wall."

  b. "The wall was sprayed with paint by Sam."

  denote one and the same state in the world, but a simple processor would not be able to find that out. Something else must represent this and it cannot be through (a variation of) (36).

Pinker concludes that even if mentalese looks a bit like a language (it probably has symbols and certain ways to arrange them) it would still be simpler in some ways and richer in others.

4.3.1.1 Representations

Representations play a major role in the discussion about ToM. Representationalists like Perner (e.g. 1991) assume that FB understanding depends on meta-representational structures while de Villiers assumes that the representations crucial for ToM are of linguistic nature and that FB understanding is the understanding of misrepresentations. Smith et al. (2003) manage to contradict de Villiers' stance and expand Perner's. They present evidence that FB reasoning in fact can be correlated with mastery of relative clauses; de Villiers argues that "complex sentences of different forms won't suffice, because each individual proposition is true (or irrealis), for example in […] relative clauses" (de Villiers & Pyers 1997: 136), i.e. relative clauses as in (37) cannot be false:

(37) The postman ran away from the dog that bit him.

But Perner et al. (2003) argue that children not only have troubles understanding misrepresentations but also non-false meta-representations (like complex desires, see *3.7.2*) which means that children actually lack the understanding for meta-representations (constructs that represent both an event and the representation of an event). Smith et al. apply this reasoning onto relative clauses and claim that they can have the same complexity and are just as difficult for children as sentential complements and FB reasoning, namely double event relative clauses as in (38):

(38) The cow bumped the horse that tickled the cat.

Hamburger and Crain (1982) claim that children have troubles with sentences like (38) because they do not grasp the relative relation but rather interpret it as a coordination like (39):

(39) The cow bumped the horse and the horse tickled the cat.

which is incorrect as the fixed chronological sequence of coordinations is not congruent with the relative interpretation. In their experiment Smith et al. used the Truth Value Judgment Test (Crain & Thornton 1998) in which children had to judge if a sentence that was read to them was congruent with a scene acted out in front of them with sentences like:

(40) The girl kicked the man that jumped over the wall.

(41) The girl kicked the man that is wearing a hat.

(42) The girl jumped on the chair and the pig chased the ball.

(40) is a double event relative clause, (41) a single event relative clause and (42) a simple conjunction, and two FB tasks were conducted. The results showed that 3-year-olds did not master FB tasks and double-event relative clauses like (40) yet, but they were very well able to interpret single event relative clauses (41) and double event conjunctions (42). Both FB and double-event

relative clauses were mainly mastered by the age of four years, and even more importantly, the scores on FB and double-event relative clauses were significantly correlated. They conclude that "FB reasoning depends on the prior acquisition of non-formal rather than formal aspects of linguistic structures" (Smith et al. 2003: 1717). With their data proving that certain relative clauses are cognitively equal to sentential complements they present evidence that contradicts linguistic determinism even stronger than the data with desire-constructions in German (Perner et al. 2003) and Mandarin and Cantonese (Tardif & Wellman 2000). They argue that the only common denominator for FB understanding, complex relative clauses and sentential complementation is of a general-cognitive nature and is probably based on a representational level.

4.3.1.2 The acquisition of concepts

To corroborate her claim that concepts cannot be formed pre-linguistically and that the ability to conceptualize A-ness versus B-ness is a process of summing up stimuli along a certain dimension (not the mere differentiation of stimuli A vs. B) which can only be done by language de Villiers (2000, see *3.4.2.1)* brought the example that readers cannot conceptualize the difference between a list of "tight fit" cases vs. a list of "loose fit" cases (a concept active in Korean) if the concept is not linguistically highlighted. The problem with de Villiers' example is that she addresses adult readers who have completed concept and language acquisition (and whose brain structurally differs from an infant's brain) so the reader behaving like she predicts does not prove her point. The only valid subjects for investigating conceptual formation and if it is dependent on language are infants. The concept of critical age in child language learning is put at stake by de Villiers' argumentation. The critical period hypothesis (Lenneberg 1967) says that language acquisition has sensitive phases that cannot be repeated or caught up with later (i.e. when the critical period for language acquisition has passed certain linguistic elements cannot be acquired natively any more). Second language acquisition is proven to take a different course than first language acquisition when it takes place after the critical period in development (literature differs as to when the critical period is definitely over, the spectrum ranges from 6 years to 13 years); the differences show neurologically, i.e. brain activity is different for first and second language acquisition in language production and processing, and they show language-internally, i.e. language is not acquired as fast, the acquisition (and probably also usage) of a second language (L2) is conscious and an L2 is comparatively deficient or at least insufficient with respect to grammaticality intuitions and nuances. This is something we cannot claim for concept formation: it seems that concepts, as shockingly new they might seem to the learner, can be understood and used productively in our thinking system without delay or limitations once we grasped what they're all about. When we learn a second language, to understand and learn the concepts this language entertains and expresses is not an insurmountable problem. In English "tight fit – loose fit" can only be expressed by a lexical circumscription for each A and each B – there is no

abstract linguistic form or regularity for this concept. Nonetheless the concept is understood when it is pointed out to an English speaking person, so to form and use a concept we do not need a linguistic form. In fact, if we decided to learn Korean we would probably make no mistakes with assigning entities to either tight or loose fit but most probably will we struggle with getting the linguistic forms right. A native English adult might have problems applying the newly acquired concepts in linguistic reality (i.e. in finding the right morphological or syntactical ways of expressing the concepts) but the concept of e.g. "tight fit – loose fit" is perfectly understood in no time. If concepts are learnt only through language and if language acquisition has sensitive phases how would it be possible to even grasp new concepts quickly, easily and without mistakes, independently of the developmental state of the learner (i.e. age)? We are very well able to think up new universes, parallel worlds etc. without words guiding us.

Pyers & Senghas (2009) reported that the first cohort of the Nicaraguan signers (remember: they started forming their language only after the age of 6, an age that is often considered the first important boarder for the critical period in language acquisition) were able to grasp the concept of FB after all because they started interacting with the (linguistically superior) second cohort more intensely between testing point one (Pyers 2005) and two (Pyers & Senghas 2009). The authors reported that the first cohort had also caught up on the linguistic side, i.e. they started using complements, too, but at the same time they do not cancel the earlier declaration that first cohort signers have an impoverished language system that expresses things holistically and graphically, lacking a certain level of system and abstractness. So even if first cohort signers started using what resembles the sentential complementation structures of the second cohort signers it is most likely that this is not the real, full-fledged, wh-movement-capable thing which is what linguistic determinism depends on so desperately but a simpler form with less (abstract) structure in it. If this assumption is correct (at this point there is no way of corroborating this statement any further due to lack of data) the ability to understand FB emerged differently in the first cohort signers. Even if we assume that first cohort signers indeed acquired a relatively full version of complementation, we know late language acquisition works differently in the brain; the assumption that two things like L1 and L2 that activate different regions of the brain, are acquired in different ways and are produced and processed differently in on-line language usage could both be the crucial and only possible trigger for one certain cognitive concept seems unlikely to say the least. Additionally, let's not forget that e.g. Apperly et al. (2006) have shown that a patient suffering from severely impaired grammar (aphasia) after his full and typical L1-acquisition was able to pass FB tests which at least shows that once ToM is in place it does not depend on language any more. Can we really expect that ToM can still develop from scratch in adults just because they learn to use a certain syntactic configuration?

Another aspect concerns de Villiers agreeing with Premack (1983) that second order categories such as "same", "different", "to the left of" etc. are based on a symbolic medium for their formation. De Villiers takes this as strong evidence that language is not only a stimulus for forming concepts but indeed the only way of enabling that. What doesn't seem to be taken into consideration is the fact that people can have (IQ-independent) problems with applying second order categories although their language acquisition was normal. A very prominent example are people with "left-right-impairment" which cannot be explained by the lack of the corresponding language because the labels and linguistic equipment for left and right are usually in place and the concept is understood in principle, an example of this effect is dyslexia. How does something like this fit into the picture?

Let's also consider cultural concepts: if you see a picture of a bunch of ancient Greeks praying to a heaven full of gods you might be able to grasp the concept of polytheism even if you had never heard of it before. It would probably help if these gods were depicted in an iconic or symbolic way but as Pinker (1995) already said mentalese will probably have or rely on symbols just like language does; this does not mean that language is the only symbolic code humans possess. As Fodor (1975) argued it is conceptually incoherent to assume that language comes first – especially so, if this is only assumed for *some* concepts and *some* linguistic expressions. If we can use (i.e. repeat) an approximate version of a new term, it is for phonetic reasons. Once we start noticing it in meaningful linguistic strings we assume that it must have a certain meaning (cf. the Gricean maxim of relevance). This is simply not enough to assume that concepts depend on language.

4.3.1.3 Implicit vs. Explicit Theory of Mind

If we talk about ToM in general it is most likely to be described as a subconscious, fast and effortless ability but as soon as the scientific focus narrows down to how children acquire ToM it seems that these characteristics are not relevant or defining for ToM any more, particularly in the field of FB reasoning research. In fact what is looked for and tested in children is a very explicit and conscious way of reasoning about mental states which is also reflected in the methods and test design for assessing this; the fact that linguistic performance demands are discussed as frequently indicates that FB reasoning is not assessed in its most natural and straightforward occurrence but in a rather mediated one. Interestingly, children are never asked about their knowledge of grammar. They acquire, use and know it but nobody would ever try and ask a child how an embedded sentence works because we would not get anything out of this, especially not data that should be utilized empirically. As it is widely agreed upon that children acquire language unconsciously (even adults are usually not able to spontaneously explain their mother tongue's grammar) even more attention should be paid to the infant acquisition pattern of ToM. Thanks to the analyses we made in sections *4.1* and *4.2* we can conclude the following:

- The standard tasks used to assess FB reasoning are highly verbal and put a heavy load on processing abilities and working memory which is why they probably test linguistic knowledge or the interface (the mapping) between language and ToM rather than ToM itself.
- Delicately designed experiments with infants have shown that there is FB understanding in children as young as 13 months who do not have any command of language yet (apart from first phonological forms).

Linguistic determinism tries to get rid of these rather serious threats by claiming that what is found in infants is some kind of implicit, rudimentary and instinctive response-pattern that might be a preliminary stage of ToM; the idea of implicit ToM is probably modeled on Karmiloff-Smith's (1992) theory that what is happening is a developmental process from implicit to explicit knowledge. She distinguishes three types of knowledge that develop through a "redescription" process: procedural knowledge that turns into implicit knowledge (a form of representation) which develops into explicit (conscious) knowledge which usually is verbal. Karmiloff-Smith, too, assumes a substantial change around the age of 4, but unlike others she does not assume that at the age of 4 children go from having no knowledge or ability to having it, she rather assumes a change in the quality or structure of this knowledge. In general it is not clear how implicit and explicit ToM differ and how – if at all – they are defined. ToM is usually defined as a way to deal with or manipulate mental states, such as represent, conceptualize and reason about them but if we want to make a distinction between an implicit (early, subconscious and/or nonverbal) ToM and an explicit (late, conscious and/or verbal) ToM we need to be more precise. How does implicit ToM work in the brain if it is indeed not representational (in contrast to a representational explicit ToM) which would mean that it only works with direct images of reality? In other words, if language implements the necessary structures for representation and embedding in the brain, how would a language-less infant be able to process anything that is more complex than a 1:1 copy of observable reality? If ToM is dependent on language structurally and representationally, implicit ToM either does not exist or has to be categorically different from explicit ToM. Both options have been proven wrong. Pinker (1995) formulated the most important arguments why language is not fit to be the only representational device of thinking (see *4.3.1*) and recent experiments with spontaneous-response tasks can put this issue to rest. The major criticism of the hypothesis that infants have a full ToM was that it is not manifest in any kind of behavior but Southgate et al.'s (2010) study proves that 17-month-olds are able to let their implicit reasoning be followed by explicit, active behavior based on that reasoning.

In section *4.2* we concluded that what is actually tested and therefore what it is that is changing at the age of 4 is not a device of ToM itself. It is rather the ability to map cognitive knowledge onto language, i.e. an interfacial ability. One reason for this claim are the prominent correlations between

performance on language and FB tasks in addition to the effects that linguistic complexity of FB tasks has on performance (see *4.2*). The second reason is that the fine-grained data we have about infant's ToM suggest that everything that is needed for FB reasoning is already there in infants, so what is missing until the age of 4 is the ability to externalize the subconscious knowledge. Indeed, we cannot deny that something is different between 3 and 4 years of age; after all we find significant differences in FB understanding tests. Given the discussion in this thesis though I do not see grounds to assume that the ToM-specific knowledge in a 15-month-old is categorically different from the one in a 4-year-old; it does not seem reasonable to assume two categorically different stages in children's ToM. I propose that the differences captured by FB tests do not tap differences in ToM.

4.3.2 Linguistic Elements – Complements, Features and Mental Verbs

4.3.2.1 Point of View-Marker

The PoV-marker is still a powerful detail in de Villiers' theory (see de Villiers & de Villiers 2009); according to her the PoV-feature is the most crucial step in the acquisition of the linguistic aspects relevant for FB reasoning as it is the semantic-syntactic difference that renders non-factive verbs (*say* and *think*) unique. In this section we will uncover why there is doubt that this marker actually exists. For one, there is no evidence that this PoV-marker is existent and active in grammar and of how it is acquired and how it fits into linguistic theory. The only indication of what happens when the PoV-feature is acquired is given in the verb acquisition path (see *3.7.1.1*) but no explicit assumptions or evidence are given. De Villiers at no point corroborates the PoV-marker with actual empirical evidence for different phases, mistakes with or overgeneralization of rules in acquisition (which are common phenomena in child language acquisition). The PoV-marker remains to be mere stipulation.

Summing up the conceptual make-up of the PoV-marker we can say that it occurs obligatorily on every CP as well as every DP. It either has to bear the PoV of the speaker of the utterance which is the unmarked case or it bears the PoV of the grammatical subject which is the case for embedded complements of non-factive verbs. Apart from that it is unclear how the PoV-feature works: why and how only speaker and subject can fill this feature while nothing else can, how this feature is "transferred" from the speaker/subject onto the subsequent CPs and DPs, which syntactic operations or relations take care of establishing the PoV etc. PoV seems to have different triggers or sources: subject-PoV is triggered by non-factive realis verbs (i.e. *say*, *think* etc.) which assign the PoV-feature to the embedded CP, all other CPs do not need to be assigned a PoV, it is the speaker-PoV by default. How is the default PoV, i.e. the speaker-PoV (cf. J. de Villiers 2005) overridden by the verb-assigned subject-PoV? If the PoV-feature is always present in all CPs and DPs, why does it only have an impact

in a very restricted and marked area and why is only one very specific verb class able to influence it? How is the relation between subject/speaker, verb and CP established? A very strange aspect of the PoV-feature is that in DPs the PoV can only be changed to subject-PoV if it is an indefinite DP; in definite DPs the PoV stays subject-PoV no matter what the embedding verb is or which PoV the containing CP has. Let's have a look at de Villiers' example:

(43) a. $_{\text{PoV-speaker CP}}$ [Peter thought $_{\text{PoV-subject CP}}$[that $_{\text{NP}}$[12][a unicorn] was dancing in $_{\text{DP}}$ [the garden]]]

b. $_{\text{PoV-speaker CP}}$[Peter thought $_{\text{PoV-subject CP}}$ [that $_{\text{POV-speaker DP}}$[the mule] was dancing in $_{\text{DP}}$[the garden]]] (J. de Villiers 2005: 212)

The context for example (43) is that Peter watches the family's mule who wears an ice cream cone on its forehead dancing in the garden which leads Peter to believe that the dancing animal in the garden is actually a unicorn (which is a FB). In (43a) the subject-PoV is assigned to the embedded CP and the DP "a unicorn" whereas in (43b) it cannot penetrate the DP "the mule". De Villiers refers to the difference between "a unicorn" and "the mule" as referential opacity and claims that her theory about PoV can explain how referential opacity arises. But all in all this reasoning seems odd:

a) The matrix verb is the same in both (43a) and (43b) and should therefore have the same effect on what comes "beneath" it; it is a PoV-assigning, non-factive realis verb, namely *think.*

b) The subject is the same in both (43a) and (43b) and we don't have reason to assume that the speakers are different in (43a) and (43b).

c) The sentences in (43a) and (43b) do not denote the same, so comparing them is not helpful

d) The DP in (43b) "the mule" is c-commanded by both the matrix verb and the containing CP

Ad c). De Villiers suggests that (43a) and(43b) are the same in contrast to "Peter thought that a mule was dancing in the garden." (J. de Villiers 2005: 212), but if we reconsider (43) it becomes obvious that in (43a) the presupposition is "an animal is dancing in the garden", i.e. Peter thinks that it is a unicorn but in reality it's a mule with a cone on his head; there is definitely a dancing animal in the garden and the FB concerns the nature of this animal. In (43b) on the other hand we are not dealing with a different configuration: depending on which constituent we stress we can render different presuppositions and subsequent FBs; for instance if we stress "the MULE" it means that Peter's false belief actually is "the mule" which in reality is something else like "aunt Berta"; if we stress "DANCING" it means that the presupposition is "the mule is currently in the garden" but Peter

[12] De Villiers refers to noun phrases with indefinite articles like as NPs and noun phrases with definite articles as DPs which is outdated as both phrases contain determiners which have to be located in D°. Therefore I will refer to both instances as DPs because the two notions do not have an impact on De Villiers' reasoning.

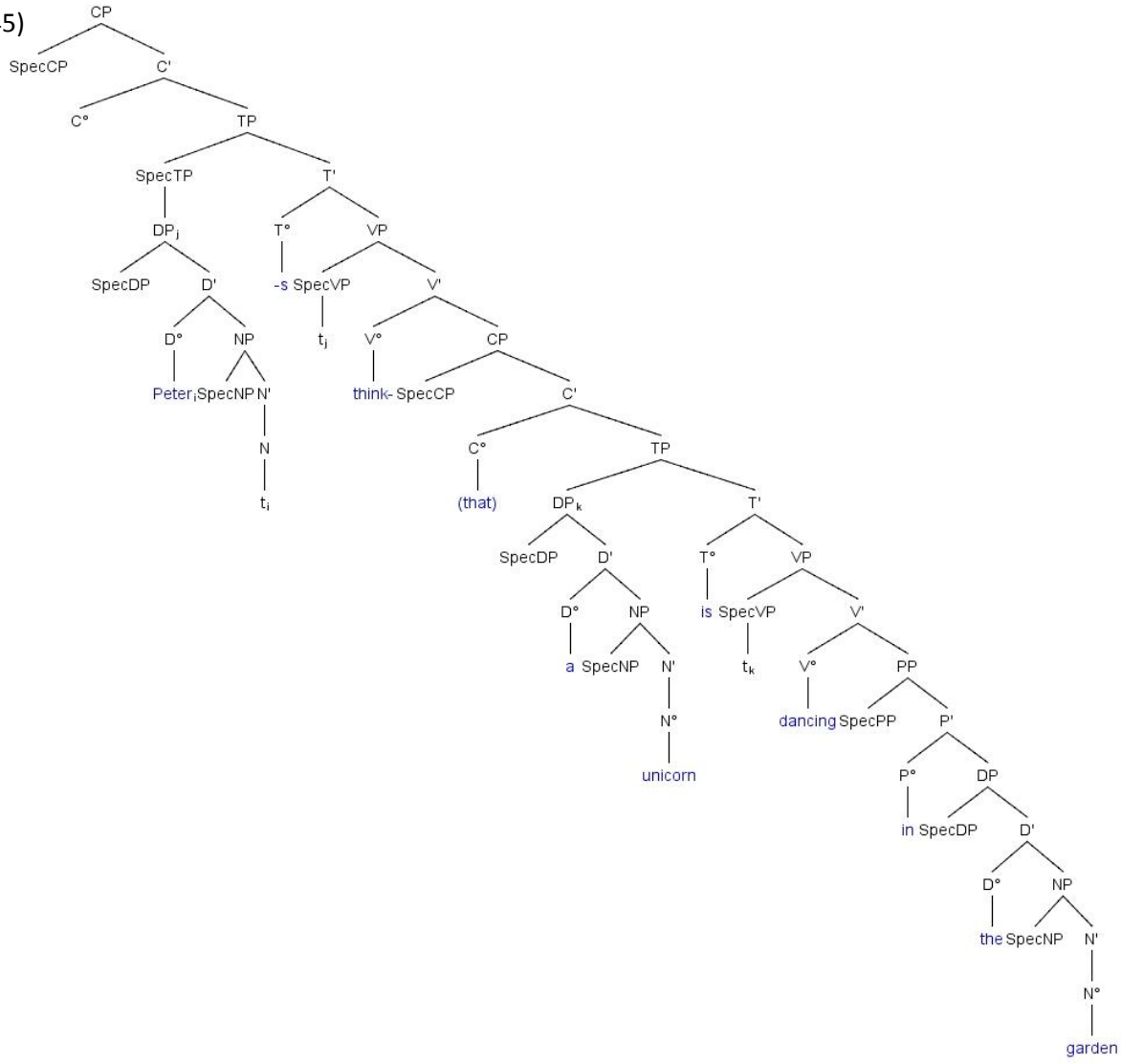
bears the FB that this mule (not a/the unicorn!) is actually dancing when in reality the mule is just trying to stand up. All in all, these two sentences might both be correct, but they are not the same.

Ad d). It is a fact that the PoV-marker is not overt in language; it is an abstract feature that has influence on other syntactic entities, i.e. it has scope over them which in syntax can be established by c-command (Reinhart 1976;1983), which is originally defined as follows:

(44) "Node A c(constituent)-commands node B if neither A nor B dominates the other and the first branching node which dominates A dominates B." (Reinhart 1976: 32)

where domination is defined as being directly above in the syntactic tree. The concept of c-command is used to describe relations and dependencies between constituents in the syntactic configuration. For our purposes the prediction is that the PoV-feature has to c-command the relevant constituents in order to establish a robust syntactic relation, for a relevant syntactic tree see (45):

(45)



In (45) we find a standard syntactic interpretation of a sentence like (43a) The subject needed for subject-PoV is "Peter" located in N° as a child node to the matrix CP. The verb assigning subject-PoV in the embedded CP is "think" located in V° in the matrix sentence. In (45) subject-PoV (i.e. Peter's PoV) would be assigned to the embedded CP as *think* is a PoV-assigning verb. Assuming that the PoV-marker indeed sits in C° we can see that the PoV-marker c-commands everything that de Villiers claims to be influenced by the PoV-feature, but also things it should not c-command: in (43b) the definite DP "the mule" should have its own PoV-feature but the higher PoV-feature sitting in CP is c-commanding the DP "the mule" just as it c-commands "a unicorn" and therefore has semantic scope over it. As c-command seems like the only reasonable way for the CP's PoV-feature to be passed on to the indefinite DP it is completely unclear why it is not passed on to a definite DP. It is already very doubtful how the verb alone can attend to its subject and project it onto the CP but if we want a definite DP to be immune to what is above it would need a barrier or some other sort of syntactic "blocking device" which it does not have. de Villiers never managed to shed any light on the relation between the definite determiner and PoV. It is especially unclear how the – as de Villiers calls it – "simple NP" which is actually a DP with an indefinite article differs syntactically from a "DP" (i.e. a DP with a definite article). The asymmetry that de Villiers is trying to call upon does not exist like that in syntax. In the bigger picture it seems weird that this feature would sit in every CP and every DP although it is not expressed overtly and does not have any other effect than rendering one special subclass of clause non-factive. It seems that linguistic determinism has to look somewhere else and apparently they don't even fight it: De Villiers & de Villiers (2009) have "nothing particularly at stake in agreeing that Point of View is fundamentally semantic and that the only kind of complements that matters is that subtype realis that capture truth in another's mind" (de Villiers & de Villiers 2009: 21) all of which does not show in syntax.

4.3.2.2 Complements

In the discussion about ToM and language researchers seem to agree on the assumption that FBs can be expressed by embedded sentential complements only. We have learned earlier that the roles ascribed to this structure differ tremendously throughout the literature: some frameworks merely see it as the scaffolding that enables talk about mental states, for others it is the crucial trigger and basis for developing ToM. Let's see which aspects are the relevant ones according to de Villiers:

i) Sentential complementation is the only way to contain meta-thoughts (i.e. propositional attitudes) about (false) beliefs linguistically

ii) All CPs (the abstract projections containing clauses like sentential complements) have a PoV-feature which by default bears a speaker-PoV but is altered to subject-PoV when the embedding verb is of a particular verb class (non-factive realis verbs like *say* and *think*)

iii) This special type of sentential complement is syntactically different from other complements even when they show accordance superficially, like e.g. complements of factive verbs like *regret*. de Villiers finds proof for that in the fact that long-distance WH-movement is only possible with non-factive verbs.

Ad i) Sentential complementation is probably the most common way to express propositional attitudes such as FBs. This does not mean though that there is no other way to express them, actually we can use several different constructions to contain what needs to be said:

(46) a. According to John the iron's plug was pulled when we left.
b. John confused the cheese with the soap *(that's why he washed his face with it).*
c. John took the mule with the ice cream cone on its head to be a unicorn.
d. Somebody switched the soap with the cheese without John knowing.
e. Somebody switched the soap with the cheese and John did not see it.
f. It is raining outside. At least John thinks that.

We can observe that the examples in (46) do not contain any full-fledged sentential complements but are perfectly apt to express what is going on taking mental states into account. They might be limited in their ability to fully substitute what sentential complements of non-factive verbs can do, but the fact that de Villiers' sentential complementation is not so unique after all already weakens her point drastically. In (46) f. pragmatics is used to express what sentential embedding does. Even though it contains syntactic relations (demonstrative "that" referring to the first sentence) this is not sentential embedding and there is no PoV-feature. Last but not least, to claim that all languages have sentential complementation with the same power and complexity as in English is a daring claim; but even cross-linguistic surveys will probably not change that the claim under i) does not hold water.

Ad ii) We have already discussed in *4.3.2.1* why the PoV-feature is questionable.

Ad iii) The most important property of sentential complementation for de Villiers and her colleagues is that "verbs of mental state and communication are unique in the complements they take" (de Villiers 2007: 1868). At first sight de Villiers is attempting a description of the syntactic behavior of mental verbs but actually the claimed uniqueness somehow refers to two syntactic domains at the same time and in both cases it is not entirely true. The first domain is syntactic behavior of mental verbs. The claim is that verbs like *think* and *say* need sentential complementation for their syntax but this does not hold water. Simplex syntactic configurations with mental verbs might be comparatively rare but it is not hard to come up with examples. Although things like "I think blue" or "I'm thinking leather couch" are elliptic in some way or another they are perfectly grammatical sentences without the need to implement complementation syntax. With the mental verb *believe* it even gets easier to find examples that can do without sentential complementation:

(47) a. Wir glaubten *ihn tot*. (German)
we thought.1stPerson.PL him.ACC dead = we thought that he was dead
b. John believes *him to be innocent*.

These examples are not syntactically simplex; generally constructions like (47) are considered to be a case of ECM (exceptional case marking): the constituent in italics contains a semantic subject (agent theta-role) that cannot receive case from its verb because either there is no verb as in (47a) or the verb is infinite as in (47b), so the case is "exceptionally" assigned by the higher matrix verb/sentence. What is crucial for us here is that the constituents in italics do not constitute full-fledged syntactic complements. Let's see which consequences this has:

a) Sentences like this don't embed CPs: In sentence (47a) we don't even have a verb in the embedded part, this is known as a "small clause"-construction in syntactic theory (a subset of ECM-constructions) and the embedded constituent (the one in italics) is usually an Adjective or Adverb Phrase, a Noun Phrase etc. depending on the head of the argument.

b) The embedded arguments don't meet de Villiers' syntactic demands for complements. Example (47b) is assumed to not be a full CP with sentential value, and even more crucially it lacks what was singled out as a defining element of complements: it lacks finiteness and is therefore on the same level as the complements desire verbs take (sic!). This crushes de Villiers' theory because the difference between *want* and *think* according to her are syntactic markers like finiteness (in other languages modality, conditional etc.) and the PoV-marker.

c) The PoV-marker does not have a site any more. Both (47a) and (47b) are clear-cut cases of sentences expressing individual mental states that can potentially be wrong just like any *think*-sentence with an embedded complement. We stated in a) that these sentences though lack what a CP. This is the final straw for de Villiers' framework because the CP is where the PoV-marker is located. Thus, the sentences in (47) are not allowed to have independent PoV or truth values. But somehow, miraculously, these sentences nevertheless manage to contain propositions that belong to another possible world or mind than the speaker's.

The second domain where de Villiers is wrong is when it comes to sentential complements of other verbs that are not part of the non-factive realis-verb-class (e.g. *regret*, *forget*). De Villiers claims that – though superficially concordant – the complement of *think* and the complement of *regret* are different on a syntactic level (see *3.7.1.1*), de Villiers used the following examples:

(22) a. She **forgot** *that he arrived late.*
b. She **thought** *that he arrived late.*

De Villiers claims that as soon as syntactic operations are taken into account the picture changes:

(23) a. * When$_i$ did she **forget** *that he arrived* t_i?

b. When$_i$ did she **think** *that he arrived* t_i? (J. de Villiers 2005: 194)

De Villiers thinks that the sentences in (22) only look the same in their S-structure (surface structure) but are different in reality (i.e. in their D-structure, the deep structure or the in-situ configuration). But this stipulation is problematic. Indeed, the difference in (23a) and is linguistic reality but the inferences de Villiers is drawing are highly doubtful and most probably wrong. First of all, she does not state what the *syntactic* difference between the complement with *think* and with *forget* actually is. She shows that different combinations and operations are possible with the two, but this does not render the examples in (22) to have two different kinds of complements or CPs. Restrictions on factive verbs like *forget* exemplified in (23) are purely semantic restrictions that lead back to the concepts of the according verbs. If what de Villiers says were true this would mean that *think* or *say* and *regret* can never be conjoined; if they feature different syntactic structures they cannot be syntactically merged. But the superficial accordance that de Villiers suggests is not so superficial; take into consideration an example like (48):

(48) John said and Harry regretted that Mary came.

Now, it is clear that these examples can only be grammatical if the proposition about Mary is true (i.e. that she actually came); if the proposition is false, these sentences crush. The point I make here is that if it is the syntax that is different for *think* and *regret*, also the sentence in (48) should be ungrammatical, but it is not. If we add a context to (48) like "but actually she didn't show up because she was ill" the sentences are not acceptable any more. But why is that? Is de Villiers really trying to make us believe that the syntax of (48) suddenly changes because of a pragmatics (!) change of scene? This seems absurd because if these complements are indeed different in their syntax we expect this coordination to be bad irrespective of presuppositions, context and pragmatics. (NB: furthermore, the sentence under (48) will have a PoV-feature clash because *say* requires subject-PoV and *regret* requires speaker-PoV).

Summing up we can say that the major assumptions about complements that carry de Villiers' framework of linguistic determinism are highly doubtful if not wrong. In *chapter 5* I will give a compact overview over the arguments discussed in this chapter and will conclude what these arguments can lead us to believe about linguistic determinism.

5 Conclusion

5.1 Summary

This thesis served the two aims to both give an exhaustive overview of the starting point, development and status quo of linguistic determinism and an in-depth analysis and criticism of the framework. After establishing general features of ToM in *chapter 2*, *chapter 3* introduced the main ideas of linguistic determinism (especially concentrating on Jill de Villiers' work); a chronological progression in describing the framework allowed for presenting the starting point of linguistic determinism and the reasons why and how arguments came forward and were developed or changed. On the one hand empirical findings led to new research questions and studies, for instance the methodological change from longitudinal studies to cross-sectional studies or the focus on deviant populations (e.g. deaf populations), and on the other hand criticism from different directions triggered new challenges and reformulations of the basic principles that linguistic determinism foots upon. In section *3.5* we saw different empirical approaches to proving one and the same claim: that language matters essentially for developing FB reasoning and ToM. This chapter also included criticism and counter-arguments of linguistic determinism that actually were heard and reacted to by the scholars in favor of linguistic determinism. The second and main aim of this thesis was to analyze and criticize this linguistic determinism in several dimensions. Data-related, methodological and theoretical problems were discussed separately with using both existing literature that was not taken into account by linguistic determinism and new observations and arguments that potentially pose a threat to the framework.

5.2 Conclusion

Considering the arguments, data and theoretical discussions that were laid out in this thesis I conclude that linguistic determinism in its present form is a seriously flawed hypothesis and potentially wrong and heading for a dead end..

Linguistic determinism relies heavily on data and empirical observations. The theory's strongest case is data from deaf populations with delayed language acquisition: it seems that both FB tests and complementation tests are mastered years later than by normally developing children and the scores on FB and language tests still correlate. Preliminary data on language and ToM in adults in de Villiers & de Villiers (2009) suggested that language and ToM cannot be processed simultaneously which the authors took to be further proof that language and ToM are causally related. I claim though that eventually both these empirical correlations can be explained by e.g. a third, linking capability that both ToM and language rely on. An alternative explanation of the findings with deaf children will be necessary because although every discipline examining children's development struggles with interpreting data from infants and toddlers and extracting the kind of information that is meaningful to theoretical considerations the latest data from spontaneous-response tasks show that infants already have a complex understanding of belief and FB which poses the greatest threat on linguistic determinism: the complex language that is claimed to be the unconditional precursor to FB understanding is indeed developed and mastered only years after these instances of FB reasoning can be found (see *4.1.1*). Furthermore data from children with SLI contradict what linguistic determinism propagates to be universally true and unconditional (see *4.1.2*).

Taking an even closer look and examining the methodology of obtaining and assessing children's ToM and language abilities we found that there are a lot of inaccuracies in the design of tests and experiments especially on a linguistic level. Even the slightest changes on the surface in e.g. test questions of FB tasks can have major impacts on the scores of preschoolers and the discussion in *4.2* made clear that tests that rely heavily on linguistic competence or are otherwise highly complex, long and/or complicated and straining on e.g. working memory will be failed by infants and young children. Considering that the basic assumption that is to be tested in linguistic determinism is how much the "pure" ability to understand FB is correlated and relies on language, this is not only a dangerous entanglement, experimenting with different experiment designs and situations and manipulating test questions etc. led to the insight that performance demands actually have a significant impact on test scores. This suggests that the correlations found between FB and complementation syntax only show the relationship between performance demands and FB

understanding and not the actual linguistic ability in question. When it comes to language testing the one major task used for syntax assessing (complement comprehension task) turned out to include highly mental contents and story lines and must be excluded as a proper method to assess "complementation only". The analysis of the experimental methods strongly suggests that the tests and experiments widely used amongst linguistic determinists should be reviewed and adapted accordingly. We have to keep in mind that we are not trying to find out who scores best at the tests we design; we try to design tests that assess the processes in our brain best and most directly.

Theoretically, linguistic determinism already lost consistency and strength in the course of time: taking into account Perner's and other critics' work de Villiers had to rephrase her argumentation and resort to non-structural elements of syntax and non-syntactic elements of language (e.g. semantics) more and more; the PoV-feature as such is already a semantic feature that is filled with pragmatic contents, with the verb acquisition path and the considerations concerning the difference between *want* and *think* de Villiers is already right in the middle of semantic reasoning etc. Even if the acquisition of such concepts and features is facilitated by syntactic and linguistic cues such as syntactic bootstrapping (see J. de Villiers 2005) these syntactic aspects cannot be argued for being the central aspect in ToM developing processes. The syntactic configuration is in fact not the one feature that singles out the linguistic constructions for false belief reasoning, it is the semantics of the verb – in de Villiers' theory it is what the verb fills the PoV-feature with. Apart from the arguments speaking against its existence (see *4.3.2.1*) the PoV-feature is blind; a container to be filled with semantic contents by something else, namely the verb. It is not a syntactic configuration that singles out non-factive verbs, it is the semantics of the verbs themselves. Furthermore, in *4.3.2.2* we established that de Villiers was not able to show how the syntax of "I think that…" is different from the syntax of "I regret that…" or even "Ich will, dass…" (German "I want that…") and I claim that this is because it isn't different. The difference between these syntactic configurations lies in semantics and the conceptual basis and the viable and realistic options these leave for syntax. Even more strikingly we found that there are syntactic configurations capable of expressing propositional attitudes (constructions with mental verbs) that do not include any kind of syntactic embedding but are completely different syntactic structures. Finally, I want to refer back to Pinker (1995) once more (see *4.3.1*) who shows that expressing and representing are two categorically different things and language cannot achieve what mental representations need to achieve. Language is not explicit enough, it is imprecise and uses mechanisms that do not suffice to properly contain what humans' minds are proven to be capable of.

5.3 Outlook

Considering the conclusion drawn in *5.2* I do not see a future for linguistic determinism in its present form. The causal relationship between language and ToM has been contradicted for both directions (see Schmitt 2006 for contradicting the claim that ToM determines language and *chapter 4* for contradicting that language determines ToM). On a different note of course it is worthwhile to proceed investigating the semantic and conceptual intricacies of ToM and its translation into linguistic terms and systems. After all, as we have observed in *2.3*, there are surprisingly many analogies between language and ToM with regards to complexity and temporal, structural and thematic aspects. The relationship between thought and language, the friction it causes in everyday life and in science, will always be of interest for researchers because it is highly relevant to find out how thinking works and how humans handle and express their thoughts and translate them into language. One interesting point for future research can for instance be found in the claim made in *4.3.2.2* that sentences like (48)

(48) John said and Harry regretted that Mary came.

are actually grammatical, contradicting de Villiers' claim that the syntax of non-factive verbs like *say* and factive verbs like *regret* are categorically different: this is only a preliminary hypothesis that needs further testing and theoretical consideration.

An open issue in the linguistic determinism discussion is the evidence that was collected in studies with deaf populations with language delays (de Villiers & de Villiers 2000; Pyers 2005; P. de Villiers 2005; Schick et al. 2007 etc.) that all reported a robust and significant delay in both language acquisition and FB reasoning and furthermore again showed correlations between the two measures. In 5.2 I suggested that this might be an indicator for a third factor that influences both cognitive entities; whatever it is that causes this deviation it should be investigated further. In future research concerning this issue it would be most important to take the criticism passed in this thesis into account and optimize methods and theoretical background.

Regardless of what happens to linguistic determinism and the related claims the intricacies that lie in mental language and its semantics and underlying concepts, the linking between the concepts and the language and the friction between mental representations and contents and the way they are expressed will always pose a major challenge to science.

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Appendix

Curriculum Vitae

Name	Susanne Höfler
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Education

2004 – 2011	MA in Theoretical Linguistics, University of Vienna
07/2007	Eastern European Generative Grammar Summer School (EGG), Brno (CZ)
07/2006	Eastern European Generative Grammar Summer School (EGG), Olomouc (CZ)
2003 – 2004	MA in German Studies; University of Vienna (discontinued)
06/2003	Graduation with honors at the vocational secondary school for preschool pedagogy, Amstetten, Austria
1998 – 2003	Vocational secondary school for preschool pedagogy, Amstetten, Austria
1990 – 1998	Primary and secondary school, Seitenstetten, Austria

Scholarships/Grants

2009	Abroad Research Grant (KWA), University of Vienna
2009	Abroad Research Grant, Siegfried-Ludwig-Fonds, Lower Austria
2009	Performance scholarship, Windhag foundation, Lower Austria
2004/5/7/8	Grant from the General Grant Foundation, Lower Austria

Study-specific occupations and activities

2009 – 2011	Computer linguist at Voice Business GmbH in Vienna
02 – 03/2009	Abroad research stay in the course of the MA thesis with Dr. Bart Hollebrandse at the Rijksuniversiteit Groningen (NL)
09 – 12/2008	Research assistant at the Viennese Sociolect and Dialect Synthesis Project at the OFAI (Austrian Institute for artificial intelligence) in collaboration with the FTW (Forschungszentrum Telekommunikation Wien), Vienna
02/2008	Co-organizer at the 13th International Morphology Meeting (IMM13), Vienna
07 – 12/2005	Research assistant at the Vienna Yukuben Project, University of Vienna, under the direction of Ao.Univ.-Prof.Dr. John Rennison

Abstract (in German)

In der Theory of Mind-Forschung der letzten 20 Jahre prägten Jill de Villiers und Kollegen den Begriff des "sprachlichen Determinismus" (linguistic determinism) für ihre Hypothese, dass die Fähigkeit zum Verständnis von sogenannten "falschen Überzeugungen" (false beliefs) kausal vom erfolgreichen Erwerb und vom aktiven Beherrschen einer gewissen syntaktischen Struktur abhängt und bedingt wird: der eingebetteten Komplementsatzstruktur. Diese Hypothese basiert vor allem auf empirischen Daten von Studien mit Kleinkindern und Kindern im Vorschulalter und im weiteren Studien mit sprachverzögerten tauben Testpersonen, Trainingsstudien u.v.m., in denen statistisch und temporal signifikante Korrelationen zwischen dem Meistern von Komplementsatzstrukturen und Tests mit falschen Überzeugungen nachgewiesen werden konnten. Seit einiger Zeit erfährt diese Hypothese des sprachlichen Determinismus auch Kritik und muss mit Gegenevidenz umgehen, doch nur wenige Aspekte der Kritik und problematischen Gegenentwürfe werden tatsächlich von den Vertretern des sprachlichen Determinismus aufgegriffen und innerhalb der Theorie behandelt.

In dieser Arbeit wurden zwei Aspekte erfüllt: zum einen bietet sie einen ausführlichen und erschöpfenden Überblick über die Theorie des sprachlichen Determinismus, seinen Anfängen, der Evidenz, die zur Argumentation herangezogen wird und der Entwicklung über die mehr als 15 Jahre seines Bestehens. Das Hauptaugenmerk dieser Arbeit lag allerdings auf dem Bemühen, den sprachlichen Determinismus erstmals auch von einer linguistisch-theoretischen Seite sorgfältig zu durchleuchten, die losen Enden der mannigfaltigen Kritik zusammenzufassen und eine umfassende Analyse der kritischen Punkte und problematischen Evidenz zu liefern und auf neue Einsichten vor allem auf der Ebene der linguistischen Argumentation und Beweisführung erstmals hinzuweisen.

Die Kritik am sprachlichen Determinismus setzt hierbei an drei Hauptpunkten an: an der dem sprachlichen Determinismus widersprechenden Evidenz, die sich in verschiedenen Studien und Abhandlungen der letzten 10 Jahre finden lässt, am Experimentdesign sowohl von Testaufgaben im Bereich der falschen Überzeugungen als auch von Testaufgaben, die die Kompetenz in Komplementsyntax messen sollen und letztlich an den linguistischen Annahmen und Grundlagen, die der sprachliche Determinismus annimmt und behauptet.

Die Analyse zeigte in allen drei Punkten, dass der sprachliche Determinismus in der bisherigen Form eine nicht haltbare Hypothese darstellt: Das Verständnis für falsche Überzeugungen ist erwiesenermaßen bereits in Säuglingen vorhanden und kann auch von Kindern mit SSES (sprachspezifische Entwicklungsstörung) trotz syntaktischen Unzulänglichkeiten erlangt werden. Die hohen linguistischen Anforderungen von Testaufgaben für falsche Überzeugungen und der hohe

mentale Gehalt von Testaufgaben für syntaktische Kompetenz verfälschen die Ergebnisse und bewirken die "stabilen" Korrelationen zwischen den beiden Kompetenzen, auf denen die Theorie des sprachlichen Determinismus fußt. Schließlich werden theoretische Grundpfeiler der Theorie ebenfalls enthebelt: der "Perspektivenmarker" (point of view marker), den de Villiers als entscheidendes Element der Komplementationssyntax angibt, ist an sich ein fragwürdiges und in linguistischer Theorie nicht haltbares Konzept; die Behauptung, dass falsche Überzeugungen ausschließlich in syntaktischen Konfigurationen mit eingebetteten Komplementsätzen ausgedrückt werden können, wurde als falsch identifiziert und die Folgen, die diese Feststellung mit sich bringt, bedeuten auch das theoretische "Aus" für den sprachlichen Determinismus. Es bleiben vor allem die Testergebnisse mit tauben Testpersonen, die es noch zu erklären und näher zu erforschen gilt, da diese eine besonders robuste Korrelation aufwiesen.