

Stefanie Röhrig

# The Acquisition of Scalar Implicatures

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Seminar für Englische Philologie



Stefanie Röhrig

The Acquisition of Scalar Implicatures

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# Vorwort

„The Acquisition of Scalar Implicatures“ von Stefanie Röhrig.

Wie schnell entwickeln sich die pragmatischen Fähigkeiten von Kindern? Wohl jeder kennt Telefonate des folgenden Typs: „Hallo, Bubi, ist deine Mama zuhause?“ — „... ja ...“ — „Kann sie denn ans Telefon kommen?“ — „... ja ...“ — „ja, dann HOL sie doch mal ans Telefon!“ - (Bubi rennt los). Man hat das Gefühl, dass Kinder in einem gewissen Alter zwar richtig sprechen, aber die kommunikativen Intentionen des Gegenüber noch nicht richtig einschätzen können. In der Spracherwerbsforschung wird speziell untersucht, wie sich die Fähigkeit, skalare Implikaturen zu verstehen, entwickelt. Konkret wird die Verwendung von *oder* (inklusive/exklusiv), Quantoren und Modalverben bei Kindern und bei Erwachsenen verglichen (Noveck, Chierchia). Nach der gängigen Lehrmeinung sind Kinder bis zum Alter von etwa 6-7 Jahren nicht in der Lage, Implikaturen als zusätzliche Informationsanteile einer Äußerung abzuleiten („*Why children are more logical than adults*“). Frau Röhrig nimmt die Erwerbsstudien zu Modalverben als Ausgangspunkt ihrer eigenen Arbeit.

Der ursprüngliche Plan der Arbeit war, Novecks Erwerbsstudie zu den Modalverben *es kann sein, es muss sein, daß ...* in drei Alterskohorten (etwa um 5, um 7 und um 9 Jahre) zu replizieren, um nachzuvollziehen, ob auch deutsche Kinder die in der Literatur dokumentierten Erwerbsstadien durchlaufen. Frau Röhrigs Auswertung der Ergebnisse ihrer Studie zeigte sich jedoch als detaillierter als die ihrer Vorgänger – nicht zuletzt wohl, weil sie das Privileg, aber auch die Riesenaufgabe hatte, die Experimente mit den Kindern selber durchzuführen, und damit ihrem Untersuchungsgegenstand vermutlich näher war als ihre Vorgänger. Dabei gelingt der Autorin die zentrale Beobachtung ihrer Arbeit: Kinder generieren bereits in einem sehr frühen Alter gewisse Implikaturen, nämlich Exhaustivitätsimplikaturen. Es handelt sich typischerweise um Anreicherungen des wörtlichen Inhalts nach dem Beispiel „Auf dem Bild ist ein Frosch“ (= Äußerung) => ‚es ist *nur* ein Frosch auf dem Bild‘ (= gemeinter Inhalt). Diese Implikatur, die auch mit den Kommentaren der untersuchten Kinder belegt werden kann, führt zu einer Neubewertung des kindlichen Sprachverhaltens auf der Basis der „Kinderimplikaturen“ (Röhrig). Dieses Erkenntnis ist dazu angetan, die gesamte Erwerbsforschung im Bereich der Implikaturen zu revolutionieren, denn im Gegensatz zu allen Behauptungen in der Literatur scheinen Kinder gewisse Implikaturen bereits *sehr früh* abzuleiten, wodurch andere Implikaturen (exhaustives *oder*) verdeckt werden, oder nicht mehr in Frage kommen. Kinder sind also vermutlich keineswegs „*more logical*“ als Erwachsene, sie gewichten pragmatische Schlüsse nur anders. Es wird in Zukunft zu untersuchen sein, wie die Gewichtungen sich mit der wachsenden kommunikativen Kompetenz der Kinder entwickeln.

Insgesamt ist die Arbeit eine sehr engagierte empirische Studie zum Spracherwerb, die die Autorin mit großem Enthusiasmus gemeistert hat. Es freut mich sehr, dass die vorliegende Publikation Frau Röhrigs „child implicatures“ (= Kinderimplikaturen) ein größeres Publikum erschließt.

Regine Eckardt, Göttingen 2009



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# Chapter 1

## Introduction

A current debate in pragmatics is whether the computation of scalar implicatures is innate or acquired, how scalar implicatures function and from which age onwards children are able to calculate scalar implicatures.

It is the aim of this paper to try to explain the acquisition of scalar implicatures and to get empirical evidence which supports one of the hypotheses on the acquisition of scalar implicatures, which are currently discussed by researchers.

Before describing the structure of this paper in more detail, I want to give a short explanation of the terms *implicature* and *scalar implicature*. An implicature is additional and implicit information beyond the meaning of the utterance that is explicitly said. Some words – such as *certainly*, *probably* and *possibly* – can be arranged on a scale ordered by their meaning. They are therefore called scalar terms. Scalar implicatures, which are the topic of this assignment, are connected with this kind of scalar terms and imply that the respective stronger expression on the scale, which includes the meaning of the weaker term, does not hold in the cases where the weaker term is uttered and the other way round.

In the first half of chapter 2 the stages which children go through during the acquisition of language and pragmatics are described. The three important stages in the acquisition of pragmatics are the Sensorimotor Period, the Preoperational Period and the Concrete Operational Period. Children's developments in these stages are also related to important social and cognitive developments of that age-groups. For example, three- and four-year-old children act according to the cooperative principle by providing background information which they know are unfamiliar to the hearer (Foster, 1990). Moreover, it seems that some of the pragmatic uses of language rely on innate mechanisms. Children's development in these stages are important as background information for hypotheses about the acquisition of pragmatics, which will be introduced and discussed later.

The second half of chapter 2 deals with pragmatic principles and theories which are important to understand how the calculation of implicatures work. The most common approach to implicatures are Grice's Conversational Maxims and the Cooperative Principle. Grice's Theory of Implicature has been improved and developed further by Neo-Gricean linguists. A more modern version of Grice's Conversational Maxims are Stephen Levinson's heuristic principles and Horn's attempt to replace Grice's maxims by only two principles, the Q- and the R-Principle. Other linguists

such as Wilson & Sperber (1977) suggest that a single communicative principle, the Principle of Relevance, which is based on the supposition of optimal relevance, can replace Grice's Conversational Maxims.

The first half of chapter 3 introduces several empirical studies and deals mainly with children's understanding and interpretation of scalar terms. The focus of the subchapter *Children's Interpretation of Scalar Terms* are the modals *must* and *might* and the logical connective *or*. Moreover, differences in the interpretation of scalar terms between children and adults will be shown. A study by Noveck (2001) found that children use the semantic interpretation of the modal *might* more often than adults. Empirical evidence from several researchers suggests that children tend to interpret the disjunction *or* as conjunction more often than adults, even in situations where it would be more adequate to apply to the disjunctive interpretation of *or*. Since both scalar terms, the modal *might* as well as the disjunction *or*, occur in the conceptual formulation of Noveck's experiment, I will discuss his experiment in more detail in chapter 3.1.3.

Before I introduce, explain and evaluate the experiment I conducted on the acquisition of scalar implicatures in chapter 4, I will introduce several hypotheses such as the Processing Limitation Hypothesis and the Pragmatic Delay Hypothesis, which try to explain why children compute scalar implicatures less often than adults, in the second half of chapter 3.

Chapter 4 comprises the planning, conduction and discussion of my German replication of the first experiment of Noveck's study (2001). This experiment will be conducted to see whether Noveck's findings on scalar implicatures are also valid for German speakers. However, I will do some modifications to Noveck's study. I will not use the expression *or* in the task of my experiment because I consider it as problematic to use two scalar terms (a modal verb and *or*), which are known to be interpreted differently by children and adults, in an experiment which focuses on scalar implicatures. Additionally, I will add another even more underinformative test sentence to see whether this statement has an impact on the amount of computed scalar implicatures. To see whether young children's bad reasoning results in Noveck's study are caused by an inclusive interpretation of *or*, I will use an act-out task in the warming-up-session, to see how children interpret *or* in the context of the experiment. Moreover, I want to see if children have knowledge of or even apply to the conversational principles and from which age onwards children are able to calculate scalar implicatures.

On the basis of my results and findings from other researchers, the hypotheses on the acquisition of scalar implicatures, which have been introduced in the second half of chapter 3, will be discussed in chapter 5 to see if there is evidence for the innateness or acquisition of pragmatics and scalar implicatures.

## Chapter 2

# Theory of language acquisition and Universal Pragmatics

### 2.1 Theory of language acquisition

#### 2.1.1 Pragmatics and the Innateness Hypothesis

Pragmatics is a field of linguistics which is concerned with the language used to interact with others. Apart from the context of an utterance, general principles such as the conversational principles and the intention of the speaker have influence on both, the formulation of the speaker's utterance and the hearer's interpretation of the statement. Examples for typical fields of pragmatic research are speech acts, presuppositions and implicatures. Bates (1976) considers the study of pragmatics in child-language to be very important because it "occupies the interface between linguistic, cognitive and social development" and enables researcher to investigate children's "developing mental processes".

Current linguistic theories assume that some of the linguistic knowledge is innate (also known as Universal Grammar) because children produce and understand statements with features, which cannot be learned from listening to and the imitation of the language which is spoken to them. According to this theory humans possess a Language Acquisition Device (LAD) which has parameters that are dependent on the linguistic input information. The linguistic input is often referred to as Primary Linguistic Data (PLD). With the help of the LAD children and language learners analyse the statements they are exposed to by parents, siblings or other people and set the parameters of the LAD. Foster (1990) is of the opinion that the linguistic input is segmented before it triggers the setting of the parameters. Depending on the PLD the parameter settings may vary in every language. Due to the presence of the LAD and its parameters children are able to learn all human languages they are exposed to (Foster-Cohen, 1999). Crain & Lillo-Martin (1999) suggest that children formulate many different grammars and modify them by setting more and more parameters of the LAD until they finally reach the target grammar, when all of the parameters have been set successfully. Foster (1990) suggests that children also possess innate strategies which are responsible for the analysis of the input and work on the grammar set by the LAD in order to "produce the rest of the rules

of communicative competence – *peripheral grammar*, as well as the *pragmatic* rules for language use”. According to Foster children have reached adult communicative competence when all parameters of the LAD are set and the innate strategies do not produce new generalisations and rules anymore.<sup>1</sup> Foster–Cohen (1999) points out that the LAD seems to be working up to purity. Languages that are acquired afterwards cannot reach the level of native speakers anymore. The author suggests that this critical period only applies to the acquisition of grammar and that pragmatic skills can still be developed.

Crain & Khlentzos (2008) argue that there is not only an LAD for the acquisition of linguistic competence but also a similar device for the acquisition of logic competence, which they call “innate Logic Faculty”. In the following the stages which children go through during the acquisition of language and pragmatics are sketched as background-information for hypotheses about the acquisition of pragmatics, which will be introduced later on.

### 2.1.2 Stages in the acquisition of pragmatics

Bates (1976) describes in her work that children go through three stages when acquiring pragmatics before their linguistic behaviour reaches the same level of linguistic competence as the one of adults. Furthermore, she assumes that although very young children may sometimes fail to communicate their intention or idea successfully, they still mean it. This is because children’s knowledge of a language (competence) often differs from their actual performance. In this case adults have to help to make the communication successful by inferring what the child wanted to say.

The three stages of pragmatic acquisition are the Sensorimotor Period, which applies to 18 month-old babies; the Preoperational Period, which describes the pragmatic competence between the age of 18 months and 4 years and the Concrete Operational Period, which refers to four- to six-year-old children. Children’s developments in these stages are also related to important social and cognitive developments of that age-groups.

#### *The Sensorimotor Period*

The beginning of the Sensorimotor Period, when children show their intention to communicate, is by many researchers also referred to as prelinguistic stage. This is because in this stage babies have not acquired language yet but show by the age of three months signs of reciprocal behaviour in communicative exchanges such as responses and initiations by crying and the use of gestures or facial expressions (Barret, 1999). Bates (1976) interprets this as an indicator that children are trying to convey an illocutionary process but are not able to construct locutionary processes. However, Mc Tear (1985) points out that the reciprocal signs should be considered as non-communicative until the child is roughly nine months old because the interaction, which is also known as proto-conversation, cannot be described as conversation since the baby has not developed language yet. At the end of the sensorimotor period, roughly at the age of 18 months, children show meta-linguistic behaviour by

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<sup>1</sup>see Appendix D.1: Foster’s model of communicative competence development

being able to correct their own utterances Foster–Cohen (1999). This shows that at this young age children, who actually just started to produce two-word utterances, already possess pragmatic skills.

### *The Preoperational Period*

According to Bates (1976) children in the Preoperational Period (18 months to 4 years) are already able to think and talk about their pragmatic behaviour by uttering metapragmatic statements. Furthermore, the author states that the communication of children in the Preoperational Stage already contains performatives and references to place, time, speaker and hearer. De Villiers & de Villiers (1979) refer to a study conducted with two- to four-years-old children which examined the appropriateness of children's responses to queries. The authors found that except the two-year-olds the rest of the age-groups of the Preoperational Period answered the queries adequately and proved to possess complex conversational skills. Mc Tear (1985) cites a study which found that two-year-olds generally answer questions even if their answer is inappropriate. The author concludes that children seem to follow the rule: "If there is a question, give an answer, even if you don't understand it". (ibid.)

At the earliest stage of the Preoperational Period children can not only clarify statements when asked to do so but are also able to use interrogatives to ask for attention and for declarations (ibid.). These early requests of 1;6 to two-year-old children are one- or two-word utterances such as *more*, *want* or *gimme* combined with gestures, names or objects. Roughly at the age of 2;6 to 3;0 children's formulation of requests gets more complex and more polite (Mc Tear, 1985; Bates, 1976). While the youngest children in the Preoperational Period talk about the present most of the time, they start to talk about the past and objects that are not present currently from the age of two onwards because of the development of their memory (de Villiers & de Villiers, 1979). Concerning metapragmatic utterances two-year-olds are able to correct their own syntax and vocabulary on a rudimentary level or by talking about speech acts such as *Peter said XY* (Bates, 1976; Foster–Cohen, 1999).

An aspect of children's language and pragmatic development roughly in the middle of the Preoperational Period is that the first modal verbs appear in child-language at the age of 2;6. But only from the age of 3;3 onwards modals are used more frequently to express possibility (Heinzmann, 2006). According to this study, the epistemic use of modal verbs is still rare in the natural language of three- to four-year-old children. As Foster (1990) states children start to use conjunctions in the second half of the third year. According to the author the conjunctions are acquired in the following order: *and*, *because*, *so*, *if*, *when*, *or*, *but*, *while*, *before*, *after*.

Heinzmann (2006) predicts that children in the Preoperational Period have problems to understand indirect statements because they do not have knowledge about words which can trigger implicatures yet. Therefore, children are expected to learn that statements sometimes do not literally mean what they express. However, there are empirical findings which contrast to this prediction. De Villiers & de Villiers (1979) cite Shatz (1974) and report that according to empirical findings two- to four-year-old children can understand indirect requests uttered by their mothers.

Close to the end of the Preoperational Stage children are able to give indirect commands, use inflectional verb forms, formal pronouns and the imperfect tense. Their pragmatic skills include implied threats and promises. However, both of the children observed by Bates (1976) can only give indirect hints related to orders, which indicates that they are not fully competent in the use of implicatures yet. Another important pragmatic development is that three- and four-year-old children obey the Cooperative Principle by introducing elements which they know are unfamiliar to their hearer in the conversation (Foster, 1990).

### *The Concrete Operational Period*

According to Mc Tear (1985) five-year-old children still acquire conjunctions and just as the children in the Preoperational Period use the conjunctions *and* as well as *and then* most often. Although the Concrete Operational Period only refers to children aged four to six, older children still develop their language skills. At the age of seven children utter more complex conjunctions such as *when, until, so . . . that* and make less grammatical mistakes when using conjunctions. Eleven-year-olds apply to a wide range of conjunctions and rarely use the basic conjunctions *and* or *and then*.

An important pragmatic development in the Concrete Operational Period is that children aged four to five seem to have developed a theory of mind which allows them to modify their speech depending on what they presume to be the hearer's state of knowledge. This development clearly enriches and improves children's communicative skills. (de Villiers & de Villiers, 1979)

The authors further cite other researchers (Shatz & Gelman, 1973; Sachs & Devin, 1973) who reported that four-year-olds adjust the complexity and mode of their speech depending on whether they talk to an adult, a baby or younger interlocutor. Foster-Cohen (1999) and Mc Tear (1985) report the same phenomenon. The latter states additionally that children are able to change to the listeners perspective (Theory of Mind) (see also: Bates, 1976; Foster-Cohen, 1999) and therefore seldom use subordinate and co-ordinate clauses as well as complementizers and WH-complementizers when talking to two-year-old children. Moreover, they refer and talk about infants limited cognitive and linguistic competence. It seems that children do not only refer to the linguistic competence of younger interlocutors but also to adults linguistic competence. In the following I want to describe two situations which I experienced and which support this theory:

- (1) My friend's nephew, Bolin (3;3 years), his parents and me were visiting one of their friends who also have a little boy, An-An (5 years). Both children are bilingual but have acquired their first-language slightly earlier than German. While I was speaking German to Bolin, his friend An-An interrupted me and said *Du musst Chinesisch mit dem sprechen. Der versteht noch nicht richtig Deutsch.*
- (2) Recently, Bolin (who is now 5;4 years) told me that his uncle cannot speak German properly yet and that he still needs to learn German. I also observed Bolin when he was playing with his teddy bear. He told me that his teddy bear is still a baby, does not understand English and can only speak German.

Every time when his bear was speaking to me Bolin changed his voice and pronunciation to show that his bear is still a baby.

Along with the development of the Theory of Mind, children acquire several politeness-forms such as implied commands that are based on the exploitation of Grice's Conversational Maxims and start to compute conversational implicatures (Bates, 1976). Metalinguistic skills such as the ability to change perspective and knowledge of Grice's Conversational Maxims are preconditions for the development of these pragmatic skills.

Moreover, children in the Concrete Operational Period are said to have control over their speech acts because they are able to encode and decode their messages before they utter a sentence (*ibid.*). Therefore, these children are also able to predict what kind of assumptions the hearer could make when he understands a statement differently than intended and can try to prevent these presuppositions by modifying their utterances.

Heinzmann (2006) reports that the Theory of Mind is important for the acquisition of modals and that children at the age of 4;5 to five years of age are able to use and express necessities and possibilities with the help of epistemic readings of modals. The author argues that this ability might be influenced by the Theory of Mind which starts to work around this age and helps children to calculate possibilities and detect false beliefs. Although children are able to produce epistemic utterances around the age of 3;3 they are not able to interpret this kind of statements yet. According to the Theory of Mind deontic interpretations of modals should be acquired earlier (roughly at the age of 3;5) and are therefore easier to interpret for children than epistemic readings, which will occur around the age of 5 years. However, Heinzmann (*ibid.*) also reports a contrary opinion of other researchers, who state that epistemic utterances are not frequent yet and that most of the epistemic statements uttered by children express certainty. The author also points out that both readings, the deontic and the epistemic one are ambiguous in German in the present tense. This is because both readings are expressed by the same grammatical form.

Although Bates' pragmatic stages only describe the development of pragmatic skills until the age of six, it does not mean that pragmatic skills are completed by that age. As Foster-Cohen (1999) states, it is around the age of seven that children can master more complex metalinguistic tasks such as sarcastic intonation, linguistic humour such as irony, difference between form and meaning of words. This is because now children possess the ability to understand the details and notions of words that appear to have the same or similar meaning on the first glance. Moreover, the author introduces Karmiloff-Smith's model of metalinguistic development. Based on this model children under the age of five have implicit language knowledge and produce as well as understand language based on their own subjective point of view. In the second stage of this model this knowledge is redescribed before children gain conscious access to their language knowledge in the third stage of this model. Seven-year-old children are supposed to be at the beginning of the stage, which enables children to describe their language knowledge verbally. At the end of the last stage (teenagehood) the metalinguistic skills will be perfected and further developed (*ibid.*).

### 2.1.3 Universal Grammar and the Language Faculty

As shown in the previous chapter, the acquisition of pragmatics proceeds as fast as the acquisition of language. Furthermore, the strategies which children use and the stages they go through seem to be similar in every language: Babies first show non-linguistic and minimal communicative behaviour. When growing up, they proceed from simple utterances to more complex statements and communicative behaviour, which shows signs of metalinguistic communicative skills. This indicates that these processes seem to be universal. In addition to this, Foster (1990) even states that some of the pragmatic uses of language seem to rely on innate mechanisms.

### 2.1.4 The Modularity Hypothesis and the Logic Faculty

According to the Modularity Hypothesis linguistic knowledge is a separated module and has to be distinguished from cognitive knowledge (Crain & Lillo–Martin, 1999). The same authors developed the Modularity Hypothesis further and believe that the Language Faculty consists of several “autonomous subcomponents” namely, “the lexicon, the phonology, the syntax, and the semantics”. They assume that, apart from occasionally providing input for each other, these subcomponents do not influence one another and operate based on their own rules. Crain & Lillo–Martin (*ibid.*) explain that each level has its own processor and provides input to the next higher subcomponent but not the other way round.<sup>2</sup>

As we have seen, this theory does not include pragmatics. Since babies proved to possess pragmatic skills, such as taking turns and making demands at a time when they cannot utter words yet, I suggest that the subcomponent of the Language Faculty which is responsible for pragmatics, develops parallel to the other subcomponents of the language module. Moreover, the pragmatic subcomponent probably receives input from the other subcomponents which are necessary in order to develop the pragmatic skills further and express the ones that are already present.

As mentioned before, Crain & Khlentzos (2008) suggest that there is a similar device as the LAD for the acquisition of logic competence, which they call “innate Logic Faculty”. The authors support their hypothesis with empirical evidence from even very young children’s judgements about certain linguistic phenomena such as ambiguity, entailments and contradictions, cross-linguistic research as well as *a priori* arguments. Despite their findings and hypothesis the question whether the Logic Faculty is “intrinsically tied to a Language Faculty remains open”. (*ibid.*)

## 2.2 Universal Pragmatics

### 2.2.1 Implicatures

An implicature is additional and implicit information beyond the meaning of the utterance that is explicitly said. Implicatures are therefore not part of or entailed in the actual proposition. For example, the message

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<sup>2</sup>see Appendix D.2: Crain and Lillo–Martin’s language module



(3) *I want you to close the window.*

is implied by the following utterance

(4) *Could you please close the window?*

This example shows that the utterance *Can you close the window* does not mean that the speaker wants to know whether the hearer has the ability to close the window but that it means something else, namely that the speaker wants the hearer to close the window because he or she feels cold.

Another example where the listener has to compute implicatures to figure out from the context what the speaker wanted to say is the following situation.

(5) An employer writes the following about his employee in a letter of recommendation:

*Dear future employer, I have experienced Mr XY as a very friendly and punctual person. Yours, YZ*

At first glance it appears that the employer did not give his employee a negative reference. At second glance, however, it becomes obvious to the reader of the letter (who knows the purpose of a letter of recommendation) that the information needed is not explicitly given in the letter. In order to understand the whole meaning of the letter he would therefore get the needed information from drawing the inference from the context because he assumes that the author of the letter provided as much information as necessary. In this example it would be that the employee is not suitable for the job.

There are different kinds of implicatures, whereas conversational implicatures and conventional implicatures are the two main categories (Levinson, 1989). These two groups of implicatures differ by the source that triggers implicatures.

The first example described above is a conventional implicature. This kind of implicature is based on the meaning of an expression and is not calculated on the basis of the context and pragmatic principles such as the Conversational Maxims. Levinson (ibid.) describes them as “attached by convention to particular lexical items or expressions”, which means that the implicature arises due to the meaning or semantic value of a certain word. Since the semantic value of a word as well as the implicatures that might be associated with the semantic value of a word are different in every language (this is because the truth conditions of certain words vary (slightly) in every language) this kind of implicature can impossibly be universal. For example, there is no German equivalent for the English conjunction *but*, which has the same truth-conditional meaning as *and*. In English however, both words can be interchanged, whereas the word *but* additionally has the conventional implicature of indicating a contrast between the conjuncts it joins together. If *and* and *but* are interchanged in a sentence, the sentence will consequently lose its conventional implicature because the implicature is detached to the semantic value of *but*.

Furthermore, Levinson (ibid.) characterises conventional implicatures as not calculated, non-cancellable and detachable because they are directly connected to an lexical item.

Example (5), on the other hand, is a conversational implicature. In contrast to conventional implicatures, conversational implicatures are pragmatic inferences and

not based on the semantic value of a word but on the Cooperative Principle as well as the Conversational Maxims and the context. The term conversational implicature was coined by Grice. Carston (1998a) states that the class of conversational implicatures consists of two subcategories: generalized and particularized implicatures. Scalar implicatures, which are the subject of this assignment, are a subclass of generalized conversational implicatures.

In the following chapter scalar implicatures, a subcategory of conversational implicatures, and their function will be described in more detail.

### *Scalar Implicatures*

Scalar implicatures are a kind of conversational implicature, based on the Conversational Principle and are computed if scalar terms appear in a sentence. Scalar terms are words of the same grammatical category with a similar or contrastive semantic meaning. These words are called scalar terms because they can be arranged on a scale according to their semantic strength and degree of informativeness. A linearly ordered scale is also called *Horn scale*. This kind of scales are named after the linguist Laurence Horn because he invented the term *scalar implicatures* (Levinson, 1989).

The first maxim of Quantity, “1. Make your contribution as informative as is required (for the current purpose of the exchange).” (Grice, 1989, p. 26), is involved in the interpretation of scalar terms and responsible for the computation of scalar implicatures. Once people hear a scalar term in a conversation they compare the scalar term to the respective stronger or weaker one and come to the conclusion that the stronger or weaker term of the same scale is not true because the speaker is supposed to obey the maxim of Quantity as well as the one of Quality. Therefore, the speaker should have uttered the stronger or weaker scalar term if he knew that it was true.

There are two kinds of scalar implicatures: upper-bound and lower-bound implicatures. The first maxim of Quantity is involved in the inference of upper-bound implicatures. The hearer infers from this principle that at most the uttered term is true. The second maxim of Quantity, “2. Do not make your contribution more informative than is required.” (ibid.), is the basis for the computation of lower-bound implicatures, which means that the hearer infers that at least the uttered term is true. If this was not the case the speaker should have uttered the respective stronger or weaker term (if he knew that it was true). This shows that scalar implicatures are upper as well as lower bound at the same time. Therefore, people will infer that the uttered scalar term is at least and at most true, which again means that from their inference the uttered term is the ideal scalar term to describe the respective state or situation.

The following example shows that scalar implicatures are upper as well as lower-bound. The sentence

(6) *I washed some of the dishes*

implies, according to the first maxim of Quantity, that *I did not wash all of the dishes* because *some* is included in the stronger scalar term *all*. The same sentence also

implies, that it is not true that *I did not wash any of the dishes* because the meaning of *any* is included in the stronger scalar term *some* and I should according to the second maxim of Quantity not make a more informative utterance than required.

In short, scalar implicatures imply that the respective stronger expression, which includes the meaning of the weaker term, does not hold in the cases where the weaker term is uttered and the other way round. Levinson (1989, p. 133) introduces the following general rule for scalar implicatures:

- (7) “(121) *Scalar implicatures*: Given any scale of the form  $\langle e_1, e_2, e_3, \dots, e_n \rangle$ , if a speaker asserts  $A(e_2)$ , then he implicates  $\sim A(e_1)$ , if he asserts  $A(e_3)$ , then he implicates  $\sim A(e_2)$  and  $\sim A(e_1)$ , and in general, if he asserts  $A(e_n)$ , then he implicates  $\sim(A(e_{n-1}))$ ,  $\sim(A(e_{n-2}))$  and so on, up to  $\sim(A(e_1))$ ”

Levinson (ibid.) points out that “Such a rule embodies a claim that the semantic content of lower items on a scale is compatible with the truth of higher items obtaining, and the inference that higher items do not in fact obtain is merely an implicature.”

Critical logical words such as *some* or *might* are scalar terms and often trigger scalar implicatures. According to Grundy (2000, p. 83) other possible scales are “(certain . . . probable . . . possible), (and . . . or) and (must . . . may . . . might)”.

## 2.2.2 Grice and implicatures: The Cooperative Principle and the Conversational Maxims

In his Causal Theory of Perception (1961), Paul Grice formulates the following principle for the use of language: “One should not make a weaker statement rather than a stronger one unless there is a good reason for doing so”. With the help of this principle it is possible to understand how and why scalar implicatures are computed. Scalar implicatures only arise if a person utters a weaker statement than required. Whereas, scalar implicatures do not arise if a stronger statement than the one required is made because the weaker term is entailed in the stronger. Grice explains that implicatures are computed if a person utters a “disjunctive sentence”, for example a weaker statement than the one required. Which means that the speaker does not directly answer or refer to the statement or question of his interlocutor but to something slightly different. From this point Grice draws the conclusion that the utterance of a weaker statement than the one required “would imply the speaker’s ignorance of the truth-values of the disjuncts” because the question and the answer do not directly refer to the same thing although they imply the same thing. Moreover, Grice (1961) explains that making a weaker statement than the one required is only justified if “one [the speaker] is not in the position to make it [the stronger utterance]”, which means that the person does not know whether the stronger statement is true or knows that the stronger statement is wrong, and if “each disjunct entails the disjunctive, but not *vice versa*”, which means that the weaker utterance is entailed in the stronger one.

Furthermore, Grice (1989) developed the Theory of Conversational Implicature and described with the help of his Conversational Principle how implicatures work. The Conversational Principle is a theory that consists of several maxims and states

that interlocutors should make connected remarks, cooperative efforts as well as follow a certain purpose when making a contribution in a conversation.

The general principle of this theory is the Co-operative Principle: “Make your contribution such as is required, at the stage at which it occurs” (Grice, 1989). The Co-operative Maxim consists of four subcategories, which are also known as the Maxims of Conversation, with their specific maxims and submaxims. The first maxim of conversation is the Quality Maxim: [4] “1. Do not say what you believe to be false” and “2. Do not say that for which you lack adequate evidence”. The maxim of Quantity is the second conversational maxim and says that: “1. Make your contribution as informative as is required (for the current purpose of the exchange). 2. Do not make your contribution more informative than is required” (Grice, 1989, p. 26). This maxim expresses that in a conversation one should give the required information but no irrelevant additional information. The Maxim of Relation consists of one maxim which says: “Be relevant”. The fourth category is the Maxim of Manner “Be perspicuous” (ibid., p. 27). This maxim has the four submaxims: “1. Avoid obscurity of expression”, “2. Avoid ambiguity”, “3. Be brief (avoid unnecessary prolixity)” and “4. Be orderly” (Grice, 1989).

Many linguists believe that apart from the Co-operative Principle, the Maxim of Quality is the most important one and has to be obeyed before other conversational maxims are (Horn, 1996; Gazdar, 1979). According to Horn, some linguists such as Wilson & Sperber do not share this point of view.

Furthermore, Grice (1989) states that it is an empirical fact, that people act in accordance to these principles because they have learned and internalized these principles in childhood. I, however, assume that people do not only act according to these principles but additionally also rely on their interlocutors to stick to the same principles when making a contribution to a conversation. Green (1989) seems to be of the same opinion.

The Conversational Principles are the basis for the computation of implicatures. Since people act according to these principles, they assume that their interlocutor is co-operative as well. Therefore, implicatures arise once one of the conversational maxims is violated. This is because people search for implications since they believe that there must be a relation between their utterance or question and the answer they got (because their interlocutor is presumably co-operative). The computation of implicatures is often also referred to as the pragmatic interpretation of an utterance.

Especially adults act in a pragmatic way and compute implicatures once they get a less informative answer than the one required. Since they are pragmatic orientated, they will in this case look for implications because they know the Conversational Maxims and rely on them. Interpreting the answer they got according to the Conversational Maxims, they will come to the conclusion that the more informative answer to their question or statement does probably not hold because the weaker one was uttered and the interlocutor should have uttered the stronger statement (Maxim of Quantity) if he was in the position to do so (Maxim of Quality).

However, in some situations it is not possible to stick to all of the maxims at the same time because some maxims may interact. In this case the speaker has to give up a maxim in order to be able to stick to another one and has to let his interlocutor,

either explicitly or implicitly, know which maxim he does not or cannot obey. (see also: Green, 1989; Kearns, 2000)

If the speaker does not inform the hearer that he did not fulfil the criteria of a certain maxim, the hearer might think that the speaker is honouring all the maxims or at least the Cooperative Principle and will, therefore, be misled or draw the wrong conclusion by interpreting the utterances according to the maxims (Green, 1989). The information the hearer gets by exploiting or interpreting the maxims are implicatures. The following example illustrates how the basic mechanism of implicatures works.

- (8) A: *Where is my wallet?*  
 B: *Somewhere in the living room.*

In this example the maxims of Quality and Quantity are in conflict. The speaker needs to say more in order to give B the necessary information about the presence of his wallet. At the same time B's utterance has to be true. Since B cannot remember where he saw A's wallet and does not want to make a statement which is not true, he has to violate the maxim of Quantity. A on the other hand believes that B acts according to the Co-operative Principle and its maxims. However, he realizes that B's answer is not informative enough to find the wallet. Therefore, he draws the conclusion that B saw the wallet in the living room but does not remember whether the wallet was on the table, on the bookshelf or next to the telly. In this way, A is able to solve the conflict which is caused by the interaction of both maxims because he assumes that B is co-operative and tries to give an answer that is as informative as possible in order to help him to find his wallet.

If the same sentences were uttered in a slightly different situation for example, after an argument, it would be better for B to say:

- (9) *I am not sure. Somewhere in the living room.*

In this case B should indicate that he is still trying to be co-operative but is not able to obey the Maxim of Quantity. The additional statement in (9) is necessary to avoid that A will draw a wrong conclusion such as: B knows where my wallet is but he does not want to tell me.

Horn (1996) assumes that the Cooperative Principle and its maxims are universal. However, this expectation has neither been claimed explicitly by Grice nor has the universality of the Cooperative Principle and the maxims been proven yet (Green, 1989).

Moreover, Gazdar (1979) and Green (1989) cite Keenan, who stated that the maxims are not universal because Malagasy speakers do not make their utterances informative enough or as Gazdar (1979) describes it, they make their statements "as uninformative as possible" by intentionally withholding necessary information. Therefore, Keenan as well as Gazdar drew the conclusion that Grice's maxims cannot be considered to be universal because Malagasy speakers do not seem to have the Maxim of Quantity in their language. Gazdar concludes that the maxims are, therefore, only applied in some (maybe even most) but not all cultures.

Keenan (1998) and Green (1989), however, did further research on this issue and remark that the phenomenon of withholding information among Malagasy people is

related to their culture. Since family life and nearly all of the activities take place in public, new information is very rare and therefore highly treasured. Furthermore, it is according to the Malagasy culture very offensive, embarrassing and socially not correct if a given information turns out to be wrong. This shows that Malagasy people do have the Maxim of Quantity in their language and even stick to it.

The actual problem in this case seems to be that the Maxims of Quality and Quantity interact and that one of the maxims needs to be given up slightly in order to be able to obey the other maxim fully. As mentioned above the hearer will draw a conclusion and try to interpret what the speaker has in mind, since the speaker did not explicitly state that and which maxim he did not fully apply to. Since it is culturally taboo for Malagasy people to give information that is possibly wrong, for them it is clear and culturally fixed that the second Maxim of Quality has priority over the Quantity Maxim. Therefore, Malagasy speaker do not need to say that they slightly neglected the Maxim of Quantity because a culturally competent hearer knows that and will draw his conclusions and implicatures about the speaker's state of mind accordingly.

People from other cultures, however, who are not familiar with the convention of the Malagasy culture, will on the first glance and for good reasons think that the Maxim of Quantity is not of existence for Malagasy speakers. At second glance, however, it becomes obvious that the Co-operative Principles and the maxims do exist in that language. Since I have not heard of any other language for which the maxims do not apply to, I think it is safe to claim that they are universal if one keeps in mind that the priority of the maxims might differ and that in some cultures and societies a different sub-maxim is higher valued than in our culture and society.

A similar phenomenon as the culture dependent implicatures are early implicatures in children, which I will explain and discuss in more detail in chapters 4 and 5. These early implicatures, which I call child implicatures because they are calculated (only?) especially by children, differ from 'normal' or in scientific research known implicatures in the way that they are based on the exploitation of different conversational maxims. While adults value the second Maxim of Quantity and the third sub-maxim of Manner more than the other maxims when calculating implicatures, children treasure and rely (in the same context and situation) stronger on the first Maxim of Quantity and the second Maxim of Manner than on the other maxims. The fact that child implicatures and implicatures calculated by adults are based on different conversational maxims of the Co-operative Principle, might be a possible reason for why researchers have up to now not realized that children are in contrast to current scientific literature and opinions able to calculate implicatures. Moreover, does the existence of child implicatures prove that even young children know, apply and even exploit the conversational maxims. This might indicate that the conversational maxims are either innate or acquired very early in childhood.

Grice's Theory of Implicatures has been improved and developed further by Neo-Gricean linguists. A more modern version of Grice's conversational maxims are Stephen Levinson's heuristic principles.

### 2.2.3 Neo-Gricean linguists: Levinson and Horn

Neo-Gricean linguists improved and developed Grice's thesis further because they do not consider all of the maxims of equal importance. The most eminent Neo-Gricean linguists are Horn, Gazdar and Levinson.

Levinson (2001) replaced Grice's maxims by three principles, namely the Q-Principle, the I-Principle and the M-Principle. Levinson's principles are also referred to as heuristics because they consist of maxims for the speaker and the consequences for the hearer.

The speakers maxim of Levinson's Q-Heuristic is based on Grice's first Quantity Maxim and states:

- (10) "(1) Do not provide a statement that is informationally weaker than your knowledge of the world allows, unless providing an informationally stronger statement would contravene the I-principle. Specifically, select the informationally strongest paradigmatic alternative that is consistent with facts." (ibid., p. 76)

Consequently, Levinson formulated the following corollary for the recipient "Take it that the speaker made the strongest statement consistent with what he knows" (ibid.). The hearer's corollary of the Q-Principle justifies the hearer's assumption that the speaker uttered the strongest and most adequate statement that matches with his knowledge. Therefore, the uttered statement invites the listener to calculate a scalar implicature and to draw the conclusion that the stronger alternative description is not true. Another kind of implicature which can be caused by this corollary are clausal implicatures.

Levinson's second principle is the I-Heuristic, which is based on Grice's second Quantity Maxim. Its speakers maxim is also known as the Maxim of Minimization and states "'Say as little as necessary'; that is, produce the minimal linguistic information sufficient to achieve your communicational ends (bearing Q in mind)" (ibid., p. 114). The hearer's corollary is also called Enrichment Rule and is slightly longer since it contains some submaxims:

- (11) "(39) [...] Amplify the informational content of the speaker's utterance, by finding the most specific interpretation, up to what you judge to be the speaker's m-intended point, unless the speaker has broken the maxim of Minimization by using a marked or prolix expression.  
Specifically:
- a) Assume the richest temporal, clausal and referential connection between described situations or events, consistent with what is taken for granted.
  - b) Assume that stereotypical relations obtain between referents or events, unless this is inconsistent with a)
  - c) Avoid interpretations that multiply entities referred to (assume referential parsimony): specifically, prefer coreferential readings of reduced NPs (pronouns or zeros).
  - d) Assume the existence or actuality of what a sentence is about if that is consistent with what is taken for granted" (ibid.).

The implicatures which are based on the I-Heuristic are generalized conversational implicatures and just the opposite of scalar implicatures. While scalar implicatures are calculated because the hearer is looking for more specific information which the speaker cannot provide, I-Implicatures arise in a context where no further explanations are needed. Levinson's third and last principle is based on the first and third submaxim of Grice's Maxim of Manner and is called the M-Heuristic:

- (12) “(69) *Speaker's maxim*: Indicate an abnormal, non-stereotypical situation by using marked expressions that contrast with those you would use to describe the corresponding normal, stereotypical situations.

*Recipient corollary*: What is said in an abnormal way indicates an abnormal situation, or marked messages indicate marked situations, specifically:

Where S has said “p” containing marked expression *M*, and there is an unmarked alternate expression *U* with the same denotation *D* which the speaker might have employed in the same sentence-frame instead, then where *U* would have *I-implicated* the stereotypical or more specific *d* of *D*, the marked expression will implicate the complement of the denotation *d*, namely *d* of *D*” (ibid., p. 136)

In contrast to Levinson, the linguist Laurence Horn reduced Grice's Conversational Principles to only two principles, namely the Q-Principle and the R-Principle. Furthermore, he maintained Grice's Maxim of Quality and states that it functions in the background of both principles.

The Q-Principle, which comprises Grice's first Maxim of Quantity as well as the first and second submaxims of Manner, is hearer-based and states “Make your contribution sufficient” and “Say as much as you can (given R)” (Horn, 1996, p. 385). The R-Principle, which was made of Grice's Maxim of Relation, the second Quantity Maxim and the last two submaxims of Manner, is speaker-based and states “Make your contribution necessary” and “Say no more than you must (given Q)” (ibid.). As can be seen, both principles interact with each other by constraining and referring to each other.

Depending on which of the two pragmatic principles is exploited, Horn's theory distinguishes two kinds of implicatures: Q-Implicatures and R-Implicatures (Kearns, 2000). Q-Implicatures are upper-bound and based on the Q-Principle. If the Q-Principle, which is a lower-bounding principle, is exploited the hearer of an utterance assumes that the speaker did not use a stronger term because it does not hold. Scalar implicatures, for instance, are a kind of Q-Implicature because they are calculated on the basis of scalar terms and arise once the Q-Principle is exploited (van Rooy, 2003; Horn, 1996). R-Implicatures are lower-bound and derived from an exploitation of the R-Principle. For example, when a hearer assumes that the speaker obeyed the R-Principle, he will calculate an R-Implicature by assuming that the speaker could have conveyed the same meaning by uttering a stronger statement. Euphemisms and negative-raising are, for example, R-Implicatures and often motivated by social skills (van Rooy, 2003; Horn, 1996). For example, if a person, who is not feeling well at all, is asked by an acquaintance how he was feeling, that person would probably say that he is not feeling too good rather than pretty bad. This is because in this situation the acquaintance is just trying to be friendly but he is not interested in the other person's health condition.



### 2.2.4 Relevance Theory

Another and rather different approach to pragmatics and implicatures is outlined by Relevance Theory, which was developed by Deirdre Wilson & Dan Sperber. The main difference between Relevance Theory and Neo-Gricean approaches is that Relevance Theory does not consider implicatures as connected with the use of critical logical terms but as calculated and processed by mental efforts.

Wilson & Sperber (1998) criticize Grice's Cooperative Principle and the Maxims of Conversation because they consider this theory as too "vague" since "it has never been fully specified exactly what their content is, nor exactly how they are supposed to function" (*ibid.*, p 370). The authors, therefore, suggest that a single Communicative Principle, the Principle of Relevance, which is based on the supposition of optimal relevance, can replace Grice's Conversational Maxims (Wilson & Sperber, 1977). Wilson & Sperber came up with this new theory because they believe that the characteristics of a maximal relevant information are that utterances are precise in informativeness, truthfully and based on adequate evidence, as well as clear, direct and easy to understand. Moreover, Wilson & Sperber consider the sub-maxim of brevity as not necessary because in certain contexts a longer piece of information might be more appropriate than the shorter one.

According to Relevance Theory an utterance is relevant when it interacts with the hearer's background knowledge resulting in cognitive effects, such as changes in or modification of the hearer's previous assumptions. A maximal relevant statement can be defined as having the strongest possible cognitive effect and minimal processing costs.

Based on Relevance Theory a hearer, will only calculate implicatures, if the information or benefit that can be gained is worth the processing effort of the input.

Carston (1998b), a follower of Relevance Theory, states that the advantage of this theory is that it consists of only one communicative principle whose "predictions are more accurate and [...] its derivations are smoother" than the ones of systems which are based on a quantity maxim. Moreover, he points out that the Relevance Principle is necessary to avoid that unlimited scalar implicatures and context enrichments will be calculated on the basis of the Q-Principle and R/I-Principle (*ibid.*).

The pragmatic theories which were introduced in this chapter are only the most important ones. Apart from this three pragmatic theories (Grice's Theory, the Neo-Gricean Theory and Relevance Theory) there are further theories and approaches to implicatures by other researcher such as Harnish (see: Carston, 1998b; Kasher, 1998).



# Chapter 3

## Acquisition of scalar implicatures

### 3.1 Children's interpretation of scalar terms

The linguist Ira Noveck was the first one, who examined children's interpretation of the scalar terms *must* and *might* in a reasoning experiment. He found in his study that children are more likely than adults to interpret weak scalar terms semantically and to consider these relatively weak terms as compatible with the respective stronger term of the scale (Noveck, 2001). Since then several studies on scalar terms such as numbers and the words *some* — *all*, *finish* — *start*, *at least* — *at most* have been conducted by other linguists. These studies confirm that children are in contrast to adults less likely to enrich the meaning of an underinformative statement (Papafragou & Musolino, 2003; Chierchia et al., 2005, 2001; Noveck, 2005; Noveck et al., 2007a; Noveck & Sperber, 2007b). In this assignment I will only talk about the modals *must* and *might* and the logical connective *or* in more detail.

#### 3.1.1 The modals *must* and *might*

The modal verbs *must* and *might* are scalar terms and part of the entailment scale  $\langle \textit{must} - \textit{can} - \textit{might} \rangle$ . The semantic meaning of the weaker scalar terms *can* and *might* is included in the stronger term *must*. In a situation where it is obvious that the stronger term *must* is true, people will infer that the weaker term *might* is true as well, since its meaning is included in the meaning of *must*. However, according to the first Maxim of Quality people should not utter the modal verb *might* in this kind of situation since they know that the stronger term *must* is true and because they are supposed to be as informative as possible.

In this case the modal verb *might* is a critical logical term because it has two possible interpretations, a semantic one (literal meaning) and a pragmatic interpretation. According to the pragmatic interpretation the meaning of *might* or *can* excludes *must*, whereas the literal meaning of the modal verb *can* or *might* is compatible with the meaning of *must*.

Noveck (2001) conducted an experiment to examine children's reasoning abilities. In this experiment participants were confronted with three boxes. One of the boxes was closed and the other two boxes were open, so that the participants could see the content. One of the opened boxes contained a parrot and a bear and the other just

a parrot. The participants were then told “a friend of mine gave me this box and said ‘all I know is that whatever is inside this box looks like this Box (Experimenter pointed to the Parrot + Bear Box) or this Box (Experimenter pointed to the Parrot – only Box)’” (ibid.). Participants then had to evaluate several statements that were uttered by a puppet. Among several neutral statements, that were uttered to see whether children had understood the task, was one critical statement, which could be interpreted in a semantic and in a pragmatic way (*There might be a parrot in the box.*).

Noveck (2001) found in this reasoning experiment on scalar implicatures that seven-year-old children are the youngest ones that show overall competence in mastering this task and that seven- to nine-year-old children stick to the literal meaning of scalar terms more often than adults. 72% of the five-year-olds, 80% of the seven-year-olds and 69% of the nine-year-olds accepted the weaker scalar term although they knew that the stronger term is more informative in this situation. This means that in a situation where they know *must* is the better verb to describe a state or situation; they will also agree to use the scalar weaker term *might*. In the same situation adults on the other hand seem to prefer the pragmatic interpretation and reject the weaker scalar term. In contrast to the children only 35% of the adults accepted the critical statement in Noveck’s experiment. These results show that children are more likely than adults to make a logical correct evaluation about a statement which is underinformative in the given situation.

The difference in adult’s and children’s behaviour occurs because adults go beyond the literal meaning of an utterance and draw implicatures. This phenomenon can be explained with the Causal Theory of Perception and the Co-operative Principle with its submaxims. In a situation where a person uses the pragmatic interpretation of the weaker modal verb, he does so because he assumes that according to the Causal Theory of Perception and Grice’s Conversational Maxims the stronger alternative does not hold or the person who made the utterance is not in the position to make it.

Noveck (ibid.) explains that the difference in children’s and adult’s answers occurs because the pragmatic interpretation develops when children get older and grow up because they will be able to stick to the Co-operative Principle.

In order to find out whether children who attend nursery interpret the scalar term *might* pragmatically or semantically three other students and I conducted a similar experiment as a pilot-study in German with four children who attended nursery. In this study we interviewed children between the age of four and six, all of them were native speakers of German and attend the ASC-Kindergarten in Göttingen. Instead of asking our subjects to evaluate the puppet’s statement concerning the content of the covered box, the puppet in our experiment asked questions about the content of the covered box. Moreover, we used the slightly stronger and more informative term *kann* instead of *könnte*. In our experiment the first open box contained a bear and the second open box contained a bear and rabbit. The critical question was: *Kann in der Box ein Bär sein?*

However, similar to Noveck’s results, we found that all of our subjects accepted the test sentence which shows that they interpreted the critical term semantically.<sup>1</sup>

<sup>1</sup>see Appendix C.1: Results ASC-Kindergarten Göttingen (Table C.1)

For one subject (Robin) it was not really clear whether he had access to the pragmatic interpretation as well, since he answered all the questions correctly except one question which accidentally contained both modals and therefore was not very clear. (*Meinst du denn, Robin kann – muss denn hier vielleicht ein Bär drin sein?*) Our subject negated this question. If the child's answer referred to the first part of the question and the modal *kann*, the answer would still be correct if interpreted in the pragmatic way. If our subject decided to answer the question *Muss denn hier vielleicht ein Bär drin sein?* his answer would be wrong for the semantic as well as for the pragmatic approach.

In contrast to Noveck's findings for adults, I expected that adults also interpret the critical question semantically. Therefore, I explained the experiment to four former classmates on a class meeting (age group twenty-three to twenty-four) and found that all of them did not compute scalar implicatures and interpreted the test sentence based on its literal meaning. Additionally, I introduced my classmates in a linguistics course to the experimental set-up when I was allowed to give a presentation. Because the time of a seminar-meeting is limited, I prepared small sheets of papers with the following four questions concerning the covered box: 1. *Kann in der Box ein Bär sein?*, 2. *Kann in der Box ein Hase sein?*, 3. *Muss in der Box ein Bär sein?*, 4. *Muss in der Box ein Hase sein?* The participants were then asked to answer the questions. In this replication of the experiment the open boxes contained a rabbit and a bear (box I) and just a bear (box II). Therefore, the critical question of this experiment was: *Kann in der Box ein Bär sein?* All seven students (of the age group twenty-one to twenty-five), that took part in this experiment, responded affirmatively.<sup>2</sup> The oldest student, however, rejected the critical sentence at first but then crossed out her answer and answered in the affirmative. This shows that adults also seem to prefer the semantic interpretation of the statement.

### 3.1.2 The logical connective *or*

Just as the modals the connective *or* is a critical term and has a pragmatic as well as a semantic meaning. The connective *or* has two possible readings because it is a logical term and part of the Horn scale (*and – or*), which means that *and* is true in a subset or superset of the sentences for which *or* holds.

The semantic meaning of *or* is also known as the 'logical' meaning and means that the statement *John or Peter went to the market* is true in exactly three situations: when only John went to the market, when only Peter went and in the situation where both Peter and John went to the market. This means in short that *A or B* is true if exactly one of the conjuncts, possibly even both conjuncts are true. This kind of reading of *or* is also referred to as the inclusive meaning.

According to the pragmatic interpretation *or* is understood as exclusive-*or*, which means that the statement *Peter and John went to the market* is true if and only if one of the boys went to the market (either Peter or John but not both). Therefore, the exclusive meaning of *or* is only true in a situation where exactly one of the conjuncts is true.

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<sup>2</sup>see Appendix D.3: Results: adults

Empirical results from scientific research on the acquisition of scalar terms (Paris 1973, Gualmini 2000, Chierchia 2005 and others) suggest that children tend to use the inclusive interpretation of *or* more often in situations where adults prefer the exclusive reading of *or*. Paris (1973) tested groups of children and young adults with mean ages of 7;9 years, 11;0 years, 13;8 years, 16;7 years and 19;2 years on the comprehension of logical relationships of language connectives. In his experiment the participants had to decide whether a sentence which was matched with a picture and presented on a slide was true or false. Paris found that the older participants interpreted the logical term *or* more often as exclusive-*or* than the younger ones.

Gualmini, Meroni & Crain (2000) conducted an experiment which was based on the truth-judgement task to see whether children are able to distinguish *and* and *or*. Additionally, the author's wanted to find out whether children have access to the inclusive reading of *or*. Therefore, they prepared two experiments. In the first experiment they examined children's understanding of *or* in a disjunctive context. The participating children were four- to six-years-old. Their results show that children are able to distinguish *and* and *or* in this context because they rejected the control sentence, which was a statement that contained the conjunction *and* in a context where only one disjunct was true, in 87% of the trials. This reaction is logically correct. In contrast to the children's results, 100% of the adults rejected the same statement. Adults' and children's answers differ because adults compute implicatures and have the more informative and co-operative statement in mind.

In the authors (ibid.) second experiment the subjects were confronted with a conjunctive context. In this context children accepted the conjunctive sentences in 96% of the cases. Only four out of thirteen children consistently rejected the disjunctive statements. The other children either accepted the disjunctive statement always (four of them) or were inconsistent in their answer (five children), which means that they sometimes accepted and sometimes rejected the disjunctive statement. The adult control group, however, accepted the conjunctive statements only in 88% of the cases but rejected the disjunction in 100% of the cases. These results show that children seem to use the inclusive interpretation of *or* more often than adults do and therefore reject the disjunctive statement in a conjunctive context only in 30.8% of the cases consistently. Adults on the other hand always rejected the disjunctive statement because they seem to prefer the conjunctive statement in that context since it is more informative and precise in this context.

Chierchia et al. (2005) conducted an experiment with nine Italian children with a mean age of 5;5 years and an adult control group in order to find out whether children access the inclusive or exclusive interpretation of *or*. In this experiment a puppet made a bet about the outcome of a story, which was acted out in front of the subjects afterwards. In the end it was the child's task to judge whether the puppet's bet has been right. The critical situation in this experiment was the puppet's bet *I bet that X will take A or B* which was matched with a story in which both disjuncts turned out to be true. 95% of the children accepted this statement which shows that these children have access to the inclusive reading of *or*. In contrast to that, only 60% of the adult control group accepted this statement. This shows that adults are less likely than children to interpret *or* inclusively in this context. Other test sentences in this experiment were statements including *or* that were matched with

situations were only one disjunct was true and statements that included *and* in situations in which only one conjunct turned out to be true. In the first situation 78% of the children accepted the test sentence while only 16% accepted the test sentence in the latter situation. This shows that children treat the conjunctions *and* and *or* differently and therefore distinguish these conjunctions.

Crain & Khlentzos (2008) refer to studies which show evidence that logic is innate. Moreover, the authors support this argument with empirical findings from cross-linguistic research in typologically different languages which show that *or* is originally interpreted as inclusive-*or* in all languages. Another argument mentioned by Crain & Khlentzos (*ibid.*) which also supports their theory is the poverty of stimulus argument which says that it is implausible that children learn from linguistic input that *or* can be interpreted inclusively.

### 3.1.3 The logical connective *or* and Noveck's study

In the previous chapter empirical evidence from several researchers revealed that especially young children tend to interpret the disjunction *or* as conjunction (inclusive-*or*) more often than adults do. Children apply the logical and semantic interpretation of *or* even to contexts in which it would be more adequate to use exclusive-*or*. However, the older the subjects are, the more often do they use the exclusive interpretation of *or* in the same situation.

Children's presence of *or* might have an influence on the result of Noveck's reasoning experiment Noveck (2001, Experiment I) because two scalar terms in one experiment might confuse children and make the task more difficult for them. In his analysis of this experiment Noveck focussed first on how good children's reasoning abilities are before he turned to his actual question of interest, which is whether children are able to compute implicatures. Since he used the term *or* in the task of this experiment (“[. . .] ‘all I know is that whatever is inside this box looks like this Box (Experimenter pointed to the Parrot + Bear Box) or this Box (Experimenter pointed to the Parrot – only Box).’”) the presence of two scalar terms in the task might have an impact on children's results of the reasoning experiment.

First of all, I consider it as problematic to use two scalar terms (modal verb and *or*) in an experiment which focuses on scalar implicatures. Especially, since it is known for both terms that adults and children access different interpretations and therefore achieve different results. If one would like to examine a scalar term in an experiment, one should avoid to use a second scalar term or any other critical term that could additionally influence the results in the task. Once two critical terms are used in the same task or experiment, it becomes very difficult to determine which of those terms is responsible for the variation in children's and adults results. In the following (as well as in the tables in the attachment) I use *A* to present the toy/item which is in both open boxes and therefore necessarily in the covered box. *B* presents the other toy/item, which is only in one of the open boxes and therefore only possibly in the covered box.

Secondly, in the analysis of his results and the amount of implicatures that were computed in each age group, Noveck (2001) seems to focus only on the statement that is most likely to trigger scalar implicatures but not on other statements that

might (e.g. due to understanding the statement as exhaustive descriptions) trigger implicatures as well. From my point of view one should, if one would like to examine critical terms, consider all of the statements and write down which statement could possibly trigger an implicature. If one found such a statement one should consider what kind of implicatures might be computed and how likely it might be that it will happen. After this step one should conduct the experiment and look at the results of every age group to see, which age group did or did not compute implicatures for a certain statement. This is especially very important for this experiment because if somebody considers the statements as exhaustive descriptions of the content, some of the statements can trigger different implicatures than the ‘normal’ understanding of the statement. Under this circumstances statement (3) in Table C.4 is not the only statement that might trigger an implicature and apart from ‘normal’ scalar implicatures there are other implicatures that might be computed. For statement (7) for example, the hearer might compute the implicature that the speaker only assumes item B to be inside the covered box. The hearer therefore rejects the statement because it implies that A is not contained in the box at the same time. This kind of implicature is caused by the idea that the statement is an exhaustive description of the content of the box.

However, if one exploits the meaning of the statements and interprets the statements as upper-bound (as the most informative utterance), then one will (as I just mentioned) not only focus on item B but also on other items that have to be in the box once B is in the box. As can be seen in Table C.2 the exhaustive interpretation of the statements also affects statements (5) *There has to be a B in the box.*, (6) *There does not have to be a B in the box.*, (1) *There has to be a bear* and statement (7) *There might be B in the box.*

If we look at the results of Noveck’s experiment (2001)<sup>3</sup> we can see that the age group of seven-year-olds got their worst results for statements (5) and (6). Moreover, the age group of five- and seven-year-olds got the lowest percentage of correct answers for statement (5). Especially the 5-year-olds are with 47% of correct answers even under chance level. The rest of their answers are however, with 53% for statements (7) and (8) slightly, and for the remaining statements above chance level. If those children who considered statement (5) as exhaustive description of the content of the box, their result would prove that nearly half of the five-year-olds calculated an implicature for this statement. I am not arguing that all of the children who got statement (5) and (6) wrong interpreted the statement as exhaustive description of the content of the box. I think that there might also be some children who got the answer wrong due to the complexity or difficulty of the task but some of the children who answered differently than expected might have answered in that way because they calculated an implicature which adults do not calculate. Table C.4 shows for which statements what kind of implicatures might be computed if one considers the statement as exhaustive description of the content and if one interprets the statement in the ‘normal’ or expected way.<sup>4</sup>

If young children, however, and in contrast to scientific evidence should be able to compute implicatures (e.g. based on an different understanding of the statement),

<sup>3</sup>see Appendix C.3: Noveck’s results (Table C.3)

<sup>4</sup>see Appendix C.4: Possible implicatures (Table C.4)



this would have an impact on their reasoning results because in that case it would not be clear if they gave “wrong” answers because they are not competent enough for this experiment or if they computed a different kind of implicature than adults.

It is actually possible that some of the five-year-olds in Noveck’s experiment computed a different kind of implicature because only 53% of the age group gave the right answer to statement (7), which is the second worst result of that age group. Noveck also writes that some five-year-olds came up with an answer that would make sense if the subject assumed the statement to be an exhaustive description of the content in the training for his second experiment (“When asked about the ‘No’ response, the participants were wont to say that there had to be a fish *and* a horse.” (Noveck, 2001)) but he does not draw the conclusion that this is a possible implicature which children compute but adults do not. It seems that Noveck only paid attention to scalar implicatures based on the ‘normal’ reading of the statement and not to other possible implicatures. This should be fine as long as one does not generalize this kind of results and assumes that children do not compute implicatures at all, just because they did not compute scalar implicatures for a certain statement.

Moreover, for Noveck’s experiment it is not easy to judge whether results, that are different than the expected answer are simply wrong, which is of course possible, or caused by other implicatures or interpretations of the statements. Therefore, it is important to look at possible hints from the person who answered the question such as explanations, reaction time or other clues. This step definitely has to be done before one concludes that the subject did not calculate implicatures at all. This is very important if a subject is not sure whether to choose *yes* or *no* or gives a mixed answer because it might indicate that that person has access to both interpretations of the statement. I am therefore interested in whether some children gave mixed answers in Noveck’s study and if so, how did he treat mixed answers. Did he simply exclude them from his results or did he assign them to a certain category?

## 3.2 Why do children compute scalar implicatures less often than adults?

As we have seen in the previous chapter, children do interpret scalar terms more often semantically than adults. In order to find an explanation for this phenomenon Chierchia et al. (2005) suggested three hypotheses that might help to find a scientific explanation for the differences in children’s and adult’s interpretation of scalar terms. In the following these hypotheses will be introduced.

### 3.2.1 Pragmatic Delay Hypothesis

As explained earlier, pragmatic as well as semantic knowledge is needed in order to be able compute scalar implicatures.

The pragmatic delay hypothesis states that children compute scalar implicatures less often than adults because they only have access to semantic knowledge but lack the for the computation of scalar implicatures essential piece of pragmatic knowledge, which is Grice’s Maxim of Quantity (ibid.).

Chierchia et al. (ibid.) therefore developed the Felicity Judgement Task, which is a new technique and designed to see whether children are able to distinguish two descriptions which occur in the same context and only differ in their adequacy. This method can also be used to see whether children have pragmatic knowledge and know or act according to Grice's maxim of Quantity.

According to this hypothesis children do not know that critical terms like *or* and *might* are part of a Horn scale and can trigger scalar implicatures. Chierchia et al. (2001) states that if this hypothesis was true, children should accept and produce a weaker term of a scale such as *might* and *or* in contexts where it would be more adequate to use the stronger term of the same scale, *must* and *and* respectively.

### 3.2.2 Processing Limitation Hypothesis / Reference-Set Hypothesis

In order to compute scalar implicatures two steps need to be followed. First of all, the plain meaning of a statement and possible alternative interpretations of a statement (recursive meaning) need to be considered. Then the truth conditions for the plain meaning of the utterance and the one for its enriched or scalar meaning need to be calculated. Once this is done both interpretations need to be compared in order to figure out which interpretation of the statement is the most informative one or most appropriate one in this context. Each part of this process takes place in the working memory. The computation of scalar implicatures therefore requires a good memory and processing system, since both possible interpretations and assertions have to be maintained in the mind at the same time.

The Processing Limitation Hypothesis Chierchia et al. (2005) is based on the assumption that children have the necessary pragmatic and semantic knowledge to compute scalar implicatures but are not able to use it because of processing limitations. Chierchia et al. (ibid.) suggest that children have, due to a possibly limited memory system, problems with the recursive interpretation of statements and therefore fail to compute scalar implicatures. In an earlier essay Chierchia et al. (2001) developed the same hypothesis already but called it Reference-Set Hypothesis because they assume that the comparison of a reference-set (such as the strengthened meaning and the plain meaning) exceeds the processing capacity especially of younger children and is therefore responsible for their difficulties in computing scalar implicatures. Chierchia's assumptions are based on findings by Reinhart (1999) who suggested that the computation of reference-sets causes difficulties for children under the age of four or five.

Chierchia et al. (2005) stated already that if this hypothesis was true, children who fail to compute scalar implicatures would be expected to achieve worse results in a task that requires a good memory system than children who do calculate scalar implicatures.

### 3.2.3 Chierchia's alternative hypothesis

A third and alternative hypothesis offered by Chierchia et al. (2005) is that children do not compute scalar implicatures because they focus on the truthfulness or falsity of a statement rather than on its appropriateness in a certain context. This

would mean that children are able to compute scalar implicatures but do not do so because they focus on different aspects than adults when evaluating a statement. While adults pay more attention on the appropriateness of a statement in the given situation and therefore compute scalar implicatures, children seem to prefer to judge a statement based on its truthfulness or falsity.

If this hypothesis was true, then children should be able to judge statements adult-like if the focus of the task was on the felicity of a statement (Chierchia et al., 2005). If Chierchia's alternative hypothesis is correct, children should, if they are confronted with a felicity judgement task in which both statements are true, say that both statements are right but that one of the utterances is more adequate in the given situation and therefore better.



## Chapter 4

# Experiment on the acquisition of scalar implicatures

### 4.1 Linguistic purpose

Based on Noveck's experiment of scalar implicatures of the modal *might* and his thesis that scalar implicatures develop when children get older because they will be able to act according to the Cooperative Principle, I planned and conducted a German replication of the first experiment of Noveck's study (2001) in order to figure out whether and from which age onwards children calculate scalar implicatures.

For my experiment I chose the same age groups as the ones Noveck examined in his experiment in order to see whether German speakers achieve similar results as the English speakers in Noveck's study. Moreover, I was interested in whether these age groups are suitable for this task or reasoning experiment and if children indicate to have knowledge of or even stick to the Conversational Principles.

Furthermore, I modified the original design of Noveck's experiment slightly because the conjunction *or* might change the truth-conditions of some of the statements and may trigger additional implicatures for other statements of Noveck's study. In order to figure out whether young children's bad reasoning results in Noveck's study are caused by an inclusive interpretation of *or*, I used an act-out task to see how children interpret *or* in the context of the experiment.

Afterwards, I did the replication experiment of Noveck's study but with the small modification that I did not use the expression *or* in my task to see whether this influences the results and if so in which way. Additionally, I added another test sentence (*In der Schachtel könnte vielleicht A drin sein*), which is even more underinformative than the one Noveck used in his study. In this way I wanted to figure out whether this underinformative statement has an impact on children's computation of scalar implicatures and to see whether more implicatures are computed for this statement than for the slightly stronger one. Finally, I paid attention to other possible implicatures such as those that might arise from the statement *In der Schachtel könnte B drin sein* to see if somebody and if so who calculates implicatures for this statement.

## 4.2 Method

### 4.2.1 Preparations

In order to be able to conduct the following experiment on language acquisition I needed some voluntary subjects. Therefore, I got in touch with a kindergarden and a primary school. Since both institutions were willing to support my project, I prepared and send out letters to inform the children's parents about my project and to get their agreement. Once I got the parent's letter of agreement back, I contacted both institutions again to arrange a time and a date for my experiment.

### 4.2.2 Participants

The experiment was conducted with seven children who attend nursery, eight children who attend the 2<sup>nd</sup> grade of primary school and seven children who attend the 4<sup>th</sup> grade of primary school. The age of the children who attend nursery ranged from 5 years 1 months to 6 years 2 months. The mean age of those children was 5 years and 5 months. The age of the second graders at primary school was in the range between 7 years 5 months and 8 years 1 months. The mean age was 7 years 6.5 months. The age-range of the subjects who attend the 4<sup>th</sup> grade of primary school was between 9 years 4 months and 10 years 0 months. Their mean age was 9 years 6 months. All participants in this experiment were native speakers of German.

### 4.2.3 Materials

The style of the experiment is basically a German replication of Noveck's study (2001) study. Since Noveck's study also contained the logical term *or* in the task, I reformulated the sentences in order to make sure that the children's answers will not be influenced by a different understanding of *or*. Moreover, I stressed the contrast between the modal verbs *könnte* und *muss* by changing it to *muss auf jeden Fall* and *könnte vielleicht* in order to see if children will be more likely to compute scalar implicature if the contrast is stronger.

Three boxes were prepared for this experiment. The first box contained A, e.g. a bear. The second box contained A and B, e.g. a bear and a rabbit. Both boxes were opened so that the children were able to see the contents. The third box remained closed and the participants were told that this box contained the same toys as one of the two open boxes in front of them. Then the following six sentences were uttered in terms by two puppets: (1) *In der Schachtel muss B drin sein.* (false); (2) *In der Schachtel kann A und B drin sein.* (true); (3) *In der Schachtel muss auf jeden Fall A drin sein.* (true); (4) *In der Schachtel könnte vielleicht A drin sein.* (true); (5) *In der Schachtel könnte vielleicht B drin sein.* (true); (6) *In der Schachtel kann A drin sein.* (true). Three sets of sentences were prepared with different toys.<sup>1</sup>

<sup>1</sup>see Appendix B.1: Conceptual formulations

#### 4.2.4 Design and procedure

The session began with a short conversation and introduction of myself, the doll and the child. Afterwards the child was introduced to the three boxes. All of the boxes were closed and the child was allowed to open box I (content: doll and dog) and box II (content: doll only). Afterwards the experimenter pointed to the third box and said *In dieser Schachtel ist das Gleiche wie in dieser (experimenter points to the box that contains a doll and dog) oder wie in der dieser Schachtel (experimenter points to the box that only contains a doll)*. Then the child was presented with a fourth box which was empty and open. The experimenter then asked the participant to put the items they think box III contains into the fourth box. The child was allowed to pick toys out of a bag that contained two dolls, two rabbits and an elephant. This act out task was designed to check if the child had understood the task and to see what kind of meaning the child assigns to the logical term *or*, the inclusive or the exclusive interpretation. If the child understood the task correctly it is supposed to put either a doll or a doll and two dogs into the empty box. If it applies to the inclusive interpretation of *or* it should fill the empty box with two dolls and one dog.

After the child had filled the empty box correctly it was told that it did well and that it was now the puppets' turn to make predictions on the content of the covered box. It was now the child's task to judge whether the puppets' statements on the content of the box are right or wrong. To prevent that the child would feel uneasy or shy with respect to answering, the subject was given a glove-puppet as well, which was supposed to 'help' the child to evaluate the statements uttered by puppets that were controlled by me. Moreover, the child was told that the puppets would sometimes say things that are wrong. For a correct statement the puppets would be rewarded by the child. If both puppets are right but one puppet said it better, then the one who had said it better would get a bigger reward. For example, one of the puppets would say that the T-Shirt the experimenter was wearing is red in a situation where the T-Shirt was light-blue the puppet should not receive a reward. If the other puppet said the T-Shirt was blue it should get a reward. If the puppet would say that the T-Shirt was light blue, it should receive a bigger reward.

After this example the puppets and the child were introduced to three boxes. Again the children and the puppet were allowed to open the first two boxes. The first box would contain a dog and a rabbit, whereas the second box would contain only a dog. I then told the subject that I forgot what was inside the third box and that I could only remember the following about the covered box *Es kann sein, dass dieses hier (experimenter points to first open box) in der Schachtel ist. Es kann aber auch sein, dass dieses hier (points to the second open box) in der Schachtel ist. Vielleicht so (experimenter points to box that contained both a dog and a rabbit), vielleicht aber so (experimenter points to the box that contains only a dog). Es kann aber nur eines von beiden in der Schachtel sein, nicht beides.*

After the instruction was given, the first puppet would say *In der Schachtel muss ein Hase sein*. If the child understood the task properly it is expected to reject the sentence and not to reward the puppet since it made a wrong prediction. If the child accepts this sentence it indicates that the experimental setup was not understood

properly and has to be explained again. The statement (1) *In der Schachtel kann ein Hase und ein Hund drin sein* was designed to check if the task was understood correctly. Participants are expected to accept this utterance. The sentence (3) *In der Schachtel muss auf jeden Fall A drin sein* should be accepted by the participants since both open boxes contain A and if a statement is true for at least one of the open boxes it is also true for the third and closed box. With the help of the critical statement (4) *Da könnte vielleicht A drin sein* it is possible to study if children compute scalar implicatures. The expressions *vielleicht* and *auf jeden Fall* were added to strengthen the contrast of both modals on the Horn scale, e.g. for *könnte* to make the utterance as weak as possible on the scale. If the subject accepts this statement it means that he considers *könnte vielleicht* as compatible with *muss unbedingt*. The affirmation of the critical statement indicates that the participant interprets the modal logically. If participants reject this sentence in favour of the stronger equivalent it indicates that they compute scalar implicatures and do not treat *könnte vielleicht* as compatible with *muss unbedingt*. This approach is called the pragmatic approach. The test sentence (5) *Da könnte vielleicht B drin sein* was designed to see if children understand the meaning of *könnte* and understood the task of the experiment. If participants interpret the modal *könnte* properly, they should accept this sentences since item B (e.g. bear) might be in the box but does not necessarily have to be in the box. This statement also has the potential to trigger an implicature. If the sentence is understood in the way that there might only be B in the box, then participants are expected to reject this statement because B can only be the content of the box if A is the content of the box as well. The test sentence (6) *Da kann A drin sein* is a variation of the slightly weaker test sentence (4). This sentence was added because it allows to study if the distance of an item on the Horn scale influences the participants computation of scalar implicatures, e.g. if the participants will be less likely to compute a scalar implicature when the uttered statement is closer to the necessary true utterance. If participants reject sentence (4) *Da könnte vielleicht A drin sein* but accept (6) *Da kann A drin sein* it would mean that they prefer to compute scalar implicatures if the distance of both utterances is bigger and that the stronger term *kann* is not weak enough to trigger them to compute scalar implicatures. Furthermore, test sentence (6) was added to the study in order to reach an even amount of utterances so that each puppet would have the chance to utter the same amount of sentences.

After the first set of test sentences was asked a short break followed in which I played a patty-cake game with the child and had a short chat with the subject so that the child could relax. Afterwards the boxes were exchanged and the experiment was repeated. In total three different sets of boxes and random orders of the test-sentences mentioned above were used for each child.

#### 4.2.5 Conduction of the experiment

The experiment in the kindergarden was conducted on 10.09.2008. When I arrived in the kindergarden at 9 a.m. I found that the children just finished their breakfast and were in the bathroom to brush their teeth. Since I had a practical training in the kindergarden before, I was familiar with the facilities and the kindergarden



staff. The teacher told me which room I could use in order to be alone with the respective child so that I could conduct my experiment in a quiet and for the children familiar environment. While I was waiting for the children to finish the toilet, I set up the camera, toys and boxes that I would need. After the children had finished, the whole group came to welcome me. The teacher chose the first child that would take part in the experiment and left with the other children. Once the child entered the room, I found that the girl preferred to play on the ground rather than at the table. Therefore, I quickly rearranged the setting so that the child would feel more comfortable. The camera was standing in a distant corner so that the child would not feel uneasy due to its presence. The camera was focussed on the child and its puppet, the three boxes and myself as the experimenter. I was sitting with two puppets opposite to the child. The boxes were in front of me and the child and clearly visible for the camera. During the conduction of the experiment with one of the children, I was not pretty sure whether the girl was able to calculate scalar implicatures or not because she slightly hesitated to give an answer. I therefore, had the other puppet utter the statement *In der Schachtel muss A sein*. Suddenly, the girl remarked that the puppets were arguing. I quickly utilized this remark and asked her to act as a mediator to end the quarrel between those two puppets by deciding which puppet was right. Since this method worked quite well, I staged an argument of the puppets about a critical and the respective stronger statement for every subject, who participated in the experiment after this girl.

The experiment in the primary-school was conducted on 16.09.2008. When I arrived at school I was shown a classroom, in which I could be alone with my respective subject to conduct my experiments. I organized the materials that I would need for the conduction of the experiment and adjusted the camera. I arranged the boxes and materials on a table that was standing in the middle of the room. The camera was standing in the right corner, opposite to the table and was focussed on the child, the experimenter and the materials. The seating was designed in a way that I sat next to the child and the boxes were standing in front of us. After the room was arranged, I met the teacher of the 2<sup>nd</sup> grade and accompanied him to his class where I quickly introduced myself, picked my first subject, learned that one of my subjects was absent since he was sick and that there was another child who wanted to take part in the experiment as well and therefore returned her parent's letter of agreement back to me.

### 4.3 Results: 5-year-olds

Before the actual experiment started the subjects were shown two open carton boxes. One of the carton boxes contained a doll and a dog and the other carton box contained only a dog (stuffed animal). Then the participants were given an empty box and were told to fill the empty box with the same items that were inside box I or box II.

Except for one child, who seems to have interpreted the task differently, all of the children who attend nursery mastered this task well. Dalia, the only child who showed a different reaction than expected filled the empty box with two dolls and a

dog. This means that she applied a different syntactic structure to the sentence and therefore did not fill the box with all the items of box I or all the items of box II but with everything (the content of box I plus the content of box II). This reaction shows that she treats the content of each box as a fixed set and then puts both sets in the third box. Dalia does so because she considers the statements about the content of the covered box as an exhaustive description of the contents. Moreover, if one looks at the video tape again, it can be seen that Dalia added a dog to the box that contained a dog already. After the task was explained again and she was told that she would only have to fill the empty box, she put a dog and a doll inside the empty carton box. At that moment I told her that this was ok. However, she still picked up another doll and added it to the content of the first box. Because of that I explained her the task again and told her that she does not need to change the items in the first and the second box. When I asked her whether she had finished her task, she quickly put the doll (which she had meanwhile removed from the first box again) inside the original empty cartoon box and told me know that she had finished. The box which Dalia had filled contained now two dolls and one dog.

#### 4.3.1 Experiment I – bear and rabbit

The setting for this experiment was arranged in the way that box I contained a bear and box II contained a bear and a rabbit.

In this set of the experiment two out of six children (Maja and Johanna) evaluated the control statement *In der Schachtel muss ein Hase drin sein* correctly by rejecting it. Four other children (Ronja, Dalia, Amely, Maik) accepted this statement. Two of them (Ronja, Dalia) and explained that in this case both a bear and a rabbit will be in the box. This shows that these children tried to think of a situation in which this statement was true and came to the conclusion that in this case, both items will be in the box. This reaction means that these children did not pay attention to the modal verb but calculated a different kind of implicature (child implicature) for the control statement based on the assumption that the statements are exhaustive descriptions of the content of the box. This kind of interpretation of the statements was not expected. (Probably they were thinking something like ‘If the content of this box is the same as the content of box II then there has to be a rabbit as well as a bear.’) Maik said that this statement (*In der Schachtel muss ein Hase drin sein*) was true but when I asked him if there might be a rabbit or if there has to be a rabbit, he said that the box might contain a rabbit. This shows that he is able to distinguish *kann* and *muss*. He might have evaluated the statement wrongly in the first place because he did either not listen properly to the statement or focussed on the item which might be in the box rather than on the modal verb.

The statement *In der Schachtel muss ein Bär drin sein* was accepted by all of the children. However, the explanation why this statement was right, was not answered correctly by all of the children. Maja, for example, pointed to the box which only contained a bear and said that this statement was right because that box contained only a bear. This shows that Maja considered the statement to be an exhaustive description of the content of the box and might either have not really paid attention to the verb of the statement or did not really understand that it was her task to

evaluate possibilities and necessities in this experiment and therefore tried to match the statement with the content of the boxes. Maja's justification of her answer was quite interesting as well. She said that this statement was *richtig* and *halbrichtig* because the box was so big and the bear so small. However, after I explained the task to her again, she said that she was not sure, which indicates that she either considered the statement as an exhaustive description of the content or did not feel competent enough to evaluate this statement.

The statement *In der Schachtel könnte vielleicht ein Hase sein* was accepted by four out of six subjects and rejected by two children (Johanna and Ronja). Three children (Johanna, Ronja and Maja) however, computed a child implicature for this statement and said that a rabbit alone cannot be in the box because in this case there has to be a bear as well. These children were able to compute a child implicature because they considered the statement as an exhaustive description of the content of the box. This exhaustive understanding of the statement will change the truth-conditions of this utterance and trigger an implicature. This result shows that even very young children are able to calculate implicatures. As I have mentioned already this kind of implicatures are based on an exhaustive understanding of the statement and the fact that children seem to value the first Maxim of Quantity and the second Maxim of Manner more than the other conversational maxims.

The weaker of the critical statements *In der Schachtel könnte vielleicht ein Bär drin sein* was accepted by three children (Dalia, Amely and Maik) and rejected by two of the subjects (Ronja and Johanna). One child (Maja) gave a mixed answer by saying that the statement was *halbrichtig*. Unfortunately, she did not explain her answer, therefore it stays unclear if she answered in this way because she calculated a scalar implicature or because she considered the statement to be an exhaustive description of the content. Both options are possible. Johanna's first answer and explanation of her answer does not really make sense. The explanation she gave would rather match if one considers the statement *In der Schachtel muss ein Bär drin sein* as an exhaustive description of the content. Johanna explained her decision as follows: "*Weil – weil da . . . es ist ja nicht noch ein Teddybär da. Es ist ja nur ein und 'n Hase drin. Da muss ja der kleine nich no ma da sein. Das stimmt ja auch nicht.*" However, if one looks how the conversation between Johanna and me proceeds, it turns out that Johanna understands this statement as exhaustive description of the content and accepts it under the circumstances that there is only a bear in the box. At the end of the discussion, it seems that Johanna might be able to compute the expected scalar implicature for this critical term. However, I do not count this as an implicature in the analysis because I had suggested her already that this statement was wrong.<sup>2</sup>

The other critical statement *In der Schachtel kann ein Bär drin sein* was accepted by three out of four children. One child (Maja) gave a mixed answer by saying *Aber vielleicht kann nur ein Bär drin sein. Ein bisschen richtig*. This clearly shows that Maja considered the statement to be an exhaustive description of the content of the box and therefore did not compute a scalar implicature. Maja was not the only child who interpreted the statement based on this assumption, Johanna and Ronja also did so. This shows that it is impossible for these children to calculate

<sup>2</sup>see Appendix B.2.2: Johanna (Experiment I (b))

scalar implicatures because they applied a different interpretation to the statement than the one that was expected. This is because children are more likely than adults to accept the statement *In der Schachtel kann ein Bär drin sein* because they understand *Ein Bär ist drin* as *Nur ein Bär ist drin*. If one interprets the critical statements in this way one will be in a position where it is impossible to calculate scalar implicatures because this kind of interpretation will influence the context and the truth conditions of the statement. Under this condition the critical statements are really only possibly and not necessarily true.

### 4.3.2 Experiment II – dog and rabbit

In the second round of the experiment, one of the open boxes contained a dog (box I) and the other box contained a dog and rabbit (box II).

Two out of four children Dalia and Johanna accepted the statement *In der Schachtel muss ein Hase drin sein*. The other two subjects rejected the statement. It is not clear whether their answers were caused by an inclusive interpretation of *or*, by the difficulty of the task or by not paying enough attention to the modal verb of the statement. I am responsible for the missing answers of another two subjects because I forgot to ask them to evaluate the statements. In contrast to the mixed result of the first control statement, all six subject answered the second and easier control statement *In der Schachtel kann ein Hund und ein Hase drin sein* correctly.

Only four subjects were asked to evaluate the statement *In der Schachtel könnte viel-leicht ein Hase drin sein*. (Again, it is me who is responsible for the missing answers.) Three of the subjects who had to evaluate this statement accepted it. Only one girl, Ronja, was not sure how to evaluate this statement. Her answer clearly shows that she interpreted the statement as exhaustive description of the content but expected a dog inside the box as well. However, she did not show any reaction when I asked her again about the dog. Probably, she was not sure how to evaluate this statement because it was quite tricky. Moreover, it is my fault as well because I should have told her that we are talking about dogs only regardless whether there is a rabbit as well or not. However, this situation was difficult for me as well because none of the children had asked me before whether I meant that there was a rabbit only. Furthermore, I realised that she had calculated an implicature but I was not sure how much help I was allowed to offer her in order to interpret the statement in the way she was expected to do and whether my help or hints would influence her responses and the outcome of my experiment. Therefore, I decided not to interfere in her interpretation of the utterance too much.<sup>3</sup>

The statement *In der Schachtel muss ein Hund sein* has two possible answers, depending on what kind of interpretation one applies to the statement. Indeed, three out of six children understood the statement in the way it was intended and accepted it. Two children (Johanna and Ronja) rejected this statement, which indicates that they interpreted the statement pragmatically (and as an exhaustive description of the content). The explanation of Johanna's answer clearly shows that she used the exhaustive interpretation and therefore considers the statement as wrong because she feels that the modal verb is too strong in this context. Probably, Ronja also

<sup>3</sup>see Appendix B.2.3: Ronja (Experiment II (b))

applied to an exhaustive interpretation because her first and spontaneous reaction to the statement was *Ich denke da ist auch ein Hase und ein Hund drin* which implies that there does not have to be a dog alone in the box. Only one child (Maik) said *Ich weiß es nicht so genau*. This might either indicate that he did not feel competent enough to answer this question or that he applied to an exhaustive interpretation of the statement and would like to say that he is not so sure whether the content of the covered box is really only a dog or if the box contains both a dog and a rabbit. In order to figure out what he meant with his utterance, I should have asked him why he is not so sure. These results show that 50% of the children applied to the expected interpretation of the task and at least 33% (if not even 50%) of the children applied to the pragmatic interpretation of the statement and calculated a scalar implicature which adults normally would not compute (child implicatures).

Concerning the critical statements it can be said that four out of six children accepted the weaker one of the critical statements (*In der Schachtel könnte vielleicht ein Hund drin sein*). One of these children (Ronja) gave an explanation which did not really match with the statement but proves that she understood that there has to be a dog. Ronja said that the puppet was right because both boxes contained a dog. This shows that she has access to the information which is needed in order to be able to calculate scalar implicature for this statement. However, she interprets the modal *könnte* as compatible with *muss*. After thinking for a while, one child (Amely) stated that this statement was *halbrichtig*. Since she did not explain why she chose this answer it is not clear whether she computed a scalar implicature or if she considered the statement to be an exhaustive description of the context of the box (which seems to be a common phenomenon especially among younger children). The last subject, Johanna rejected this statement but her explanation does not match with the statement.<sup>4</sup> Later on this statement was asked again twice and Johanna's answer shows that she interpreted the statement as an exhaustive description of the content every time.

Only four children were asked to evaluate the critical statement *In der Schachtel kann ein Hund drin sein*. Again, it is me who is responsible for this mistake because I forgot to ask this statement. However, the results are similar to the ones for the first critical statement. Two out of four children accepted this statement, one child (Maja) said that it was *halbrichtig* and Johanna rejected this statement. There is no evidence why the subjects answered in this way but it can be said that the subjects that evaluated this statement gave the same answers as they gave for the other critical statement.

At the end of the experiment three children<sup>5</sup> were asked to judge which puppet was right, the one who had said in the covered box has to be a dog or the one who had stated that there might be a dog. Two of the children (Ronja and Johanna) said that the puppet who had said *muss* was right. These children were able to give a pragmatic answer (scalar implicature) in this context. Ronja even gave a

<sup>4</sup>see Appendix B.2.2: Johanna (Experiment II)

<sup>5</sup>Only three children were asked to do so because I got the idea to have the two puppets argue about the statements at the moment when I was conducting the experiment with Ronja. Since she was one of the last children who took part in the experiment, there is not data concerning this issue from the subjects who played this game with me before Ronja.

correct explanation by saying *Du (points to Casper) hast Recht, weil hier (points to both boxes) ist ja immer einer drin*. One child (Maik) said that he is not so sure yet but believes that Casper (who had said *muss*) was lying. Even after I explained the task again, he still thought that the puppet who had uttered *könnte* was right. This is probably because he considered the statement to be an exhaustive description of the content of the covered box. Based on this assumption only the modal verb *kann/könnte* is the correct verb to describe the situation (since there can only possibly be a dog alone in the box). At the end of the experiment and after Maik was allowed to see the actual content of the box, he said that Casper was actually right.

### 4.3.3 Experiment III – dog and doll

In this experiment the open boxes contained a dog (box I) and a dog as well as a doll (box II).

As in the previous two rounds of this experiment the statement *In der Schachtel muss eine Puppe sein* triggered mixed reactions. Two out of five children rejected the statement, two children (Dalia and Amely) accepted it in the first place and one subject (Maja) said that it was *halbrichtig*. Both of the children who originally accepted this statement rejected it after the setting and the task was explained once more. This shows that they are able to interpret the statement in the expected way as well.

All of the six subjects accepted the statement *In der Schachtel kann ein Hund und eine Puppe drin sein*. In this experiment the statement *In der Schachtel muss ein Hund drin sein* was accepted five out of six times. Only one child (Johanna) rejected this statement because she considered it to as an exhaustive information about the content of the box. Johanna explained that the statement was wrong because there was a dog and a doll in one of the boxes. This explanation is a good evidence that Johanna really understood the sentence as an exhaustive description. When I asked her whether this statement was true if it would not matter whether there was a doll or not, she said that in this case the statement was true. This reaction shows that Johanna has access to both, the exhaustive literal meaning and the expected interpretation of the utterance and knows how to evaluate the statement properly based on different interpretations. Johanna was consistent in considering the statements of this experiment as exhaustive descriptions of the content. This becomes obvious from her comment on the statement *In der Schachtel kann eine Barbie sein*.<sup>6</sup> Moreover, it appears in the conversation about this statement that she mixes up *kann* and *muss*. However, this might also be because she kept playing with her doll meanwhile. The fact, that she treats the statement *In der Schachtel kann ein Barbie sein* equal with the statement *In der Schachtel kann eine Barbie und ein Hund sein* is very obvious at the end of the conversation. At that moment the puppet had actually said *In der Schachtel kann eine Barbie sein* but Johanna remarks that the puppet has to receive a reward for having uttered the statement *In der Schachtel kann eine Barbie und ein Hund sein*. This shows that once we talk about a Barbie it means *Barbie and dog* for Johanna. This is because she

<sup>6</sup>see Appendix B.2.2: Johanna (Experiment III)

knows that the presence of only a Barbie is impossible and therefore computes a child-implicature. The rest of the children who attend nursery and had to evaluate the statement *In der Schachtel kann eine Barbie sein* stated that this utterance was right.

Concerning the critical statements three out of six children accepted the statement *In der Schachtel könnte vielleicht ein Hund sein*. The other three gave a mixed answer such as *halbrichtig*. One of the children who accepted this statement in the first place (Maja) said that the utterance was only *halbrichtig* when I reminded her that the puppet had said *könnte vielleicht*. It is not clear whether the children who gave a mixed answer did so because they considered the statement to be an exhaustive description of the content or because they calculated a scalar implicature. The results for the statement *In der Schachtel kann ein Hund sein* were similar to the ones of the slightly weaker critical utterance *In der Schachtel könnte vielleicht ein Hund sein*. Three out of five children accepted the statement and two subjects gave a mixed answer. Maja, one of the children who gave a mixed answer, definitely calculated a scalar implicature. She even explained her answer by saying *Da sind ja zwei Hunde, also müsste da ein Hund drin sein*.

When three of the children were asked which puppet was right, the one who had said that there has to be a dog or the one that had said that there might be a dog inside the box, all of them said that the puppet who had used the modal *muss* was right. Maja, however was the only child who said that both puppets were right but the one who had uttered *muss* had said it better.

#### 4.3.4 Summary

The pre-test results of the five-year-olds show that the vast majority of them are able to master the task and interpret *or* exclusively. One child applied a different syntactic structure to the task and therefore interpreted the statements as exhaustive descriptions of the content.

Concerning the actual experiment it appears on the first glance that five-year-old children are too young to master this reasoning task. However, this is not because their reasoning skills are not developed enough, this is because children interpret the statements differently than expected. It turned out that children tend to understand the uttered statements as an exhaustive description of the content. This kind of interpretation also affects the truth-conditions of the statements. Therefore, it is (based on a this kind of interpretation) impossible to compute the expected scalar implicatures for the statements *In der Schachtel könnte vielleicht A sein* and *In der Schachtel kann A sein* because *kann/könnte A* is the most informative statement under this circumstances.

However, based on the exhaustive reading of the statements there is a 'new' critical statement for which scalar implicatures can be computed. The new critical statement in this context would be the utterance *In der Schachtel muss A drin sein*. People, who consider this statement as an exhaustive description of the content and calculate scalar implicatures should reject this statement because it is too strong in this context (since there could also be A + B in the covered box). The results of my experiments prove, that actually some of the five-year-olds access this kind of inter-

pretation. In average 17.6 % of the five-year-olds computed a scalar implicature for this statement. While none of them calculated this kind of implicature in the first experiment, 40 % (possibly even 50 %) did so in the second and 16.7 % in the third round of the experiment. This shows that although only one child computed this kind of interpretation in the third experiment, three out of six children proved to have access to this kind of interpretation of the statement in the second experiment.

Moreover, it is eye-catching that many children also computed a (childlike) scalar implicature for the statement *In der Schachtel könnte B drin sein*. This statement can also trigger an implicature once it is understood as exhaustive description of the items in the box. Many of the children in my experiment rejected the statement because they imply that it is impossible that there is only B in the covered box. The results show that it seems to be common among five-year-olds to calculate an implicature for this statement. 50 % of the subjects did so in the first experiment. However, in the second and third experiment this kind of interpretation of the statement and the calculation of an implicature seems to decrease (see Table 4.1). This might be due to the fact that the children recognized the intention of the task and how they are supposed to interpret this statement.

Furthermore, some of the children who attend nursery seem to calculate an implicature for the statements *In der Schachtel kann/könnte vielleicht A drin sein*. However, the implicature they compute is not the one expected. Nearly all of the children's implicatures for these statements occur because they considered the utterance as an exhaustive description of the content. They calculate this kind of child-implicature because they do not focus on the modal verb of the utterance but on the item the puppet mentioned. In this case, for example they will only consider the possibility of A being inside the box and reject or evaluate this statement as *halbrichtig* because it is also possible that there is *A and B* in the covered box.

Although 66.6 % of the children gave a logical answer (yes-answers - I did not count *halbrichtig* or *weiß nicht*) to the statement *In der Schachtel kann/könnte vielleicht A drin sein*, only 16.6 % calculated a scalar implicature for this statement. This is because the scalar implicatures shown in this table are scalar implicatures in the sense adults calculate them (which means *no*-answers) and not child-implicatures. (Child-implicatures are presented in attachment C.6.) Moreover I only added those children who answered with *no* or gave an explanation which clearly shows that they calculated (adult-) scalar implicatures to this table. Those who said *halbrichtig* or *weiß nicht* were not counted as scalar implicatures in table 4.1.

The results of this experiment with children who attend nursery proves that these children are able to compute (scalar) implicatures. However, the implicatures they compute are not the same as the ones adults calculate or the ones that were expected. Children's implicatures are based on an exhaustive reading of the statement.



**Table 4.1:** Percentage of correct responses of the five-year-olds to modal statements in each of the experiments. 'Necessary conclusions' refers to the fact that item A has to be in the covered box while 'possible conclusions' refers to the fact that item B might be but does not have to be in the covered box.  
\* :  $p < 0.05$ , \*\* :  $p < 0.01$

statement	expected answer	experiment		calculated scalar implicatures					
		I	II	III	average	I	II	III	average
necessary conclusions (item A)									
muss auf jeden Fall A	yes	100**	60	83.3	82.4**	-	-	-	-
kann A	yes	75	50	60	61.5	?	?	20	6.6
könnte / könnte vielleicht A	yes	50	66.6	33.3	50	?	16.6	16.6	11.1
total		75*	60	58.8	64.6				
possible conclusions (item B)									
muss B	no	33.3	50	40	40	-	-	-	-
könnte vielleicht B	yes	66.6	75	100	80**				
kann A und B	yes	100**	100**	100**	100**	-	-	-	-
total		66.7**	76.9	81.3*	74.5**				

## 4.4 Results: 7-year-olds

The children who attend primary school were given the same pre-task as the children who attend nursery. The only difference was that the boxes contained different toys. Box I contained a ball and box II contained a ball as well as a doll. The majority of the children had no problem with this task and solved it quite quickly. Hanna filled the box with a doll and a ball, which is correct. However, when I asked her whether there was another possible solution for this task, she said that this was the only possible answer. This is why I explained her the task again and told her that there are two possible answers. But Hanna still did not know what the other possible solution was. Ayla Clara was the only subject who did not master the task in the first place. She filled the empty box with a ball and a rabbit. When I asked her whether the content of her box was now the same as one of the other boxes, she answered in the affirmative and said that her box contains the same items as box I. This is why I asked her to name the items in her box as well as the one of box I. At that moment she realised that the items were not the same. The pre-test was then repeated and Ayla Clara filled the box with the correct items straight away. Therefore, I assume that the pre-test task might have appeared too easy for her, so that she did not fully pay attention on what she was doing and that her first answer was purely an oversight.

### 4.4.1 Experiment I – bear and rabbit

In general it can be said that the seven-year-olds did quite well in the reasoning scenario. However, they still interpreted some statements differently than expected.

In this experiment box I contained a bear and box II contained a bear and a rabbit. Two of the subjects (Lara and Monique) answered most of the questions in the way it was expected. Lara even computed a scalar implicature for the logical weaker one of the critical statements (*In der Schachtel könnte eventuell ein Bär drin sein*). However, she partially accepted the first statement *In der Schachtel muss ein Hase drin sein* by saying *Ein bisschen*. It is difficult to say whether Lara accidentally gave this answer and did not think about it probably before answering or if she interpreted the statement inclusively. Monique, the other child, also gave the expected answer but considered the statement *In der Schachtel könnte vielleicht ein Hase drin sein* as an exhaustive description of the content. She added that this statement would only be true if there was a bear in the covered box as well.

A common phenomenon among the seven-year-olds was that they interpreted the statement *In der Schachtel muss auf jeden Fall ein Bär drin sein* as exhaustive information about the content. Five out of seven subjects evaluated the statement differently than expected. It was easy to figure out that they interpreted the statement exhaustively because all of them except Marie justified their decision. The subjects explained that it is not correct that there must only be a bear in the covered box since there was also a rabbit in the second box and it would therefore be possible that there is a rabbit and a bear in the closed box. Two out of those five children were told that it would not matter whether there was a bear in the box as well or not. Both children then consequently gave the expected answer. This

reaction and the explanations for the answers prove that even seven-year-olds still calculate child-implicatures.

Similarly, two children rejected the statement *In der Schachtel kann ein Hase sein* because they considered the utterance as exhaustive information about the content of the box. They accepted that statement only if there would be a bear in the box as well. One of these two children also interpreted the statement *In der Schachtel muss ein Bär sein* in the same way and came up with a similar explanation. Ayla Clara who considered the statement *In der Schachtel muss ein Hase sein* as exhaustive information about the content of the box, was not asked the statement *In der Schachtel kann ein Bär sein*. Therefore, it is unknown in which way she would have interpreted this statement.

Concerning the critical statements two of the seven-year-olds (Ayla Clara and Lara) computed a scalar implicature for the statement *In der Schachtel könnte vielleicht ein Bär sein* whereas only one of the subjects calculated an implicature for the slightly stronger statement *In der Box kann ein Bär sein*. Ayla Clara, who computed a scalar implicature for the slightly weaker critical term was not asked to evaluate the stronger critical term. Therefore, it stays unknown whether she would have computed a scalar implicature for that statement or not.

All of the seven-year-olds were confronted with a critical statement (*In der Schachtel kann/könnte vielleicht ein Bär sein*) and the logically stronger statement *In der Schachtel muss ein Bär sein* at the end of the experiment. Seven of the subject favoured the logically stronger statement. Four of the participants rejected the weaker statement because they considered it to be wrong. Three of the subjects said that the weaker statement was true as well but that the modal *muss* was more adequate. Only one child, Hanna, said that the logically weaker term was correct because otherwise there has to be a bear and a rabbit in the box. This explanation matches with her behaviour in the experiment and proves that she assumed the statement to be an exhaustive information about the content of the box. It also shows that it is impossible to compute scalar implicatures based on her interpretation of the statements.

#### 4.4.2 Experiment II – dog and elephant

In this experiment box I contained a dog and box II contained a dog and an elephant. Just as in the first experiment some of the seven-year-olds interpreted certain statements as if they were exhaustive descriptions of the content. For example six out of seven children answered the statement *In der Schachtel könnte vielleicht ein Elefant sein* correctly although two out of seven subjects (Hanna and Monique) assumed the statement to be an exhaustive description of the content which would mean that there is only an elephant inside the box.

Two out of eight children (Marie and Ayla Clara) partially or fully accepted the statement *In der Schachtel muss ein Elefant drin sein* in the first place. Ayla Clara, however, rejected the statement when she had to evaluate it again later on. When she had to judge how good the statement was for the first time, she accepted it because she thought that if there has to be an elephant there has to be a dog

as well. She therefore concluded that this statement was only true if there was an elephant and a dog in the box. This is why she said that the uttered sentence was *halbrichtig*. Her way of thinking can be traced based on the remarks she made before she evaluated the statement.

Furthermore, two out of eight children (Theresa and Robin) interpreted the statement *In der Schachtel muss auf jeden Fall ein Hund sein* as exhaustive information about the content of the box and therefore rejected it. Theresa, however, changed her mind and accepted the statement after the task was explained again and after she was reminded that she could compare the content of the opened boxes with each other to figure out whether the statement was right or wrong.

With respect to the critical statements it can be said that only seven out of eight children were asked the statement *In der Schachtel kann ein Hund drin sein*. All of the asked subjects accepted this statement. In contrast to this result, only four out of eight children accepted the critical sentence *In der Schachtel könnte vielleicht ein Hund drin sein*. One of the subjects (Theresa) evaluated this critical statement as *halbrichtig* and three other subjects (Lara, Marie and Hanna) rejected the statement. Marie and Hanna who computed a scalar implicature for this statement in this second experiment did not do so in the first experiment.

At the end of the experiment seven out of eight children were confronted with two puppets. One of the puppets uttered a critical statement and the other puppet uttered the statement *In der Schachtel muss ein Hund drin sein*. The subjects had to decide which puppet was right. Three of those subject said that *muss* was right and *kann/könnte* was wrong, two of them said that *muss* was better, one subject (Marie) said that *könnte* was better and another subject (Anthony) said that both puppets were right. After Anthony was allowed to see the content of the covered box he said that *muss* was right and *kann* just a little bit right. Marie's reaction to this comparison of the two statements is a little bit surprising since she proved earlier that she is able to compute scalar implicatures and knows which statement is more informative. It might be possible that she did not fully pay attention to the task or felt competent enough to answer the task without thinking about her answer probably beforehand. These results show that all of the children are able to use Grice's Conversational Maxims and know which statement is most adequate in what kind of situation.

#### 4.4.3 Experiment III – dog and rabbit

The open boxes contained a dog (box I) and a dog and a rabbit (box II). In this experiment only one child (Theresa) evaluated all of the statements adult-like and even computed scalar implicatures for both critical statements. Another child (Robin) interpreted the statements as exhaustive description of the content. His reaction to the statement *In der Schachtel muss auf jeden Fall ein Hund drin sein* prove this. Robin still rejected this statement although he was told that for answering this statement it would not matter whether there was a rabbit in the box as well. Robin even said that it would be wrong to use the modal *muss*. Five out of eight children understood some of the statements in the expected way and other statements as exhaustive descriptions. This shows that these children have access to the 'adult-

like' interpretation of the statements but still prefer to interpret certain statements exhaustively. For example, Ayla Clara interpreted the statement *In der Schachtel könnte vielleicht ein Hund drin sein* pragmatically and therefore rejected it. In contrast to that she accepted the statement *In der Schachtel könnte ein Hase drin sein* only partially because if the covered box contains a rabbit, it should contain a dog as well. Her reaction to this statement shows that she expected the statement to be an exhaustive description of the content. One child (Lara) answered the statement *In der Schachtel muss ein Hase drin sein* wrongly in the first place. After the task was explained again and she had to decide whether *muss* or *kann* was correct, she said that *muss* was the correct verb. However, when I told her that we would open the covered box at the end of the experiment, she quickly changed her mind and stated that there *could* be a rabbit in the covered box. Therefore, I am not quite sure whether she applied to an inclusive interpretation when first answering the question or if she felt competent enough to evaluate the statement and therefore did not pay attention to which item of the box I was talking about, the dog or the rabbit. Lara answered all of the other questions correctly in the first place.

Furthermore, it needs to be said that all of the children answered the statement *In der Schachtel muss ein Hund sein* correctly except Robin, who understood the statement as an exhaustive description of the content of the box. Two out of seven children (Monique and Ayla Clara) interpreted the statement *In der Schachtel könnte vielleicht ein Hase drin sein* literally. Ayla Clara considered the statement as partially right and therefore gave a mixed answer. Monique, however, proved that she had access to both interpretations, the expected 'adult-like' interpretation and the exhaustive interpretation (which is the basis for child-implicatures). She evaluated the statement as right in the first place but when she had to evaluate the same statement again later on, she said that it was wrong because the covered box should under this circumstances contain both a dog and a rabbit and not only a rabbit.

Only two out of six children answered the statement *In der Schachtel muss ein Hund drin sein* correctly in the first place. One child (Anthony) gave a mixed answer and three children (Lara, Marie and Ayla Clara) accepted the statement in the first place but rejected it after the task was explained again or after they were asked whether *muss* or *kann* was the correct verb.

Concerning the critical statements only two out of eight children (Theresa and Ayla Clara) computed a scalar implicature for the statement *In der Schachtel könnte vielleicht ein Hund sein*. Two other children (Hanna and Anthony) gave a pragmatic answer for this statement as well but the implicature these two children computed was triggered and based on the assumption that the statement provides exhaustive information about the content of the box. Only one child (Theresa) out of six children who were asked to evaluate the statement *In der Schachtel kann ein Hund drin sein* calculated a scalar implicature for this utterance.

At the end of the experiment when the children were asked to decide which puppet was right, the one who said *In der Box muss ein Hund sein* or the one that said *In der Schachtel kann/könnte vielleicht ein Hund sein*, six out of seven children gave a pragmatic answer. Three out of these six children said that *muss* was right and the other three said that actually both puppets were right but *muss* was more

appropriate than *kann*. Only one child (Marie) said that *könnte* was better. This might indicate that she understood the statement as an exhaustive description of the content. However, after she was allowed to open the covered box she said that *muss* was right.

#### 4.4.4 Summary

Since nearly all of the seven-year-old children mastered the pre-task well it seems that they do not have any trouble with the interpretation of *or* and that this logical term did probably not affect the results in Noveck's experiment.

To sum up the results of the actual experiment, it can be said that only one child (Theresa) evaluated most of the statements she heard in the way it was expected. She only understood one statement of the first experiment (*In der Schachtel muss ein Bär drin sein*) as exhaustive description of the content. Theresa did not calculate scalar implicatures in the first experiment, which might be related to her understanding of the just mentioned logical stronger statement. In the second experiment Theresa only calculated a scalar implicature for the weaker one of the critical statements (*In der Schachtel könnte vielleicht ein Hund sein*) and in the third experiment for both critical statements. This might indicate that Theresa's awareness of statements that trigger scalar implicatures grew during the experiments.

Lara, who was largely error-free as well (except at the beginning of the third experiment when she originally accepted the statement *In der Schachtel muss B drin sein* but later rejected it), seems to be able to calculate scalar implicatures as well because she always rejected the statement *In der Schachtel könnte A drin sein* in the first and second experiment. In the third experiment, however, she suddenly said *vielleicht* which shows that she understood the statement as exhaustive description of the content of the box at that moment.

The rest of the seven-year-old children who took part in the experiment applied both (exhaustive and expected) interpretations to the statements that had to be evaluated. This shows that this age group seems to have access to both the adult (expected) interpretation and exhaustive interpretation (which can trigger child-implicatures) of the utterances. It also has to be mentioned that although some of these children sometimes rejected the weaker one of the critical statements, none of them ever rejected the logically slightly stronger statement *In der Schachtel kann A drin sein*.

Two of the subjects who had access to the childlike (exhaustive reading) and adultlike ('normal') interpretation of the statements never computed scalar implicatures for any of the critical statements. When they were confronted with a critical statement and the logical strongest statement both children also tended to say that both puppet's were right but that *muss* was more appropriate.

These results suggest that there might be a correlation between children who consider both statements as right but the logical stronger one as better, the interpretation (exhaustive understanding or normal) they apply to the statements and the amount of scalar implicatures they compute. If one looks at the results in more detail, there seems to be indeed a correlation between these factors. Those children (Theresa, Lara and Ayla Clara) who considered the weaker critical statement to be

wrong when they had to compare it to the stronger one computed scalar implicatures in at least two out of three experiments. On the other hand the children who apply both the understanding that the utterance is an exhaustive description of the content and the normal interpretation to the statement, tend to say that *muss* is better but both puppets are right. The same children also compute scalar implicatures (if they do so at all) less often than those children who prefer the ‘normal’ interpretation of the statements. The children who stated that actually both puppets were right but the verb *muss* was more appropriate either rejected the critical statements not at all (Monique and Robin) or rejected it in only one out of three experiments without giving an explanation (Marie and Hanna). Moreover, Hanna and Anthony rejected the weaker of the critical statements in experiment III. However, they did not do so because they calculated a scalar implicature, they did so because they considered the statement to be an exhaustive description of the statement. Therefore, I am not quite sure whether those children who rejected the critical statement once and consistently said that both puppets were right but the verb *muss* more appropriate calculate scalar implicatures or if they just rejected the statement because they interpreted the statement as exhaustive description of the content.

Concerning the statement *In der Schachtel kann/könnte B sein* some of the seven-year-old children (Monique, Hanna, Ayla-Clara) rejected this statement because they understood the statement as exhaustive description of the content of the box and calculated a child-implicature. One child (Monique) even did so in all of the experiments. In contrast to her answer in the first experiment Hanna (partially) accepted this statement in the second and third experiment but explained that this statement was only true if there was item A in the box as well. This shows that although she did not calculate a child-implicature anymore at this moment she still understood the statement as an exhaustive description of the content of the box.

**Table 4.2:** Percentage of correct responses of the seven-year-olds to modal statements in each of the experiments.  
 \* :  $p < 0.05$ , \*\* :  $p < 0.01$

statement	expected answer	experiment			calculated scalar implicatures				
		I	II	III	average	I	II	III	average
necessary conclusions (item A)									
muss auf jeden Fall A	yes	37.5	75	87.5*	66.6	—	—	—	—
kann A	yes	100**	100**	83.3	94.7**	—	—	16.7	5.3
könnte / könnte vielleicht A	yes	75	50	50	58.3	25	37.5	25	29.2
total		68.2	73.9*	72.7*	73.2**				
possible conclusions (item B)									
muss B	no	75	75	33.3	63.6	—	—	—	—
könnte vielleicht B	yes	71.4	85.7*	85.7*	80.95**	—	—	—	—
kann A und B	yes	87.5*	87.5*	100**	91.7**	—	—	—	—
total		78.3**	82.6**	75*	78.6**				



## 4.5 Results: 9-year-olds

The nine-year-old subjects were given the same pre-task as the seven- and five-year-olds. The open boxes contained the same items as they did for the seven-year-olds namely, a ball and a puppet in the first box and only a ball in the second box. All of the nine-year-old children mastered the pre-test well and filled the empty box correctly by either filling it up with a ball and a doll or only with a ball.

### 4.5.1 Experiment I – bear and rabbit

The open boxes contained a bear (box I) and a bear and a rabbit (box II). More than half of the nine-year-old children understood and mastered the task well. Generally, it can be said that the reasoning abilities of this age group are good. Two out of seven children gave adult-like answers which means that apart from mastering the reasoning task, they also computed scalar implicatures for both statement *In der Box kann ein Hase drin sein* and *In der Schachtel könnte vielleicht ein Bär drin sein*.

However, one of the subjects (Chiara) differs from the average in the way that she apparently got the statement *In der Schachtel muss ein Hase sein* wrong. She might have answered wrongly because she felt competent enough to make a judgement and therefore did not really pay attention to the statement. Otherwise, her answer would only be correct for an inclusive interpretation of the task. Moreover, two out of the children who evaluated this statement correctly additionally implicated or directly said that *kann* is the adequate verb to use in this situation. This behaviour shows that these children are cooperative and pragmatically orientated.

One of the fourth-graders (Nils) unexpectedly computed an implicature for the statement *In der Schachtel könnte vielleicht ein Hase drin sein*. He rejected this statement because he calculated a child-implicature and understood the statement in the way that it describes the exhaustive content of the box, which means that he understood or interpreted the statement as *There might be a rabbit alone in the box*.<sup>7</sup>

If one looks at the results of the whole group of nine-year-olds one can see that more scalar implicatures were computed for the statement *In der Schachtel könnte vielleicht ein Bär sein* than for the statement *In der Schachtel kann ein Bär sein*.<sup>8</sup> For the latter of both statements it is also observable that the amount of no-answers is not identical with the amount of children who computed a scalar implicature because one child (Nils) clearly computed a scalar implicature but gave a mixed answer since he does not consider the uttered statement as completely wrong. This shows that this child is aware of both the pragmatic interpretation and the literal meaning of the statement.

At the end of the experiment those children who did not compute scalar implicatures for one or both of the critical statements during the experiment, were confronted with a critical statement and the stronger equivalent. They now had to judge which puppet was right. Three out of four children proved that they had

<sup>7</sup>see Appendix B.2.5: Nils (Experiment I)

<sup>8</sup>see Appendix C.9: Results: 9-year-olds

access to the pragmatic interpretation of the statement by favouring the stronger statement. Two out of those three children additionally stated that both statements are correct although *muss* is more adequate in this context. The fourth child computed a scalar implicature because it said that *könnte vielleicht* was wrong. However, one subject believed that the weaker term *kann* is correct. It is unclear whether the child mistakenly gave the wrong answer or not. Another possible reason for this reaction is that the subject calculated a child-implicature because it understood the statement as *Nur ein Bär ist in der Schachtel* which is under this circumstances possibly but not necessarily true.

#### 4.5.2 Experiment II – dog and elephant

In this experiment box I contained a dog and box II contained a dog and an elephant. Just as in the first experiment, there were two children that answered all of the statements correctly and computed scalar implicatures for both critical statements. Moreover, in this set of the experiment there were two children who evaluated all of the statements correctly in the first place but did not compute scalar implicatures for the critical statements (*In der Schachtel kann/könnte vielleicht ein Hund sein*) or did so only for one of the critical sentences. Additionally, one of the children who evaluated the statement *In der Schachtel muss ein Elefant sein* correctly added that there also has to be a dog. This shows that this subject gives an pragmatic answer and sticks to Grice's Conversational Maxims by providing as much information as needed in the context.

The phenomenon that some of the nine-year-olds understand certain statements as exhaustive description of the content seems to be common among my subjects. One of the nine-year-olds (the same child as in experiment I) understood the statement *In der Schachtel könnte vielleicht ein Elefant sein* in this way. He rejected the statement and calculated a child-implicature because it is impossible that there is only an elephant in the covered box. Another subject, Manuel, understood the statement *In der Schachtel muss auf jeden Fall ein Hund sein* as exhaustive description of the content in the first place. After he was told that it would not matter whether the box additionally contained an elephant or not, he came up with the correct answer straight away.

Again, in this replicate of the experiment three out of six children computed implicatures for both critical statements (*In der Schachtel könnte vielleicht ein Hund sein* and *In der Schachtel kann ein Hund sein*). However, it has to be noted that only two children computed scalar implicatures for both statements (Marlen and Peter) and that two other subjects (Louise and Chiara) only computed a scalar implicature for one of the statements. This shows that Louise and Chiara are able to compute scalar implicatures but do it randomly, which means that they are not consistent in computing scalar implicatures yet.

At the end of the experiment those children who did not clearly indicate that they are able to compute scalar implicatures or did not compute scalar implicatures at all were asked which puppet was right the one who said *In der Schachtel kann/könnte vielleicht ein Hund drin sein* or the one that stated *In der Schachtel muss ein Hund drin sein*. Two out of those three children said that *muss* is better than

*kann/könnte vielleicht* and one of them added that actually both statements are right but *muss* is more adequate. This again shows that all of the children use Grice's Conversational Maxims. Furthermore, these results also give a possible explanation about why those children did not compute scalar implicatures during the experiment. Probably they did not do so because they have access to both, the literal meaning and the pragmatic interpretation of the modal, which means that they are theoretically able to compute scalar implicatures and in addition to this they know that the weaker modal *kann/könnte vielleicht* is not completely wrong just because it is less adequate in this context than the stronger modal *muss*.

However, one child (Manuel) considered *kann* as better than *muss*. He probably did so because he considered the statements to be exhaustive descriptions of the content and calculated based on this assumption a child-implicature. After he was allowed to open the covered box and saw its content he was repeatedly asked which statement was more adequate in this context. At that moment he still insisted that the stronger statement (*In der Schachtel muss ein Hund sein*) was wrong. His behaviour matches with his first understanding of the same statement during this experiment and experiment I. It seems that Manuel assumed the statement to be an exhaustive description, which would mean that there has to be a dog only in the box. This interpretation of the statement also explains why he does not compute scalar implicatures. This is because it is impossible to compute scalar implicatures if one understands the statement as an exhaustive description of the items in the box. The case of Manuel is a good example to prove that even the oldest participants of my experiment still (and even consistently) calculate child-implicatures.

### 4.5.3 Experiment III – dog and rabbit

In this experiment box I contained a dog and box II contained a dog and a rabbit. In the third replicate of the experiment two of the children (the same ones as in the previous two experiments) were error-free and used a pragmatic interpretation of both critical statements.

One of the subjects, Louise, evaluated the statement *In der Schachtel könnte vielleicht ein Hase sein* pragmatically. At first, she rejected the statement and explained that there could only be a rabbit in the box if there was a dog in the box as well. When she had to evaluate the same statement again, she accepted it but only under the circumstance that there would be a dog in the box as well. However, in the previous two replicates Louise interpreted the statement in the way it was expected. Her behaviour in this last replicate shows that even nine-year-old children still calculate child-implicatures.

It can be said that one of the subjects, Chiara, interpreted the statement *In der Schachtel könnte ein Hund sein* pragmatically although she did not explicitly reject the statement. She gave a mixed answer by saying *Ein bisschen richtig, ein bisschen falsch*. Chiara provided a mixed answer because she does not consider *muss* as wrong. She thinks that the modal *muss* is just less adequate in this situation.

All of the subjects who computed a scalar implicature for the critical statements *In der Box kann ein Hund sein* also did so for the statement *In der Schachtel könnte*

*vielleicht ein Hund drin sein*. This shows that all of the children are consistent in their answers and treat both critical terms in the same way.

Just as in the previous experiment those children who did not compute scalar implicatures were confronted with a critical statement and the stronger statement *In der Schachtel muss ein Hund drin sein*. All of the subjects gave the pragmatically correct answer. Two out of three subjects said that *muss* is more adequate and one child (Manuel) said that *muss* was the correct term in this context, which implies that he considered the logically weaker term as wrong. This shows that he computed a scalar implicature in this situation although he did not do so during the actual experiment.

#### 4.5.4 Summary

Since all of the nine-years olds did very well in the pre-test, the logical word *or* does not seem to have any impact on Noveck's results.

Concerning the results of the nine-year-olds in the actual experiment it can be said that two out of six children were error-free in each replicate of the experiment and used the pragmatic interpretation for both critical terms. Besides, it can be said that except Manuel all of the children who did not compute scalar implicatures in the experiment proved to have access to the pragmatic interpretation of the logical weaker statement when they were asked to judge which of the statements (*kann/könnte vielleicht A – muss A*) was right.

Louise's and Chiara's behaviour with respect to the critical statements suggests that their awareness of the critical logical terms grew during the experiments and led to the result that they computed scalar implicatures for both critical statements in the last experiment. In the first experiment Louise only computed a scalar implicature for the weaker one of the critical terms (*könnte vielleicht*). In the second experiment it seems that she realized that the slightly stronger term *kann* also triggers implicatures and in the last replicate of the experiment she computed scalar implicatures for both critical statements. Chiara did not compute scalar implicatures for any of the critical terms in the first experiment. In the second experiment the weakest logical term (*könnte vielleicht*) seems to have caught her attention and led to the result that she computed a scalar implicature. In the following (and last replicate) she used the pragmatic interpretation for both critical terms. Therefore, I think it would be interesting to see whether this development was real or a coincidence. To find out, more replicates would have to be done. Furthermore, it would be interesting to see whether this phenomenon is just a temporal one or if the subjects would interpret the same statements pragmatically in the first place if the same experiment would be repeated after a couple of weeks or months.

Manuel is the only child who did not compute scalar implicatures in any of the replicates. However, this does not mean that he is unable to compute implicatures at all. He does not calculate scalar implicatures because he considered the stronger term *muss* as wrong since he understood the statement *In der Schachtel muss auf jeden Fall A drin sein* as exhaustive description of the items in the box in the second round of the experiment. If one interprets the statements in the way Manuel did, it is impossible to compute scalar implicatures in this context because the statement

*In der Box kann A drin sein* would be the most informative one. This explains why Manuel was the only child that did not compute scalar implicatures.

The fact that some of the nine-year-old children (Nils and Louise) rejected the statement *In der Schachtel könnte B drin sein* and even explained that they did so because this statement cannot be an exhaustive description of the content of the box, shows that this kind of interpretation and the calculation of child-implicatures is (even among the oldest participants of my study) still a common phenomenon.

**Table 4.3:** Percentage of correct responses of the nine-year-olds to modal statements in each of the experiments.  
 \* :  $p < 0.05$ , \*\* :  $p < 0.01$

statement	expected answer	experiment			calculated scalar implicatures				
		I	II	III	average	I	II	III	average
necessary conclusions (item A)									
muss auf jeden Fall A	yes	100**	83.3	100**	94.4**	—	—	—	—
kann A	yes	50	50	33.3	44.4	33.3	50	50	44.4
könnte / könnte vielleicht A	yes	33.3	50	33.3	38.7	66.6	33.3	50	50
total		61.1	61.1	55.6	59.3				
possible conclusions (item B)									
muss B	no	83.3	100**	100**	94.4**	—	—	—	—
könnte vielleicht B	yes	83.3	83.3	83.3	83.3**	—	—	—	—
kann A und B	yes	100**	100**	100**	100**	—	—	—	—
total		78.3**	82.6**	75*	92.3**				

## 4.6 Comparison

Before evaluating the critical statements I want to focus on children's reasoning competence to see at roughly which age children are competent enough to deal with this kind of reasoning task. It is important to check whether the majority of children had a reason to answer in the way they did or whether their correct answer just occurred by chance because the chance level that a subject would give a correct answer due to guessing is 0.5. The percentages of correct answers for each of the six modal statements can be seen in table 4.4. In order to figure out whether the answers occurred by chance, I used a non-directional test of significance. Therefore, I calculated the t-value for proportions. Afterwards I compared my results with the critical t-value of the chart which presents the t-distribution in order to see whether my results are significant.

**Table 4.4:** Average of correct responses to modal statements of Experiment I to III in percentage.

In this table I consider *yes* as the correct answer for the statements *In der Schachtel kann/könnte A sein* although it underdetermines the fact that there actually has to be A in the covered box. I do so because it is according to the truth table of the task the correct answer. This is because once a statement is true for at least one of the open boxes, it is also true for the covered box.

\* :  $p < 0.05$ , \*\* :  $p < 0.01$

statement	correct answer	age (years)		
		5	7	9
muss auf jeden Fall A	yes	82.4**	66.6	94.4**
kann A	yes	61.5	94.7**	44.4
könnte / könnte vielleicht A	yes	50	58.3	38.7
total		64.6*	73.2**	59.3
muss B	no	40	63.3	94.4**
könnte vielleicht B	yes	80**	80.9**	83.3**
kann A und B	yes	100**	91.3**	100**
total		74.5**	78.6**	92.3**

If one considers the average results of the three experiments, the table shows that the correct answers of the five-year-olds are above chance level in three out of six statements. For these three statements the answers of the five-year-olds are even highly significant. Moreover, their total percentage of correct answers for possible conclusions is highly significant ( $p < 0.01$ ) above chance level while the one for the necessary conclusions is only significantly above chance level ( $p < 0.05$ ). Concerning the average of corrects results of the three sets of experiments, seven-year-olds are above chance level in three out of six conditions. Their answers are highly significant. Moreover, table 4.4 shows that seven-year-olds are in average (of the three sets

of experiments) highly significant above chance level concerning the evaluation of possible and necessary conclusions. In average of the three sets of experiments, the nine-year-olds answered correctly at rates that are highly significant above chance level for four out of six statements. Moreover, their total percentage of correct answers of possible conclusions is highly significant ( $p < 0.01$ ) above chance level while the one for necessary conclusions is not even simply significant above chance level. However, the bad result for necessary conclusions are due to the fact that this age group is more likely than any of the other age groups to interpret the critical statement pragmatically.

Anyway, it is difficult to say which age group shows the earliest signs of mastering the task. Both the five-year-olds as well as the seven-year-olds are significantly above chance level for three out of six statements (although not for the same three statements). The nine-year-olds are the only age group which answered all of the statements except the critical ones correctly at rates that are above chance level. Moreover, especially the five- and seven-year-old children interpreted some of the statements as exhaustive descriptions of the content which has an impact on the amount of correct results for the statements *In der Schachtel muss A sein* and *In der Schachtel könnte B sein* and makes it more difficult for the amount of correct answers to pass chance level. Based on a this kind of understanding of the mentioned statement (exhaustive reading), especially the younger children tend to calculate different kind implicatures (child-implicatures).

Noveck (2001) states that seven-year-olds are the youngest ones who master the reasoning task consistently. In my experiment it cannot be said clearly which age group is the youngest one to show consistent competence in the reasoning task because nearly all of the statement are somehow critical and children apply different kind of interpretations to the same statement which results in the calculation of different kinds of implicatures (child-implicatures or ‘normal’ scalar implicatures). Moreover, the five- and seven-year-olds produced in average results that are highly significant above chance level for three out of six statements and the seven-year-olds for four out of six statements. Furthermore, there is, except for the statement *In der Schachtel muss B drin sein* (which has a highly significant difference), no significant difference between the five-year-olds and nine-year-olds for any of the statements. The results of the five- and seven-year-old children for the same statements do not even show a simply significant difference. This seems to indicate that even the five-year-olds in my study are competent enough to master this reasoning task already.

With respect to the results of the reasoning experiment, the five-year-olds in Noveck’s study are (in total) highly significant above chance level for the evaluation of necessary conclusions and not significant above chance level for evaluating possible conclusions, whereas the five-year-olds in my study are (in total) highly significant above chance level for the evaluation of possible conclusions and simply significant above chance level at evaluating necessary conclusions. Concerning the individual statements, Noveck’s five-year-olds are simply significant above chance level for the evaluation of nearly all the necessary conclusions while my five-year-old subjects only passed chance level for one of the necessary conclusions. With respect to possible conclusions (of the individual statements) my five-year-olds are even highly significant above chance level for two out of three possible conclusions



while Noveck's subjects did not reach results that are significantly above chance level for the evaluation of possible conclusions.

If I compare the result of my three individual sets of experiments<sup>9</sup> and also the average of all of them with Noveck's data, there is no significant difference between Noveck's results and mine.<sup>10</sup> Only for the statement *In der Schachtel muss A drin sein* in the first experiment there is a significant difference between the results of my seven-year-old subject and the results of Noveck's subjects<sup>11</sup>. This difference is even highly significant ( $t < 0.01$ ). While only 37.5% of my subjects answered this statement in the way it was expected, 90% of Noveck's subjects gave the expected answer. This highly significant difference between the results is probably caused because the majority of my subjects thought that the statement was an exhaustive description of the items in the covered box. For the same statement in the second set of my experiment, there was no significant difference between my data and Noveck's data anymore because a higher amount of the seven-year-old children interpreted the statement in the way it was expected.

With respect to the statement *In der Schachtel muss B sein* and the influence of the logical connective *or* it has to be said that there is no significant difference between Noveck's results and my results (neither in the average of the experiment nor in one of the sets of experiments). This shows that my assumption, that the logical connective *or* might have an impact on the results of Noveck's experiment, is wrong since there is no significant difference between the results of my experiment and Noveck's results.

Concerning the interpretation of the critical statements only the seven-year-olds interpreted the statement *In der Schachtel kann A sein* semantically at rates which are significantly above chance level and significantly higher than that of the five- and nine-year-olds. This is because the majority of the nine-year-olds seem to assume that the possibility of finding A in the covered box is wrong because they expect that A is necessarily inside the covered box and therefore calculate scalar implicatures. With respect to the critical statement *In der Schachtel könnte vielleicht A sein* none of the age groups in my study gave a logical correct answer at rates which is significantly above chance level. This is because my subjects assumed that this statement was an exhaustive descriptions of the content of the covered box or calculated scalar implicatures for this statement more often than for the slightly stronger critical statement *In der Schachtel kann A sein*. However, there is, except for the seven-year-olds in my second set of experiment ( $t < 0.05$ ), no significant difference between the amount of logical correct answers for the statements *In der Schachtel kann A / könnte vielleicht A sein*. This means that only the seven-year-olds in my second set of the experiment treat the two critical statements differently.

Especially for the five-year-olds the understanding of the critical statements *In der Box kann A / könnte vielleicht A sein* in the way that they considered these statements as exhaustive description of the items in the covered box influences the amount of semantically (logically) correct answers by preventing children to calculate scalar implicatures. However, as the results of my experiments show, five-year-olds

<sup>9</sup>see Appendix C.7 to C.9

<sup>10</sup>I used the non-directional test for my calculations.

<sup>11</sup>see Appendix C.3: Noveck's results

calculate child-implicatures and a small number of subjects of this age group even calculates scalar implicatures for the critical statements.<sup>12</sup> This has an impact on the reasoning results. Therefore, it can be said that the reasoning results of the critical statements are influenced by two factors firstly, the amount of scalar implicatures and secondly the amount of exhaustive interpretations of the content of the box which lead to the calculation of child-implicatures.

**Table 4.5:** Overview scalar implicatures. Percentage of scalar implicatures calculated in average for the modal statements in experiment I to III.

statement	age (years)		
	5	7	9
kann A	7.6	5.3	44.4
könnte / könnte vielleicht A	11.1	29.2	50

Moreover, not all of the children who rejected the critical statements *In der Schachtel kann A / In der Schachtel könnte A sein* calculated scalar implicatures. Table 4.5, which shows the amount of scalar implicatures for each statement, only includes those subjects who rejected the critical statement and those subjects who justified their answer and indicated that they calculated scalar implicatures. The same holds for the percentage of those who calculated child-implicatures and those who interpreted the statement as exhaustive description of the content<sup>13</sup>. It also has to be mentioned that there is a certain amount of unknown results for the critical statements because the subjects did not justify why they rejected the critical statements. This means that they either rejected the statement because they considered it to be an exhaustive description of the content or because they calculated scalar implicatures. However, table 4.5 shows that there is a significant difference between the amount of scalar implicatures calculated by the five-year-olds and the nine-year-olds ( $p < 0.05$ ) and a highly significant difference between the seven- and nine-year-olds ( $p < 0.01$ ) concerning the critical statements. For the statement *In der Schachtel könnte A sein* the amount of scalar implicatures increases continuously.

To sum up the results of my study, the following can be said:

1. In general it can be said that the calculation of scalar implicatures increases with the subject's age, which confirms Noveck's findings.
2. In my experiment the statement *In der Schachtel könnte A sein* is more likely to trigger scalar implicatures in the seven-year-old subjects than the slightly stronger statement *In der Schachtel kann A sein*. For the other age groups there is no significant difference in the amount of pragmatic interpretations for both statements. (see Table 4.5)
3. Although only a small minority of the five-year-olds in my study eventually calculated scalar implicatures, there is evidence that even the youngest age

<sup>12</sup>see Table 4.5: Overview Scalar Implicatures; and Appendix C.6: Overview: Child-implicatures (Early scalar implicatures)

<sup>13</sup>see Appendix C.5: Overview: Exhaustive interpretations

- group of my subjects is able to compute scalar implicatures for the critical statements. Moreover, this age group is more likely to compute scalar implicatures for the statement *In der Schachtel könnte A sein* (11,1%) rather than for the statement *In der Schachtel kann A sein* (7,6%). (see Table 4.5)
4. Moreover, there seems to be a correlation between the amount of children who considered the statement as exhaustive description of the content and those who calculated scalar implicatures. While scalar implicatures are increasing with age, child-implicatures, which are triggered by an exhaustive interpretation of the content of the box, are decreasing. If one compares table 4.5 with table C.7 one can see that the five-year-olds calculate child-implicatures more often than scalar implicatures. Roughly the same amount of seven-year-olds calculate scalar implicatures for the statement *In der Schachtel könnte A sein* as they understood the statement as exhaustive description of the content of the box / calculated child-implicatures for the statement *In der Schachtel muss A sein*. The nine-year-olds compute scalar implicatures much more frequently than child-implicatures.
  5. Based on statistical calculations of the difference between my data and Noveck's data, there is no significant difference between any of my results or the average of my results and Noveck's data. This confirms Noveck's findings and shows that the logical term *or* does not influence the results of Noveck's study. Since both studies were conducted in different languages (Noveck's in English and mine in German) and the results do not differ significantly from each other one might conclude that children's behaviour concerning scalar implicatures seems to be universal.
  6. One of the most important findings of my study is that especially young children calculate a different kind of implicature (child-implicature) than adults for the statements *In der Schachtel kann/könnte B drin sein* and *In der Schachtel muss A drin sein*. This kind of implicature is based on the idea that the statements describe the exhaustive content of the box. While the amount of children who calculate child-implicatures for the statement *In der Schachtel muss A sein* seems to change with the age of the subjects, the amount of children who calculate child-implicatures or understand the statement *In der Schachtel könnte B drin sein* as exhaustive description of the box seems to remain quite stable. This finding proves that (in contrast to research literature) even very young children do calculate implicatures.



# Chapter 5

## Discussion

### 5.1 Discussion of hypotheses

#### 5.1.1 Noveck

Trying to find an explanation about why children prefer the semantic interpretation of the modal *might* in a situation where the modal *must* is more adequate, while adults prefer to interpret the critical modal pragmatically, Noveck (2001) rejects two interpretations of this phenomenon.

The first hypothesis Noveck rejects is the assumption that “younger children are just looking for a quick verification” (ibid.). This means that children only consider the logical interpretation of the modal *might* and do not think any further. Noveck rejects this hypothesis because the data he got is not consistent with this idea. After I have reviewed the video-tapes of my subjects and have reviewed the data I got from my own experiment, I have to say that the children were not impatient but thought about the respective modal statement before they evaluated it. Therefore, I have to say that I agree with Noveck and do not believe in this hypothesis.

The second hypothesis which Noveck rejects, states that both adults and children have equal access to implicatures, “but that the context more readily cancels it for children than for adults” (ibid.). Noveck rejects this hypothesis because he feels that scalar implicatures among children should occur more often in his data than they did occur. Secondly, he cannot see a good reason for why the context cancels scalar implicatures for children and not for adults. Noveck supports his theory by stating that cancelling implicatures is more complex than calculating them. He therefore expects “more sophisticated participants” to cancel implicatures rather than the other way round (ibid.).

I agree with Noveck’s line of argumentation and his hypothesis that the cancelling of scalar implicatures should be more complex than their calculation. However, the findings of my experiments suggest that children seem to have a reason for not computing scalar implicatures: the understanding of the statement as an exhaustive description of the content of the covered box. As can be seen in my experiment, all age groups, even the youngest ones, neglect the exhaustive interpretation of the statement and are able to calculate scalar implicatures in a situation where they are confronted with both modal statements and have to decide which puppet was right.

Nevertheless, I am not quite sure yet whether children calculate scalar implicatures first and then cancel it and whether this is due to the fact that they take the statements as exhaustive description of the content of the box or because children are not able to calculate scalar implicatures when they hear the critical statements separately. The latter possibility might be true if the idea that the statement is an exhaustive description of the content comes to the subject's minds first and in this way blocks their access to scalar implicatures.

Moreover, Noveck (ibid.) comes up with two possible explanations about why children interpret the critical statement more often semantically than pragmatically. First of all, he suggests that children prefer the semantic interpretation of statements rather than the pragmatic one.

In contrast to Noveck, I do not believe in this hypothesis because although the data of my experiment shows that children interpret the critical statement more often semantically (logically) than pragmatically it also indicates that children prefer to interpret other statements in the same experiment pragmatically. For example, in average 33.3% (see table C.7) of the five-year-old children applied to a pragmatic interpretation (child-implicature) of the statement *In der Schachtel könnte vielleicht B sein* while only 7.6% (see table 4.5) of that age group interpreted the statement *In der Schachtel kann A sein* pragmatically ('normal' scalar implicatures). From my point of view, the higher amount of semantic interpretations for the critical statement *In der Schachtel kann/könnte A drin sein* does not arise because children prefer the logical interpretation of the statement but because children's evaluation are based on a different understanding and interpretation of the statement.

Noveck's second suggestion was that the logical interpretation is easier to access for children than the pragmatic interpretation. Further, he explains that especially young children seem to have less access to the pragmatic interpretation than older subjects or adults. He assumes that the subjects accept the critical statement until they find a good reason to reject it. Moreover, he thinks that children's answers indicate in how far they process the statement and "how far they go in their reflections" (Noveck, 2001).

From my point of view, Noveck is right with the assumption that the semantic/logical interpretation of *might* seems to remain the default interpretation. From my perspective, this is because younger children consider the exhaustive reading of the uttered statements concerning the content of the box more adequate any other interpretation which arises from further reflections on the statement. However, when children get older, the understanding of the statement as exhaustive description of the items in the box, which had up to now interfered with the calculation of scalar implicatures, becomes the less prominent interpretation of the statement and gives way to the pragmatic interpretation of the critical statement. However, I do not agree with Noveck's remark that children do less processing than adults when reflecting on the critical statements. The phenomenon that children are able to calculate scalar implicatures when they have to decide which statement was right (the semantically correct one or the pragmatically correct one) and their reactions in the situation when they were told that it would (for the evaluation of the critical statement) not matter whether B was in the covered box as well or not, shows that children do not do less reflections on the statements than adults. It also proves that

the higher amount of semantic interpretations of the statements in children are the consequence of understanding the uttered statement as exhaustive description of the content of the covered box.

### 5.1.2 Chierchia

I will now discuss the hypotheses introduced by Chierchia et al. (2001, 2005). The first hypothesis is the Pragmatic Delay Hypothesis which was introduced in chapter 3.2.1 and states that children have semantic but lack pragmatic knowledge. Chierchia et al. (2001) suggested that if this hypothesis was true, children should use a weaker scalar term in a situation where the stronger term would be more appropriate.

In order to figure out whether this hypothesis is true, Chierchia et al. (ibid.) developed the Felicity Judgement Task, which tests whether children recognize a difference between two statements which have the same truth-value but differ in appropriateness. In an experiment by Chierchia et al. (2001, 2005) which examined children's comprehension of *or* children were told a story and then had to evaluate which statement was better, the one that contained the conjunction *and* or the one with the disjunction *or*. The outcome of the experiment was that 93.3% of the children (56/60 children) chose the more adequate statement which contained the conjunction *and*. With the help of their new experimental technique Chierchia and colleagues were able to show that the Pragmatic Delay Hypothesis must be wrong because their results show that children know and use the Maxim of Quantity.

The results of my experiment confirm Chierchia's findings. In the situation where both puppets were arguing about a critical statement and the stronger pragmatic statement, 83% of the five-year-olds, 81% of the seven-year-olds and 80% of the nine-year-olds favoured the more adequate statement *In der Schachtel muss A sein*. Chierchia's and my results show that even if children should lack of some pragmatic knowledge, they do know the Maxim of Quantity, which is essential pragmatic knowledge for the calculation of scalar implicatures. Therefore, it can be said that the Pragmatic Delay Hypothesis cannot explain why children calculate less scalar implicatures than adults.

Chierchia's alternative hypothesis (Chierchia et al., 2005) states that children make their judgements about a statement based on truthfulness or falsity of a statement rather than on appropriateness. As mentioned already this would mean that children are actually able to calculate scalar implicatures but do not do so because they focus on a different aspect of the statement. If this thesis is right, and children do focus on truthfulness or falsity rather than on appropriateness, then children who are confronted with both, the critical statement *In der Schachtel kann/könnte A drin sein* and the pragmatically correct statement *In der Schachtel muss A drin sein*, are expected to say that actually both puppets were right.

The results of my experiment show that some of the children do indeed consider both puppets as right (which supports this hypothesis) but add that the puppet who had uttered the more appropriate statement had said it better (which does not support this hypothesis). These results support Chierchia's hypothesis in the way that they prove that children do focus on truthfulness and falsity of a statement when

making an evaluation. However, all of the children added that one of the puppet had said it better. This shows that children do not neglect appropriateness in favour of evaluating the truthfulness or falsity of a statement (as Chierchia suggested) but pay attention to appropriateness at the same time.

Moreover, children's evaluation of a statement concerning truthfulness/falsity and appropriateness vary with the age. While in average only 20% of the five-year-olds said that both puppets are right, 50% of the seven-year-olds and 75% of the nine-year-olds did so or said that the statement *In der Schachtel muss A sein* was more appropriate (which implies that the statement *In der Schachtel kann/könnte A sein* is right as well). This indicates that this hypothesis does not seem to be true for this setting (argument-setting/felicity) because there is a development in age which implies that the older the children get, the more they are aware that both statements are true. This result is contradictory to the one expected and implies that the hypothesis is wrong.

However, the number of children who were confronted with both statements and had to evaluate which puppet was right, is not representative because only three of the 5-year-olds, seven of the seven-year-olds and four of the nine-year-olds were asked. This amount is not representative. Therefore, I do not want to make a definite statement on the truthfulness or falsity of this hypothesis although the data implies that the thesis is wrong. In order to prove whether this hypothesis is right, the experiment has to be repeated with a bigger number of children. Moreover, it would be interesting to see whether there are other researchers who applied to this technique or have data which might confirm or reject this hypothesis.

### 5.1.3 Crain and Khlentzos

Crain & Khlentzos (2008) argue that children do not only have an innate Language Faculty but also a Logic Faculty which enables young children to make competent judgements about linguistic phenomenon such as entailments, ambiguity and contradictions. Moreover, they present arguments which support their supposition "that disjunction is inclusive-*or* in human language". The authors apply Fodor's Mad Dog Nativism, which is a line of arguments that is said to prove that every primitive lexical concept is innate, to logical concepts<sup>1</sup> and come to the conclusion that "primitive logical concepts are innate." Moreover, they support their line of argumentation with empirical evidence from child language and cross-linguistic research. The authors also suggest that logic is innate and therefore not learnable no matter how much time and input the learner receives to acquire logical concepts.

If this hypothesis is true and young children calculate less scalar implicatures than the older ones because logical concepts are innate, then I would expect, that the logical (semantic) interpretation of critical terms is easier to access (since it is innate) and should, especially among the younger subjects, occur more frequently than the pragmatic interpretation. Moreover, I would expect that the first and spontaneous evaluation of the critical statement should receive a higher amount of logical interpretations by the subjects than the same statement when it occurs later. Therefore, the amount of logical responses should not increase when the experiment

<sup>1</sup>see Appendix D.4: Mad Dog Logical Nativism



is repeated. Instead it should stay stable or decrease because the awareness of another possible interpretation of the statement might arise when children have to evaluate the same statement repeatedly.

The data I got from my experiment supports the innateness hypothesis and shows that younger children did indeed apply the exhaustive literal meaning to the critical statements more often than the older subjects. 30–40% of the five- and seven-year-olds understood the statements *In der Schachtel muss auf jeden Fall A sein* and *In der Schachtel könnte vielleicht B sein* as exhaustive description of the content of the box. Consequently, the younger subjects calculated scalar implicatures much more seldom than the older ones. Logical answers occurred especially among the five- and seven-year-olds much more frequently than scalar implicatures. Additionally, the pragmatic answers increased with the age of the subjects. The highest score of “adultlike” pragmatic answers and scalar implicatures was found in the oldest group of subjects which took part in my experiment (the nine-year-olds) for the statement *In der Schachtel könnte A drin sein* (50%).

Moreover, the critical statements received a higher amount of semantic responses in the first and second set of the experiment in each age group, which shows that children first apply the semantic interpretation to the statement because it seems to be easier to access. In the second and third set of statements the amount of logical correct answers decreased slightly.

#### 5.1.4 My hypothesis

According to my point of view children go through three to four stages before they start to calculate scalar implicatures for the statements in my experiment.

In the first stage children interpret the statements they hear based on the Q-Principle and the Co-operative Maxim. Moreover, they stick to the acquired semantic meaning of the uttered statement and consequently apply the semantic interpretation to the statement. Moreover, children believe that the statements *In der Schachtel muss/kann A sein* and *In der Schachtel kann B sein* are exhaustive descriptions of the content of the box. With respect to the task in my experiment, children’s strategy to master the task is to try to figure out with the help of the statements they heard, which of the open boxes contains the same items as the covered box because they treat the statements they heard as exhaustive descriptions of the content of the box. Therefore, they try to match the sentences they hear with one of the open boxes. For this reason, it appears on the first glance as if children’s focus is on the truthfulness or falsity of a sentence rather than its appropriateness.

In the second stage children understand the uttered statements as exhaustive descriptions of the content of the covered box and try to figure out for which box the statement is true. The new achievement in this stage is that children start to exploit the Q-Principle and even conduct child-implicatures which are mainly based on the Q-Principle. Children think that the speaker said as much as he can and provided sufficient information. They rely on the Q-Principle and therefore believe that the statement, e.g. the statement *In der Schachtel kann B drin sein*, is an exhaustive description of the whole content of the covered box. In this stage children typically react to the statement *In der Schachtel muss ein A sein* as follows:

*Nur A also. Das ist falsch.* This reaction clearly shows that children are capable of calculating implicatures based on the Q-Principle in this stage already. However, they do not expect yet that the speaker applies to the R-Principle (which means provide the necessary information but do not say more than you must) and says less than he actually means. Therefore, children do not get the idea to think further than accepting the statement they heard as exhaustive description of the content of the box. Children's answers are in this stage only based on the assumption that the speaker applies to the Q-Principle. Although some of the children use the R-Principle in this stage (by just evaluating the statement as wrong rather than giving any evidence for their answer) it seems that they have not fully discovered the R-Principle yet but use it before they are fully aware of it.

For some of the statements, such as for the utterance *In der Schachtel kann / muss B drin sein*, some children did already discover (at the end of the second stage) that the speaker violated the R-Principle, which means that the speaker did not provide as much information as necessary. If the speaker had fully obeyed the R-Principle, he should (according to the child's point of view) have said that he is not talking about the whole content of the box and that item A could be in the box at the same time as item B although he only mentions item B in his statements. However, children still stick to an exhaustive interpretation of the statement. It seems that the statements *In der Schachtel kann / muss B drin sein* invite children to think of other possible interpretations of the statement because they can without putting too much effort realize that the speaker violated the R-Principle (he did not give all the necessary information) since they cannot directly match this statement with one of the open boxes (because none of the open boxes contains only item B). This phenomenon shows that children and adults seem to have a different understanding of what is *necessary* (or according to Grice's Maxims *required*) information in this context. While adults believe that the statement *In der Schachtel muss A / kann B sein* is sufficient or informative enough to understand the statement and the intention of the task (because they also stick to the maxim *Do not say more than you must* (Horn) / *Do not make your information more informative than required* (Grice)), children do not consider this information as sufficient / informative enough because they understand the task differently. Anyhow, children in this stage still interpret the task wrongly because they have not figured out yet that it is purpose of the task to evaluate possibilities and necessities. They, therefore, try to match the uttered statement to one of the open boxes and calculate child-implicatures. This is possibly because children are consistent in the strategy they apply to in order to solve the task and because they might think that the tricky part of this statement is that they have to realize that the speaker 'violated' the Q-Principle. (The statement 'violated the Q-Principle' refers to the idea, that from the children's point of view the information is not sufficient enough and does not contain all the information the speaker should have provided. However, from adult's point of view the information is sufficient and not more than required because they know the intention of the task.)

In contrast to the set of statements just mentioned, the sentences *In der Schachtel kann / muss A drin sein* do not invite children to consider these statements as a violation of the R-Principle because these sentences are ambiguous unless the speaker explicitly says *In der Schachtel kann / muss eines der A's drin sein* and, therefore,

does not contain an obvious violation of the Q-Principle. This is probably the reason why all of the seven-year-old children accepted the statement *In der Schachtel kann A sein* in the first and second experiment. From my point of view young children tend to interpret an ambiguous sentence as exhaustive description of the whole content because they prefer the presumably innate logic interpretation of the statement and do not expect that the speaker implies something and violates the Q-Principle. For adults, in contrast, the reason for cancelling the (innate) semantic interpretation of the statement is stronger because they are more likely to realize the purpose of the experiment and therefore compute scalar implicatures more often than children.

In the third stage children have a new / different understanding of the task. They now evaluate the uttered statements based on the content of the task. This means that they first consider the content of the open boxes and then evaluate whether the statement the puppet uttered is right or wrong (and not the other way round). Moreover, children realize in this stage that the speaker violated the Q-Principle. Now they neglect the Q-Principle by themselves as well and focus on the R-Principle instead. Children, therefore, interpret the statement pragmatically but give a logical answer (because they neglect the Q-Principle). The phenomenon that children consider the statement *In der Schachtel kann / könnte A sein* as exhaustive description of the content, which had up to now interfered with the calculation of scalar implicatures (because the statement is ambiguous), becomes now the less prominent interpretation and gives way to the ('adultlike') pragmatic interpretation of the statement. This causes that the amount of exhaustive interpretation for this statement decreases and the amount of scalar implicatures increases.

In the fourth and final stage children use both the Q- and R-Principle when interpreting the uttered statement. After having acquired the R-Principle they now start to exploit the Q-Principle again and therefore interpret the critical statements pragmatically (in the same way as adults do) and calculate scalar implicatures.



# Chapter 6

## Summary and Outlook

### 6.1 Summary

To sum up the main findings of this assignment the following has to be said:

1. Only two out of twenty-two children did not master the pre-task in the first place. This shows that the majority of the children interprets *or* in this kind of task as exclusive-*or*. This indicates that young children's bad reasoning results in Noveck's study (2001) are not caused by a different reading of *or*. Since there is no significant difference in the results of my experiments and Noveck's data, I can conclude that the results of my experiment I to III confirm the outcome of the pre-test I conducted as well as Noveck's findings concerning scalar implicatures.
2. Due to the fact that the results of both studies (Noveck, 2001; and my study) do not show any significant difference, although they were conducted in different languages, one can assume that the subject's evaluation of the statements in this kind of setting and task are universal.
3. Concerning the results of the reasoning experiment the nine-year-old children in my study gave the expected answers for all of the statements except the critical ones. Moreover, their answers were highly significant above chance level, which shows that they are consistent in their answers and competent enough to master this task. Five- and seven-year-old children also show highly significant results for some of the statements (but for different statements than the nine-year-olds) which shows that they are consistent in their answers as well and did not just guess the answer. However, younger and older children evaluated the statements at rates that are significantly above chance level for different statements because their results are influenced by a different interpretation of the statement and a different strategy to solve the task (see chapter 5.1.4: My hypothesis).

4. With respect to the Conversational Principles, it can be said that children do know and use them. Apart from that, they do not only rely on the Conversational Principles but exploit the Q-Principle at the age of five already. Later, when they realise that the speaker violated the Q-Principle and applied the R-Principle to his utterance, children start to be aware of this maxim and use it by themselves. This new awareness helps them to understand the task in a different way (see chapter 5.1.4: My hypothesis).
5. The results of my experiment show that the five-year-old subjects in my study are actually able to calculate scalar implicatures for the statement *In der Schachtel könnte A sein*. However, only a small minority which is not representative did so.
6. As expected, the statement *In der Schachtel könnte A sein* is more likely to trigger scalar implicatures in the subjects (of all age-groups) than the critical statement *In der Schachtel kann A sein*. However, the difference in the amount of computed scalar implicatures for both statements is only significant in the data of the seven-year-olds.
7. Concerning the acquisition of scalar implicatures the following has to be said:
  - a. The amount of calculated scalar implicatures increases with the subject's age. This confirms Noveck's findings. The nine-year-old subjects computed the highest amount of scalar implicatures. There is a significant difference between the five- and nine-year-olds and a highly significant difference concerning the amount of calculated scalar implicatures between the seven- and nine-year-olds.
  - b. There seems to be a growing awareness of critical scalar terms from experiment I to experiment III. Some children, for example Theresa, Louise and Chiara, calculated scalar implicatures in the third experiment but did not do so in the first experiment.
  - c. Moreover, there seems to be a correlation between the children who considered the critical statements as better, right or wrong and the interpretation of the statement as well as the calculation of scalar implicatures. For example, those children who considered both statements to be right did not calculate scalar implicatures.
  - d. Apart from that, there seems to be a correlation between the phenomenon that children consider the statement as exhaustive description of the content of the box and the calculation of ('normal'/'adultlike') scalar implicatures. While scalar implicatures are increasing with age, the child-implicatures, which are triggered by a the understanding that the statements describe the whole content of the covered box, are decreasing.
  - e. Finally and most importantly, children do calculate implicatures at the very young age of five already, e.g. for the statement *In der Schachtel könnte B sein* and for the statement *In der Schachtel muss A sein*. This kind

of child-implicatures are upper-bound scalar implicatures because children believe that the speaker made the most informative statement and that his statement refers to the exhaustive content of the covered box. Adults in contrast calculate lower-bound scalar implicatures for the same statements because they infer that the speaker is talking at least about the item mentioned. Some of the nine-year-olds still calculate child-implicatures. The differences in childlike and adultlike scalar implicatures arise because the conversational (sub) maxims children and adults value most differ. While adults value the second Maxim of Quantity and the third submaxim of Manner most, children value the first Maxim of Quantity and the second Maxim of Manner more than the other Maxims of Grice's Conversational Principles. (Based on Horn's theory it has to be said that adults value the R-Principle more than the Q-Principle, while children prefer the Q-Principle to the R-Principle.) As we have seen the understanding of the task of the experiment also has an impact on what kind of Conversational Maxims the subjects exploit.

8. With respect to the hypotheses on language acquisition, the thesis that children just evaluate the statements quickly without thinking about them too much, must be rejected because neither mine nor Noveck's empirical results (Noveck, 2001) are consistent with this idea.

Although Noveck (*ibid.*) rejects the hypothesis that children cancel implicatures more often than adults do (because he expects more sophisticated people to cancel implicatures rather than the other way round), I still think that this hypothesis might be partially true. I think so because the findings of my experiments suggest that children have a reason for not computing scalar implicatures, namely the idea that the statements refer to the whole content of the box. I think that scalar implicatures in children are not cancelled but prevented by this kind of understanding of the statement because this interpretation of the statement seems to come to the subject's minds first and in this way blocks their access to scalar implicatures.

Concerning the Pragmatic Delay Hypothesis, I have to say that, although the data of my experiment shows that children interpret the critical statement logically more often than pragmatically, I still reject this hypothesis. I do so because my data also indicates that children prefer to interpret other statements in the same experiment pragmatically. I therefore think that children's evaluations are based on a different understanding and interpretation of the statement and not on a lack of pragmatic knowledge. Moreover, evidence from my experiment as well as the results from Chierchia et al. (2001) show that the Pragmatic Delay Hypothesis is wrong because even young children know and use the Maxim of Quantity.

Another suggestion by Noveck (2001) was that the logical interpretation of the critical statement is easier to access for children than the pragmatic interpretation. This seems to be true because logic seems to be innate and because children stick to the semantic interpretation of the statement and even the idea that the statement refers to the whole content of the box before they

think about any other possible interpretation. However, I do not agree with Noveck's remark that children do less processing than adults when reflecting on the critical statements.

The alternative hypothesis (Chierchia et al., 2005) that children make their judgements about a statement based on the truthfulness or falsity of a statement rather than on appropriateness appeared to be right on the first glance. However, some of my subjects consider both, the critical and the logical correct statement to be right but added that the logically correct statement was more appropriate. This shows that children do not neglect appropriateness in favour of evaluating the truthfulness or falsity of a statement. In contrast to the predictions of this hypothesis, there is evidence that the older the children get, the more likely they are to say that actually both statements are correct. Therefore, this hypothesis has to be rejected as well.

Crain & Khlentzos (2008) developed the hypothesis that children process a Logic Faculty which enables them to make competent judgements about linguistic phenomena. Based on this theory young children come up with the logical interpretation of statements first because the logical interpretation is the innate setting and, therefore, easier to access. My data supports the hypothesis of Crain & Khlentzos because it proves that young children indeed apply the logical interpretation to the critical statements more often than older subjects. Additionally, in each age group the critical statements received a higher amount of logical responses in the first sets of the experiment and the amount of logical correct answers decreased slightly in the second and third set of the experiment.

9. Based on the results I got from my reasoning experiment on scalar implicatures, I developed my own hypothesis about the acquisition of scalar implicatures. From my point of view children go through three to four stages before they start to calculate scalar implicatures for the statements in my experiment.

In the first stage children's answers are based on the Q-Principle and the Co-operative Maxim. They therefore interpret the statements literally and as exhaustive description of the box and use a different strategy than adults and older children to solve the task of the experiment.

In the second stage children calculate child-implicatures based on the exploitation of the Q-Principle. However, they do not realize that the speaker is implying something as well. Here it becomes obvious that there is a difference in children's competence and performance concerning implicatures. Although they are calculating implicatures, it seems that they are not fully aware of it and, therefore, do not expect that the speaker implies something as well.

Once children reach the third stage, they discover the R-Principle and realize that the speaker is violating the Q-Principle. Children now use a new strategy to solve the task of the experiment. This new understanding of the task is related to the discovery of the R-Principle. Now children are aware of that the speaker does not say all he knows. Therefore, they now rely on all the evidence they (or both speaker and hearer) have. This is why they do not match the uttered statement with the open boxes any longer but do it the



other way round by matching the content of the open boxes with the uttered statement. Now, children interpret the uttered statement pragmatically but neglect the Q-Principle and give a logical answer. This is probably because the logical answer is easier to access, since it seems to be innate.

In the last and final stage children calculate scalar implicatures because they are aware of the Q- and R-Principle and exploit the Q-Principle.

## 6.2 Evaluation and possible improvements to my experiment

Although I tested the experiment at home, went through all the sentences I would say to the children and prepared a sheet of paper which contained the task and the statements for each round of the experiment as a backup and reminder for myself, so that I would not forget statements in the actual experiment, I still made some mistakes during the conduction of the experiment.

I found that it was very difficult to explain the task to the children adequately without mentioning the term *oder*. Moreover, I have to criticise myself on the same issue as I criticised Noveck before: When I looked at the video tape again I found that when I had to repeat the task or explain the task to the children one more time, I accidentally mentioned the critical term *oder* although I was trying to avoid it. However, in these cases I realized it most of the times and did in order to make sure that the children do not interpret the statement inclusively point out that I meant *entweder . . . oder . . .* but not both. Additionally, I found that I occasionally used the modal *kann* when I had to explain the task repeatedly. This happened because I found that for some children, especially for those who attend nursery, a somehow simpler explanation of the task would be more suitable. I realized that my original explanation of the task was quite tricky or complicated for them because it consisted of a very long and complex sentence. Therefore, I tried to find an easier and less complicated way to explain the same task. At that moment I focussed on not mentioning the critical term *oder* and did not realize that I occasionally used one of the modals I wanted to investigate in this experiment. Although, I think that this did not influence the results of my experiment I believe that in a perfect description of the task I should neither have mentioned *oder* nor *kann*. In order to improve this issue next time, different formulations of the task should be prepared and learned by heart beforehand because it is nearly impossible to look at a paper to read out the task during the conduction the experiment. This is because, during the experiment, the experimenter has to pay attention that he would not forget to mention an utterance, control two hand puppets at the same time, talk to the child and if necessary mediate between the puppets and the child. Furthermore, the experimenter has to pay attention on that the experiment will (especially for the five-year-olds) look like a game or story from the child's point of view. One of the subjects of my experiment realized that I was using a sheet of paper as a backup and surprised as well as a little bit disappointed said *Ach du liest das!*. Therefore, and in order not to distract the children it is probably better to learn the task by heart.

As I just mentioned, it is very important not to forget to ask a statement because each statement is important in the evaluation to see whether the child understood the statements as a complete description of the content all the time or if it used different interpretations depending on the statements. Moreover, it is important that every statement has been evaluated the same number of times. If statements that did not receive the same number of evaluations are calculated into percentages and shown in a table, this will mislead a reader who only looks at the percentages and not at the complete evaluation. The more subjects take part in the experiment, the smaller will be the impact of missing evaluated statements on the results. Since I could only interview seven to eight children of each age group, a missing evaluation has a big impact on the result. This is why, I suggest to interview more children (if time allows) so that the impact of an accidentally missing statement will be as small as possible.

Another important point which has to be considered concerning the data I got from my experiment is its reliability. Cowart (1997) criticises that the standard methods in syntactic research treat informants' answers as "a definite representation of that informant's attitude toward that sentence" and do not pay enough attention to error variance in a judgement.

On the basis of Coward's remarks it has to be said that the results I got for my experiment are not definite since I did not check whether my subjects would come up with the same evaluations of the statements if they would take part in same experiment a couple of weeks later. My data only indicates that if subjects of the examined age groups have to evaluate statements in this kind of reasoning experiments, the answers tend to be similar to mine and Noveck's result. The fact that especially the answers of the youngest children vary within the three sets of my experiment (although the sets were nearly directly conducted after each other) shows that the answers cannot be treated as definite evaluations. Since I conducted three sets of the experiment the error variance of the average result of each age group should be smaller than if I had only conducted the experiment once. However, the quality of the data would have been better and more reliable if I had been able to examine more subject and to conduct another set of the same experiment a couple of days or weeks later to ensure a higher reliability of the results.

Finally, I have to admit that I actually conducted the experiment with seven fourth-graders but did not include one of them (Constanze) in the evaluation and results of my experiments. I decided to do so because I found during the evaluation of her statements that her answers were kind of strange. She got the highest amount of correct statements in the first experiment. In the second replicate she judged all of the statements as *halbrichtig* and in the third experiment her answers were mixed. In order to figure out the reason for this kind of unusual development and to see whether she had problems with the task, I looked at the video-tape again and in more detail. I very soon found that the order of the sets differed from the 'normal' order. When I conducted the experiment with her, I first showed her the boxes of experiment III, then the ones of experiment I and finally the ones of experiment II. This also explains why her development concerning the answers was unusual. Furthermore, I found that at the moment when we conducted the last set of the experiment, the other children were playing outside already. Therefore, Constanze just wanted

to finish the experiment to go out in order to play with her classmates. This becomes obvious because she evaluated every statement as *halbrichtig*, did not even look at the boxes when answering and evaluated the statements extremely quickly. Therefore, I decided not to include her into the evaluation because her results were falsified by other factors such as wrong order of the boxes and her classmates plying outside.

Constanze's case shows that another important factor which can influence the results of the experiment is the time of the day. Constanze's results prove that children's answers depend on whether they allow themselves enough time to evaluate the statements or if they are in a hurry. Therefore, it would be better to get information e.g. about special breaks or other group activities outside before the experiment starts. Furthermore, one should keep these breaks and events in mind and avoid to start a new round of the experiment just before these occasions. Alternatively, the experiment could be interrupted temporary to let the child play outside and start the experiment again after the break.

I also excluded one of the five-year-olds (Lisa Marie) from the results. Lisa Marie's results were excluded from the evaluation because I forgot to ask her to evaluate the critical statement in the first round of the experiment. In the second round of the experiment Lisa-Marie had quickly opened the covered box and seen its content before the beginning of the experiment. Therefore, I preferred not to include her answers in the evaluations because her answers and the answers of her contemporaries were not based on the same situation and setting. Apart from that, Lisa Marie was not really interested in this experiment and wanted to play something else instead. Due to my mistake in the first set of the experiment and the fact that Lisa Marie had seen the content of the covered box in the second set, her results are not suitable for the evaluation because possible developments between the first and the last set of the experiment cannot be observed objectively.

### 6.3 Suggestions for further research

As mentioned earlier already the answers of younger children varied in each set of the experiment. It can be said that in each set the amount of correct answers increased slightly and developed in the direction of the expected answer. The variance within the three sets can either be considered as a coincidence or as a possible development in the interpretation and understanding of the task. Therefore, it would be important to repeat the three sets of experiments with the same participants after a couple of weeks or month to see whether the results will be similar to the results I got. This repetition of the sets of the experiments with the same participants over a longer period of time probably only needs to be done with the five- and seven-year-olds since the nine-year-olds were quite consistent in their evaluation.

Moreover, it would be important to conduct this experiment with a second group of subjects. This group should take part in exactly the same sets of the experiment as my participants with the only difference that each set of the experiment will be conducted on a different day. Then the results should be compared to see whether the subjects, who had a time difference of a couple of days or weeks between each

set of the experiment show a similar development or change in their answers as the children in my experiment did. If one compares the results of both groups for each set and finds that the results are similar, it would mean that the results of my sets are not coincidental but indicate that the stages in the understanding of the task and development of scalar implicatures really exist.

In order to see whether my supposition that young children have access to scalar implicatures already and that the understanding of the statements as a complete description of the content prevents them to calculate these implicatures, the setting of the task has to be changed slightly. One option is to maintain the setting of the experiment and to prevent children from understanding the statements as exhaustive descriptions of the content by telling them in advance that the statements refer to single items in the box and not the total/exhaustive content of the box. If the task is explained in this way, children will get an additional hint which tells them that the assumption that the statements describe the whole content of the covered box is not suitable in order to solve this task because they will know in the first place that the speaker applies to the R-Principle and do not have to figure it out in the process I described in the previous chapter by themselves. However, I prefer to change the setting of the experiment so that the children can easily realize by themselves that the statements are no exhaustive descriptions of the content, just in case they did not understand this premise of the task properly or forgot it during the experiment.

I expect that more subjects will calculate scalar implicatures if the experimental setting does not licence the understanding that the statements refer to the whole content of the covered box. A possible setting would be the following: There are two open boxes. The first box contains item A and B while the second box contains the items A and C. Children are then shown a third and covered box and told that this box has the same content as one of the open boxes. Moreover, they should be told that they will hear several statements, which only refer to one of the items of each box, and that they have to evaluate whether it is possible that the item mentioned might be part of the content of the covered box. Moreover, the critical statement could be changed to make the reasoning task slightly easier. Instead of saying: *In der Schachtel könnte A drin sein* one should say *In der Schachtel könnte eine(r) der A's drin sein* which would help participants to understand the sentence in the way it is intended.

Moreover, it should be tested whether very young children have access to the R-Principle already. If this is the case it will support my hypothesis otherwise my hypothesis would not be correct.

Finally, I have to mention that did not have the chance to test how adults evaluate the statements in my experiment. Therefore, and because of the fact that the eleven adults I questioned (seven of them in the seminar and four of my friends on a class-meeting) seemed to prefer to answer the critical statement logically in the first place, adults' evaluation of the statement should be examined in a proper experiment. In an experiment with adults, I would choose exactly the same setting as the one I used in this study to see whether their answers vary within the three sets of the experiment as well. I expect that adults will also tend to give a logical answer in the first set of the experiment and a higher amount of pragmatic answers in the

second and/or third set of the experiment or once they realize the purpose of this experiment.



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# Appendix A

## Detailed analysis of some of the children who attend nursery

### A.1 Dalia (5;1)

Dalia was the first and, with an age of 5 years and 1 months, the youngest subject that took part in the experiment. She was very interested, attentive and seemed to enjoy the experiment. At the beginning of the experiment she was still a little shy and did not talk very much.

By the time when the actual experiment started, Dalia felt more comfortable and was less shy. For myself it was very difficult to explain the task in an easy way without saying *or*. After having explained the task without mentioning the critical term *or*, I accidentally said that the content was the same as in box A or as in box B. However, once I had said it, I realized it and did not continue my sentence. At this point Dalia clearly showed, that she understood the task already because she completed my sentence. Furthermore, this incident showed that Dalia also has access to the exclusive interpretation of *or*.

During the first experiment (box I contained a bear and box II contained a bear and a rabbit) Dalia answered all the questions quite confidently. She took her task, which was to reward the puppets for correct utterances very seriously and even came up with the idea of taking the rewards away from the puppet, who had just uttered a wrong statement. Dalia performed very well and showed that she understood the task. She answered all of the test-sentences correctly except the first one *In der Schachtel muss ein Teddy drin sein*. Dalia accepted this sentence but added that both items (rabbit and bear) have to be inside the covered box. What she meant is, that there can only be a rabbit inside the covered box if the box contains a bear as well. Dalia's answer shows that she understood that the third box contains the same items as one of the two open boxes and that it is impossible that the covered box contains only a rabbit.

However, the affirmation of this sentence is only correct if there is really a bear and a rabbit inside the box because the test-sentence contains the modal *muss*, which expresses the necessity. According to the task it is not clear, whether both rabbit and bear or only a bear are inside the covered box. Therefore, Dalia's explanation

is only true if the test-sentences expresses a possibility such as the sentence *In der Schachtel könnte vielleicht ein Teddy drin sein*.

I am not sure why Dalia evaluated this statement wrongly. Maybe she did not pay attention to the modal verb in this sentence. Another possibility is that Dalia treats item B (rabbit) as a complex, which is joined together with item A (bear) (since both items are in the same box) and that she, therefore, does not consider item B (rabbit) separated from item A (bear) because a rabbit alone is in none of the open boxes.

The critical statements in this first round of the experiment were *In der Schachtel könnte vielleicht ein Teddy drin sein* and *In der Schachtel kann ein Teddy drin sein*. Just like most of the children in Noveck's experiment, Dalia applied the logical interpretation to these sentences and accepted them. She did not identify these statements as critical utterances and, therefore, did not compute scalar implicatures.

In the second round of the experiment the first open box contained a dog (A) and a rabbit (B) and the second open box contained only a dog (A). Just as in the first round of the experiment, Dalia answered all of the questions correctly except the one *In der Schachtel muss ein Hase drin sein*. Again, she did not identify the critical statements (*In der Schachtel könnte vielleicht A drin sein* and *In der Schachtel kann A drin sein*) as such and, therefore, did not compute scalar implicatures.

In the third round of the experiment, when the first box contained a doll and a dog (A and B) and the second box contained a doll (A) only, Dalia gave the same answers as in the two previous rounds. This shows that she is consistent with her answers and that her answers did not occur by chance. In this third and last round of the experiment, Dalia again, answered the sentence *In der Schachtel muss B drin sein* wrongly. However, after the task was explained again and she was told and shown that box II does not contain item B, she quickly changed her mind and rejected the test sentence twice. Consequently, she did not reward the puppet and instead took the rewards, which the puppet possessed already back.

Moreover, Dalia did not identify the two critical sentences (*In der Schachtel könnte vielleicht A drin sein* and *In der Schachtel kann A drin sein*), which indicates that she is not able to compute scalar implicature. This means that she either considers the statement as an exhaustive description of the content of the box or treats the meaning of *könnte* compatible with the one of *muss*.

However, during our play the two puppet's who uttered the statement started to argue about their rewards<sup>1</sup> since Dalia rewarded Casper with a small reward for uttering the sentence *Hier muss auf jeden Fall ein Hund drin wohnen* and the princess with a big reward for uttering the sentence *Da kann vielleicht ein Hund drin wohnen*. Dalia agreed that both puppets said it correctly. Therefore, I asked her whether the modals *müssen* and *können* have the same meaning. Dalia correctly said that the meaning is not the same. Therefore, I asked her which puppet had said it better. Dalia said that the Casper had uttered a better statement than the princess. This incident shows that Dalia does know that both modals can be used in this situation and that *muss* is the better one since it is stronger. Furthermore, Dalia's behaviour shows that she does not lack semantic or pragmatic knowledge and that she is able to interpret statements that contain scalar terms. However,

<sup>1</sup>see Appendix B.2.1: Dalia

Dalia is not able to or does not compute scalar implicature in a situation, where she has to judge whether a statement is right or wrong. However, she proved that she knows very well which statement is more adequate once she is directly confronted with both utterances and has to make up her mind. Therefore, I assume that Dalia did not compute scalar implicature because she understood the statement as exhaustive description of the content of the box and then evaluated it according to the truthfulness or falsity rather than on its felicity.

## A.2 Lisa Marie (5;8)

Lisa Marie was the second child who attends kindergarden and took part in my experiment. Although she was one of the oldest children from nursery that took part in the experiment, she gave me the impression that she did not understand the task properly and seemed not very confident about her answers. Therefore, I believe that her answers (although most of them were right) are not based on understanding the task but occurred by chance. Her statement *Das versteh' ich nicht so ganz*, which she uttered right after I had explained her why her answer was correct supports my impression. Moreover, she answered the first statement, which was the control sentence *In der Schachtel muss B drin sein* with *Weiß ich nicht*, which indicates that she did not feel competent enough to make a judgement about this statement. Her insecurity about answering the questions also became obvious because she sometimes just shook her head to negate a sentence and confirmed whether her judgement was right quite often. Remarks such as *Ist der ehrlich?* (referring to Casper) show that she did not understand the task properly or that the task was too difficult for her. Furthermore, Lisa Marie was not able to justify her answers. When asked for an explanation for one of her answers, she just came up with the following justification: *Weil das irgendwie – irgendwie mir so vorkommt in meinem Kopf.*

Moreover, at some parts of the conversation Lisa Marie gave me the impression that she had made up her mind about the content of the covered box before she evaluated the statements. For example, her answer to one of the utterances was *Also ich denke, dass das da drinne wär.* Furthermore, she seemed rather bored and wanted to see the content of the covered box already after the puppets had uttered the second statement.

In the first round of the experiment Lisa Marie had to judge five statements (I am responsible for the missing statements). Lisa Marie accepted both the critical statement and its stronger equivalent which would, if she had understood the task properly, indicate that she interprets the critical sentence in a logical way. However, as I have mentioned already I am not sure whether she really understood the task or just gave random answers. Lisa Marie accepted the statement *In der Schachtel muss auf jeden Fall A drin sein.* She said *Richtig. Da muss aber, – Da ist aber auch 'n Teddy drin?* At the first moment this answer showed me that she understood the task but after I told her that she was right and why, she said that she did not understand.

In this situation, I found that it is very difficult to explain the task without using the term *or*. I failed and accidentally used the term *or*. But Lisa Marie still did not

give me the impression that she understood the task, since she just replied *Hmm*. She accepted the critical sentence *In der Schachtel kann A drin sein* and said *Das glaube ich auch*, which is a semantically correct answer. However, when the other and slightly weaker test sentence *In der Schachtel könnte vielleicht A drin sein* was asked, she said that she was not quite sure (*Ich weiß es auch nicht so richtig*) and said while pointing to the open box which contained both a bear and a rabbit *Also ich denke, dass das da drinne wär*. This shows that she understood that the covered box contains the same items as one of the opened boxes and that she had made up her mind about the content of the covered box already. However, she probably did not understand that it was her task to evaluate the necessity and possibility of the statements.

Lisa Marie had problems to evaluate the necessity and possibility of statements because she only understood that the covered box contains the same items as either the first or the second box and because she treats the content of the box like a “unit” and does not consider the items separately. This problem becomes obvious at the end of the experiment after she had opened the boxes. At that point I asked her which puppet had said it correctly the one who had said *muss A* or the one that had said *kann A*. Lisa Marie rejected both statements because none of the puppets had mentioned the rabbit that was included in the third box as well (*Vom Hasen hat keiner was gesagt*). This shows that Lisa Marie considered the statement to be an exhaustive description of the content of the box.

In the second set of the experiment Lisa Marie had seen the content of the covered box before the puppets uttered their statement because she had quickly opened the covered box and looked inside. However, I still decided to carry on with the experiment and told her that the puppets had not seen the content of this box yet and that she now needs to judge whether the puppets statements are right.

In this session Lisa Marie again did not evaluate whether the statements were right concerning necessity and possibility but made her judgements based on the actual content of the covered box. Moreover, just as in the first experiment, she did not consider the toys separately. She only considered the content of the boxes as a set. For this reason she got the statement *In der Schachtel muss auf jeden Fall A drin sein* wrong by saying *Nur ein Hund? Falsch!* This again shows that she considered the statement to be an exhaustive description of the content of the covered box. With respect to the statement *In der Schachtel muss B drin sein* Lisa Marie did not come up with a clear answer. She just said *Nur ein Hase? Ein Hase ist drin sein. Ich weiß, dass einer drin ist*. This answer shows that she interpreted the statement as complete description of the content of the box. Concerning the critical statement *In der Schachtel könnte vielleicht A drin sein* she acted according to the Conversational Maxims by saying *Ja, da ist einer drin*. This utterance can be interpreted in two ways. First of all it might be a semantically correct answer since she accepted the sentence by saying *ja*. On the other hand this answer can also be considered as the computation of scalar implicature, since she reformulated the statement and instead of repeating the same modal verb by saying *Ja, da könnte einer drin sein*, she used the strongest possible expression and said *Ja, da ist einer drin*, which clearly expresses that the modal verb used in the original statement was too weak.

In the third replicate of this experiment Lisa Marie was more competent in answering the questions. It seems that she now had understood the task and that it was her job to evaluate the necessity and possibility of the statements. Most of her answers are correct and show that she was able to evaluate the necessity and possibility of the statements.

In this experiment Lisa Marie acted according to the Conversational Maxims and the Cooperative Principle. Her reaction to the test sentence *In der Schachtel muss auf jeden Fall A drin sein* indicate this. Instead of just saying *yes* she pointed it out more clearly by saying *Da ist ein Hund drin*. She interpreted the critical statements *In der Schachtel könnte vielleicht A drin sein* and *In der Schachtel kann A drin sein* logically. While Lisa Marie partially accepted the former of the two statements, she clearly rejected the latter one. This behaviour along with her answer to the statement *In der Schachtel muss auf jeden Fall A drin sein* show that she understood the task and interpreted the critical statement logically because she has the more cooperative version of the sentence in her mind and knows that the critical sentences are only partially true.

### A.3 Ronja (5;5)

In the first replicate of my experiment the open boxes contained a bear as well as a bear and a rabbit. Ronja evaluated five out of six statements correctly. All in all, she was quite confident about her judgements and quick in answering. Her behaviour and answers indicate that she understood the task and is able to evaluate the necessity and possibility of the statements.

At the beginning of the experiment, Ronja had problems with evaluating the control statement *In der Schachtel muss B drin sein*. Before and right after this first statement was uttered Ronja said *Ich denke 'n Bär und 'n Hase*. At first glance there is no relation between Ronja's answer and the test statement. Since I assumed that she answered according to the Cooperative Principle I came up with the following question *Also, du denkst, wenn da 'n Hase drin ist, ist da auch 'n Bär drin?* Ronja agreed which shows that she had understood the experimental set up and interpreted the test-statement as exhaustive description of the content of the box.

The only statement, Ronja could not answer even after the task and the experimental set up was explained repeatedly, was the statement *In der Schachtel muss auf jeden Fall A drin sein*. She only partially accepted this statement and came up with an explanation that was not relevant.<sup>2</sup> However, it might be possible that Ronja's way of thinking is similar to Dalia's, who paid less attention on the modal verb and considered the whole content of the box when evaluating the sentence. This means that both girls interpreted the statement literally and only accept the rabbit as a possible content under the condition that the covered box also contains a bear. This way of thinking would also explain Ronja's answer to the statement *In der Schachtel könnte vielleicht B drin sein* which was *Hm, ein Bär mit dem Hasen* and similar to her reaction to the control statement.

<sup>2</sup>see Appendix B.2.3: Ronja (Experiment I (a))

With respect to the critical statements *In der Schachtel könnte vielleicht ein Bär sein* and *In der Schachtel kann ein Bär sein*, I forgot to ask Ronja to evaluate the prior of the two statements. Instead, I just said *Da kann vielleicht ein Bär drin sein*. Ronja however, rejected the weaker critical sentence *Da kann vielleicht ein Bär drin sein* in the first place because the puppet had said *vielleicht*.<sup>3</sup> However, Ronja quickly corrected herself and changed her answer to *Der hat halbrecht*. This shows that she considered *kann vielleicht* as not compatible with *muss* and that she is able to interpret the critical sentence pragmatically. Another possible interpretation of Ronja's answer is that she considered the statement to be a description of the whole content of the box.

Although Ronja also evaluated the stronger critical sentence as *halbrichtig*, she accepted it twice in the first place<sup>4</sup> which would be a semantically correct answer. If this is not a coincident it might indicate that she is less likely to accept the statement that contains *vielleicht* and additionally weakens the modal verb. This might indicate that if an utterance is obviously too weak or an understatement of the actual situation, Ronja is able to compute scalar implicature. For the other critical sentence which did not contain *vielleicht*, she did not compute scalar implicature in the first place because it was not so obvious to her that the utterance was too weak. However, it is not certain whether Ronja calculated a scalar implicature or not because she did not justify her answer. If she considered the critical statements as exhaustive description of the items in the box, which is also possible because she interpreted some of the other statements in this way as well, she might come up with exactly the same answer. Only an explanation by Ronja on why she answered in the way she did would help us to decide whether she calculated a scalar implicature or not.

In the second experiment Ronja evaluated three out of five questions correctly. Just as in the previous experiment her answer to the statement *In der Schachtel könnte vielleicht B drin sein* was different than the one expected. This shows that Ronja is consistent in her answers and has a good reason for her judgement. Moreover, there seems to be a simple explanation for her reaction. If one considers Ronja's question and reactions related to the statement it becomes obvious that her problem is caused by her (exhaustive) understanding of the statement.<sup>5</sup> It also seems as if she did not fully understand the task. Ronja had problems to evaluate whether the presence of the rabbit in the box is necessary or possible because she only thought about the rabbit in combination with the dog and did not consider the rabbit and dog as separate items. This exhaustive interpretation of the statements indicates that she thinks pragmatically and relies on the Cooperative Principle. For Ronja it seems to be more important to help the puppets to figure out the definite content of the box (rather than making judgements on the possibility and necessity of the item's presence in the box). This becomes obvious if one looks at the beginning of the experiment. When Ronja had just been introduced to the boxes, she already made a guess about what she thinks is in the box. If one keeps Ronja's intention in mind it is clear why she does not really accept this statement: She tries to be cooperative

<sup>3</sup>see Appendix B.2.3: Ronja (Experiment I (b))

<sup>4</sup>see Appendix B.2.3: Ronja (Experiment I (c))

<sup>5</sup>see Appendix B.2.3: Ronja (Experiment II (a))



and would like to point out, that if the box contains a rabbit, it must contain a bear as well. This means that she considered the statement as an exhaustive description of the content of the box.

A similar situation which also shows that it is Ronja's aim is to help the puppets to figure out the definite content of the box is her reaction to the utterance *In der Schachtel muss auf jeden Fall ein Hund drin sein*. In this situation she again acts in a pragmatic way by pointing out that she thinks that there might be a rabbit as well as a bear.<sup>6</sup> (The dialogue also shows that Ronja is not in the position to justify her answer yet.) The conversation shows that her way of thinking is far more complicated than the one expected. This is because she did not consider the items that were inside the second box (dog and rabbit) separately but only as a pair or unit. This can be proved with Ronja's reaction close to the beginning of the experiment. Right after I explained her the task, I removed the rabbit from the second box, so that both open boxes contained a dog only. In this situation Ronja accepted the statement *Wenn ich den jetzt wegnehme, ist hier* (experimenter points to the covered box) *auf jeden Fall ein Hund drin* at once. This reaction proves that she evaluated the statements *In der Schachtel muss auf jeden Fall ein Hund drin sein* and *In der Schachtel könnte vielleicht B drin sein* wrongly because she considered the dog and rabbit as couple and not separately. Moreover, she interpreted the statement as exhaustive description of the content, exploited the Q-Maxim and tried to give a cooperative and pragmatic answer.

The critical statement *Hier könnte vielleicht ein Hund drin sein* was accepted by Ronja. She said that the puppet was right because both boxes contained a dog.<sup>7</sup> This means that she either considered the statement as exhaustive description of the content or interpreted the modal *könnte* as compatible with *muss*. This is why she does not compute scalar implicature.

However, when she was asked whether there has to be or might be a dog she answered *Da muss – äh da kann ein Hund drin sein*. This shows that she tends to use the pragmatic interpretation but then quickly changes her mind and applies the logical interpretation to the statement and does not compute a scalar implicature in the end. Since it seemed that she has access to both interpretations, I wanted to figure out which interpretation she prefers in a situation where she has to decide between both statements. Therefore, I staged an argument between both puppets. One of the puppet's (Casper) insisted on that there must be a dog in the covered box and the other puppet (girl) insisted on that there might possibly be a dog inside the covered box. Ronja quickly realized that the puppets were arguing and when it was her time to judge who was right, she said that there also might be a dog and a rabbit inside the box (same phenomenon as mentioned above). Therefore, I told her that the puppets were discussing about dogs only and had the puppets start their argument again. This time Ronja clearly pointed out that Casper was right and even gave the following explanation: *Hm, weil da muss ja immer ein Hund drin sein*. This reaction proves that Ronja has access to the pragmatic interpretation of the modal verbs, is able to compute scalar implicature and can detect which statement is more relevant or better. Moreover, this explanation shows clearly that

<sup>6</sup>see Appendix B.2.3: Ronja (Experiment II (b))

<sup>7</sup>see Appendix B.2.3: Ronja (Experiment II (c))

she acts and makes her judgement according to the Causal Theory of Perception and the Conversational Principles.

In the third experiment Ronja had to evaluate seven statements related to the covered box. She evaluated all of them right and in this way showed that she had now understood the task completely and was competent enough to make her judgements. For most of the statements Ronja clearly said that the statements were either right or wrong. The only statements for which she did not fully accept or reject, were the critical statements *In der Schachtel könnte vielleicht A drin sein* and *In der Schachtel kann A drin sein*. Rather than answering with right or wrong, Ronja said that these statements were only partially true. These answers show that Ronja has access to the logical and the pragmatic interpretation of the statements. Her answers are right since those critical statement can be interpreted in two ways. According to the logical interpretation of these sentences, which means that *kann* or *könnte* is compatible with *muss*, Ronja should accept the statement. If Ronja had applied the pragmatic interpretation, she should consider *kann* or *könnte* as not compatible with *muss* and, therefore, reject the sentence. Ronja's answer however, is in the middle between both answers. It is therefore not clear, which interpretation she prefers but it clearly shows that she is aware of both interpretation and the difficulty of making a clear judgement about the statement.

## A.4 Johanna (5;10)

Johanna was the last child that took part in my experiment in the kindergarden. The session with her took part in the afternoon, after the children had finished their nap and tea-time. Although Johanna still seemed a little bit tired, she was very attentive and enjoyed rewarding the puppets.

In the first session, in which the boxes contained a bear only (box I) as well as a rabbit and a bear (box II), Johanna evaluated most of the statements correctly. (I am responsible for the missing answer for the sentence *In der Schachtel könnte vielleicht ein Bär drin sein* because I forgot to ask her about this statement.) Out of the six questions that were asked, Johanna answered four of them in the way that was expected. Since Johanna justified and sometimes explained her answers instead of just saying *right* or *wrong* it was possible to understand why she got those two questions wrong. Johanna rejected the sentence *Hier [in der Schachtel] könnte vielleicht ein Hase drin sein* because she interpreted the statement as exhaustive description of the content and thought that I was trying to say that there might only be a rabbit inside the box.<sup>8</sup> Her answer *Also, nur ein Hase geht nicht* clearly shows that she interpreted the statement differently than expected. However, according to her understanding of the statement, her answer is still correct. Therefore, it can be said, that Johanna's answers and explanations show that she largely mastered the task.

The other statement, Johanna got wrong in this set of the experiment is the critical statement *In dieser Schachtel, da kann vielleicht ein Bär drin sein, aber nur vielleicht*. Johanna rejected this sentence, shook her head and said *Das stimmt*

<sup>8</sup>see Appendix B.2.2: Johanna (Experiment I (a))

*nicht*. However, (as I mentioned in an earlier chapter already) her first explanation for this answer is not completely comprehensible.<sup>9</sup> Therefore, it is not very clear why she negated the sentence and if she is really able to compute scalar implicature or not. One possible explanation for her behaviour is that she might indeed be able to compute scalar implicature but does not really know how to explain her judgement. Later in the conversation Johanna rejected the sentence again and said *Nein, wenn's vielleicht ist, stimmt das aber auch wirklich nicht*. But, when I asked her if the puppet is a little bit right she said *Ja, aber nur so ein ganz kleines bisschen*. This reaction shows, that she is probably able to compute scalar implicature since she knows that the sentence is correct but she still prefers to judge the statement as wrong because it is too weak.

Moreover, Johanna accepted the following statement at once *Ich denke hier kann, hier kann – was kann den hier drin sein? Ich denke hier kann ein Bär drin sein*. But before she made her judgement, she confirmed with me whether the verb the puppet had uttered was really *kann*. Therefore, I asked her whether the statement is completely right or just a little bit. Johanna replied *Also, es stimmt auch ein bisschen*. If one reviews Johanna's answers and reactions it can be said that she is aware of the scalar terms and knows how to judge accordingly.

In the second session the open boxes contained a dog and a rabbit (box I) and a dog only (box II). Apart from the two critical statements (*In der Schachtel muss auf jeden Fall A drin sein* and *In der Schachtel kann A drin sein*) which Johanna negated, she got two other statements wrong, but corrected her answers when the task was explained again.

As in the previous experiment Johanna's explanation for her answer to the statement *In der Schachtel kann A drin sein* is not logical at all and does not support the idea that she did compute scalar implicature. The way she explained her answer rather suggests that she did not really understand the task.

At the end of the experiment Johanna had to decide which puppet's statement was correct, the one who had said *In der Schachtel kann A sein* or the one who had said *In der Schachtel muss A sein*. Johanna said that the puppet who uttered *muss* is correct and that the other puppet is wrong or just a little bit right. This shows that if Johanna is confronted with both statements and has to decide which utterances is better, she considers the one that is more adequate as right and the other one as wrong. This shows that she seems to be able to compute scalar implicature under this kind of circumstances.

In the third and last set of the experiment Johanna got most of the questions right. As in the previous experiments Johanna accepted the statement *In der Schachtel muss B drin sein*. When asked for an explanation, she justified her judgement with the sentence *Eine Barbie und ein Hund. Also ist es vielleicht richtig*. At this point Johanna behaves similar to Dalia. It seems that both of them assume that there has to be a Barbie as well. However, their judgement is still wrong because the statement is only correct, if the modal *kann* is used.

Johanna appears to be less confident in judging the statement *In der Schachtel kann A und B drin sein*. She emphasises that this statement might be true. This is because she considered the statement to be an exhaustive description of the content.

<sup>9</sup>see Appendix B.2.2: Johanna (Experiment I (b))

At the first point Johanna rejected the sentence *In der Schachtel muss ein Hund drin sein* because she probably thought that the statement is a description of the whole content of the box. When I told her that both boxes contain a dog and asked her why she thinks that this statement was wrong she said *Na, weil da weil da noch 'ne Barbie mit dazu ist und bei dem andern Hund nicht. Also stimmt das nicht.* But after the task was explained again, she changed her mind and agreed that the sentence is correct.

In this experiment Johanna accepted both critical sentences. But it turned out that she is more likely to accept the statement *In der Schachtel kann A drin sein* rather than *In der Schachtel könnte vielleicht A drin sein.* If one assumes that Johanna's judgement is not arbitrary, this shows that she is able to realize the difference in meaning of scalar terms. This assumption is supported by Johanna's evaluation, when she has to decide which puppet had uttered the better statement. She said that the modal *muss* is more appropriate in this situation and that the puppet who uttered *könnte* will just get a small reward.

Every time when Johanna had to decide which puppet had said it better, she rewarded the one that said *muss* rather than *könnte* or *kann*. This shows that she is able to apply to the Maxim of Quality and the Causal Theory of Perception. Probably, Johanna is able to compute scalar implicatures in a situation where she needs to compare two utterances because the situation is less complicated and the procedure she normally has to go through in order to compute scalar implicatures is simplified already.

# Appendix B

## Materials

### B.1 Conceptual formulations

Lege bitte das gleiche in diesen Karton, wie in dieser Schachtel (auf Schachtel I (Puppe und Hund) zeigen) drin ist *oder* das gleiche wie in dieser Schachtel (auf Schachtel II (Puppe) zeigen) drin ist.

Gibt es noch eine andere Möglichkeit, also hättest du auch etwas anderes in den Karton legen können? Wenn ja, was?

*Excercise:*

Diese beiden Puppen sagen nun Sätze. Du darfst sagen, ob die Puppe es richtig gesagt hat oder nicht. Du musst aber gut aufpassen, denn die Puppen sagen manchmal auch etwas falsches oder etwas was nur so ein bisschen richtig ist. Wenn die Puppe es richtig sagt, bekommt sie eine Belohnung, wenn sie etwas falsch sagt, bekommt sie nichts. Wenn du denkst, dass beide Puppen Recht haben, bekommt die Puppe, die es besser gesagt hat, eine größere Belohnung.

Puppe 1: Das T-Shirt ist grün.

Puppe 2: Das T-Shirt ist blau.

Puppe 3: Das T-Shirt ist hellblau.

Welche Puppe hat es besser gesagt?

*Set I – bear and rabbit*

“Ich habe vergessen, was in der Box ist. Ich weiß nur noch, dass dieses hier (auf Box I: Teddy und Hase zeigen), also ein Hase und ein Teddy, vielleicht aber auch dieses hier (auf Box II: Teddy zeigen), also nur ein Teddy, in der Schachtel ist. Vielleicht so (auf Box I zeigen), vielleicht aber so (auf Box II zeigen). Es kann aber nur eins von beiden in der Schachtel sein, nicht beides.

Diese beiden Puppen raten nun was in der Schachtel drin ist. Wenn die Puppe es richtig sagt, bekommt sie eine Belohnung, wenn sie etwas falsch sagt, bekommt sie nichts. Wenn du denkst, dass beide Puppen Recht haben, bekommt die Puppe, die es besser gesagt hat, eine größere Belohnung als die andere Puppe”.

1. In der Schachtel muss ein Hase drin sein. (Kontrolle)  
In der Schachtel kann ein Bär und ein Hase drin sein. (Kontrolle)
2. In der Schachtel muss auf jeden Fall ein Bär drin sein.  
In der Schachtel könnte vielleicht ein Bär drin sein.
3. In der Schachtel könnte vielleicht ein Hase drin sein. (Implikatur möglich)  
In der Schachtel kann ein Bär drin sein.

*Set II – dog and doll / dog and elephant*

In this set of the experiment the content of the boxes was not the same in kindergarten and primary school.

Kindergarden: A = a dog, B = a doll

School: A = a dog, B = an elephant

1. In der Schachtel muss B drin sein. (Kontrolle)  
In der Schachtel kann A und B drin sein. (Kontrolle)
2. In der Schachtel könnte vielleicht B drin sein. (Implikatur möglich)  
In der Schachtel kann A drin sein.
3. In der Schachtel muss auf jeden Fall A drin sein.  
In der Schachtel könnte vielleicht A drin sein.

*Set III – dog and rabbit*

1. In der Schachtel könnte vielleicht ein Hase drin sein. (Implikatur möglich)  
In der Schachtel kann ein Hund drin sein.
2. In der Schachtel muss auf jeden Fall ein Hund drin sein.  
In der Schachtel könnte vielleicht ein Hund drin sein.
3. In der Schachtel muss ein Hase drin sein. (Kontrolle)  
In der Schachtel kann ein Hund und ein Hase drin sein. (Kontrolle)

## B.2 Sentence material

### B.2.1 Dalia (5;1)

#### *Experiment III*

Box I: dog, Box II: dog and rabbit  
(P1= puppet 1 (Casper), E= experimenter)

...

P1: Hier muss auf jeden Fall ein Hund drin wohnen! So.

*Dalia:* Ja

E: Ja?

*Dalia:* Hm. Du bekommst nur eine kleine.

P1: Warum krieg ich denn eine kleine?

*Dalia:* Das tauschen wir um. (gibt dem Kasper eine kleine Belohnung und der Prinzessin eine große)

P1: Warum bekomme ich denn eine kleine? Ich habe gesagt, da muss ein Hund drin wohnen. Die Prinzessin hat nur gesagt, da kann vielleicht. Die ist sich ja gar nicht so sicher. Aber ich bin mir da ganz sicher.

E: Aber hat denn die Prinzessin auch Recht, ...

*Dalia:* ja

E: ... wenn sie sagt, vielleicht kann da einer wohnen, und sie sagt, da muss einer wohnen. Das ist ja nicht das Gleiche? Oder ist das doch das Gleiche?

*Dalia:* Nö

E: Wie jetzt?

*Dalia:* Das ist nicht das Gleiche.

E: Wer hat es denn jetzt besser gesagt?

*Dalia:* Der Kasper.

...

### B.2.2 Johanna (5;10)

#### *Experiment I*

Box I: bear, Box II: bear and rabbit  
(E = experimenter)

#### (a)

E: Ich finde, hier könnte vielleicht ein Hase drin sein.

*Johanna:* Das stimmt nicht. Vielleicht.

E: Vielleicht ein Hase?

*Johanna:* Hmm, nee, glaube ich nicht, dass ein Hase drin ist.

- E: Warum glaubst du das nicht? Hier ist aber doch ein Hase.  
*Johanna: Ja, aber ein Hase das würde ja nich drin sein.*  
 E: Achso, du meinst nur ein Hase.  
*Johanna: Ja*  
 E: Du meinst da muss dann ein Hase ...  
*Johanna. Hm (nickt)*  
 E: ... und ein Bär drin sein.  
*Johanna: (nickt) Hm. Ja. (nickt)*  
 E: Also nur ein Hase geht nicht.  
*Johanna: (nickt)*  
 E: Aber ein Hase und ein Bär kann da drin sein.  
*Johanna: Hmmh (nickt)*  
 ... (Kind und Experimentatorin unterhalten sich über das Fellmuster des Hundes)  
*Johanna: Aber die Prinzessin hatte es doch richtig, dann bekommt sie doch eine Belohnung.*  
 E: Was hatte sie denn noch mal gesagt? Jetzt hab' ich's schon wieder vergessen.  
*Johanna: Hm, sie hat gesagt, da KANN ein Barbie – und ein Hund drin sein.*  
 ...

## (b)

- ...  
 E: (Kasper zeigt auf die verschlossene Kiste) Also ich finde, hier muss auf jeden Fall ein Bär drin sein. Muss auf jeden Fall ein Bär drin sein.  
*Johanna: (nickt) Ein kleiner.*  
 E: Also so'n Bär. (zeigt auf den kleinen Bär in Kiste I und auf den kleinen Bären in Kiste II) So'n kleiner. Ja?  
*Johanna: Das – stimmt.*  
 E: Das stimmt.  
 ...  
 E: Ich finde in dieser Kiste, (Prinzessin zeigt auf die verschlossene Kiste) da kann vielleicht ein Bär drin sein. Aber nur vielleicht.  
*Johanna: Das stimmt nich. (schüttelt)*  
 E: Das stimmt nicht. Ne? Warum stimmt das nicht?  
*Johanna: Weil – weil da ... es ist ja nicht noch ein Teddybär da. Es ist ja nur ein und 'n Hase drin. Da muss ja der kleine nich no ma da sein. Das stimmt ja auch nicht.*  
 E: Also es muss – muss ein Bär da sein. Äh, sie (zeigt auf die Prinzessin) hat gesagt, kann vielleicht, und das stimmt nicht, weil da muss ja einer drin sein, ne.  
*Johanna: Hm*  
 E: Weil hier einer ist und weil da einer ist  
*Johanna: Hm, ja, dann wär' also der hier drin (zeigt auf den einzelnen Teddybären)*  
 E: Das sind doch die gleichen, ne?  
*Johanna: Hm. Ja.*



- E: Also entweder ist der (Puppen zeigen auf den einzelnen Teddy) drin oder der (Puppen zeigen auf den Teddy der bei dem Hasen in der Kiste ist) is drin, aber auf jeden Fall ist da 'n Bär drin.
- Johanna: *Hmh.*
- E: Und die (zeigt auf die Prinzessin) hat gesagt, kann vielleicht, also stimmt das nicht.
- Johanna: *Hmh. Ja.*  
*Hm, ja, wenn's vielleicht ist, dann stimmt das aber auch wirklich nicht.*
- E: Hm. Oder nur so 'n bisschen.
- Johanna: *Ja, aber nur so ein ganz kleines bisschen.*
- E: Nur ein ganz, ganz kleines bisschen.
- Johanna: *Hm. Kriegt sie nur eine kleine Belohnung.*
- ...
- E: Ich denke hier kann, hier kann — was kann denn hier drin sein? Ich denke, hier kann ein Bär drin sein.
- Johanna: *Ein Bär.*
- E: Kann ein Bär drin sein.
- Johanna: *Kann!?*  
*(nickt) Das stimmt.*
- E: Stimmt ganz oder 'n bisschen?
- Johanna: *Also, es stimmt auch 'n bisschen.*
- E: Stimmt auch 'n bisschen.
- Johanna: *Also kriegt er auch 'ne kleine ...*
- ...

### Experiment II

Box I: dog, Box II: dog and rabbit  
(P = puppet 1 (princess), E = experimenter)

- ...
- P: Also, ich finde, ... Ich bin die Prinzessin und ich finde, in diesem Haus (zeigt auf die verschlossene Schachtel), da wohnt, da wohnt vielleicht ein Hund.
- Johanna: *Hm. – Das is falsch!*
- E: Warum is'n das falsch?
- Johanna: *Weil da nich nur ein Hund drin sein kein kann, also da drin sein kann.*
- E: Echt? Da kann nicht nur ein Hund drin sein?
- Johanna: *Sonst wäre er ja alleine.*
- E: Ja, aber der hier (zeigt auf den Hund in der ersten Schachtel) ist ja auch alleine.
- Johanna: *Ja aber, wenn die zwei Hunde drin sin (zeigt auf den Hund in Box I und auf den Hund in Box II), dann, — dann ist es richtig, wenn die zwei Hunde drin sin. Dann hat 'se Recht.*
- E: Also warte mal, diese Kiste – was da drinne ist, ist ja genauso wie das hier (zeigt auf Box I)
- Johanna: *Hhm*
- E: Also nur ein Hund.
- Johanna: *Joa (nickt)*

- E: Ein Hund alleine ...
- Johanna:* Ja,
- E: ... vielleicht aber auch so wie das (zeigt auf Box II)
- Johanna:* dann glaub' ich ...
- E: Also ein Hund und ein Hase. Nicht beides (zeigt auf beide Kisten) zusammen. Also nur so (zeigt auf Box I) vielleicht aber auch so (zeigt auf Box II). Also nicht beides (zeigt auf beide Kisten) zusammen. Nur eins von beiden.
- Johanna:* Hm, dann – dann denk ich mal, dass es das hier ist. (zeigt auf Box A)
- E: Also denkst du, da kann
- Johanna:* Hm
- E: Du denkst, da muss ...
- Johanna:* Hm
- E: Was denkst du denn jetzt eigentlich? Sag's mir mal. Kann oder muss oder könnte?
- Johanna:* Da ka, da könnte dieser Hund (zeigt auf Box I) auch da drin sein (zeigt auf die verschlossene Box).
- ...

### Experiment III

Box I: dog; Box II: dog and doll

(P = puppet 1 (princess), C = puppet 2 (Casper), E = experimenter)

...

- P: Ich denke, in diesem Karton kann eine Barbie sein.
- Johanna:* Hm, (nickt leicht) Also eine Barbie und ein Hund!  
Hmmm.
- E: Also eine Barbie mit einem Hund.
- Johanna:* Hmm
- E: Aber dann müsste ich ja sagen, kann eine Barbie und ein Hund.
- Johanna:* Hmm. Das ist vielleicht richtig. Nur vielleicht. (reibt sich die Augen)
- E: Ok
- C: Und wenn ich sage, hier muss eine Barbie drin sein?
- Johanna:* Nee. Das ist ja nicht richtig. (beginnt mit dem Haar der Handpuppe zu spielen)  
Also, muss eine Barbie drin sein, dann ist es richtig.
- C: Aber ich hab gesagt da muss eine Barbie drin sein.
- P: Und ich hab gesagt da kann eine Barbie drin sein.
- C: Warum hat die denn jetzt Recht und ich nicht?
- Johanna:* Weil sie ja gesagt hat, da muss eine Barbie drin sein.
- C: Und ich hab gesagt da kann.
- Johanna:* Ja, also ist es bei der Prinzessin richtig.
- E: Aber warum muss denn da eine Barbie drin sein?
- Johanna:* Hm. Ja, eine Barbie und 'n Hund also ist es vielleicht richtig.
- E: Ja, vielleicht, das heißt, hier kann eine Barbie und ein Hund drin sein.
- Johanna:* Hm.
- E: Aber da muss ja keine Barbie drin sein, weil hier ist ja auch keine Barbie.
- Johanna:* Ne.

- E: Also kann?  
*Johanna: Hm kann, kann eine drin sein – kann!*  
 E: Ja. Kann, aber muss nicht.  
 ... (Sie reden über das unterschiedliche Aussehen der Hunde.)  
*Johanna: Ja, aber die Prinzessin hatte's doch richtig gesagt. Dann bekommt sie doch auch eine Belohnung.*  
 E: Was hatte die denn noch mal gesagt? Jetzt habe ich's schon wieder vergessen.  
*Johanna: Hm, die hat gesagt, da KANN eine Barbie – und ein HUND drin sein.*  
 ...

### B.2.3 Ronja (5;5)

#### *Experiment I*

Box I: bear; Box II: bear and rabbit  
 (E = experimenter)

#### (a)

- ...  
 E: Hier muss auf jeden Fall ein Bär drin sein.  
*Ronja: Hm ne (schüttelt), halbrichtig.*  
 E: Warum is'n das halbrichtig?  
*Ronja: Weil die Kiste ja so groß ist und der kleine Bär so klein.*  
 E: Ja, aber in einer großen Kiste kann ja auch ein kleiner Bär drin sein. Also guck mal, wenn das drin ist (stellt Box I (Bär) auf die verschlossene Kiste) ...  
*Ronja: Hmhm*  
 E: ... ist 'n Bär drin  
*Ronja: Hmm (nickt)*  
 E: ... dann stimmt das, ne? (stellt die Box zurück) Und wenn das drin ist (stellt die zweite Box (Bär und Hase) auf die verschlossene Kiste) ist ja auch 'n Bär drin.  
*Ronja: Hmmh (zögerlich)*  
 E: Da ist zwar noch 'n Hase dabei aber auch 'n Bär.  
*Ronja: Hm (nickt)*  
 E: Also wenn's so ist, ist 'n Bär drin (zeigt auf Box II, die noch auf der verschlossenen Kiste steht) und wenn's so ist (tauscht Box II gegen Box I aus), ist auch 'n Bär drin.  
*Ronja: (nickt) Hmhm.*  
 E: So, wenn die jetzt sagt, da muss ein Bär drin sein, stimmt das dann?  
*Ronja: (schüttelt den Kopf und lächelt) Ne, weiß ich nicht.*  
 E: Das stimmt, weil hier ist ja 'n Bär (zeigt auf Box I) und da (zeigt auf Box II) ist ja auch 'n Bär.  
 ...

#### (b)

...

E: Und der sagt, da kann vielleicht ein Bär drin sein.

Ronja: *Vielleicht nur.*

E: Vielleicht nur sagt er. Und hat er Recht ...

Ronja: *(Schüttelt mit dem Kopf) Nee.*

E: ... oder hat er nur halbrecht?

Ronja: *Der hat halbrecht!*

E: Weil der gesagt hat vielleicht, ne?

Ronja: *Hmhm. (nickt)*

...

(c)

...

E: Kann hier ein Bär drin sein? Hier kann ein Bär drin sein. Hm?

Ronja: *Hmhm (nickt).*

E: Ja?

Ronja: *Hmhm (nickt)*

E: Ist das ganz richtig oder halbrichtig?

Ronja: *Halbrichtig*

...

### Experiment II

Box I: dog; Box II: dog and rabbit

(P1 = puppet 1 (Casper); P2 = puppet 2 (girl); E = experimenter)

(a)

...

E: Ich denke, hier könnte vielleicht ein Hase drin sein.

Ronja: *Nur ein Hase?*

E: Ja, vielleicht ein Hase und noch was.

Ronja: *Ein Hund*

E: Ja, vielleicht ein Hase und ein Hund.

Ronja: *(nickt)*

E: Vielleicht ein Hase –

Ronja: *(keine Reaktion, schaut nach unten)*

E: – vielleicht ein Hase und ein Hund.

Ronja: *Hmhm*

E: Ja?

Ronja: *Hm.*

...

(b)

...

P1: Also, hier (Puppe zeigt auf die verschlossene Box) muss ein Hund drin sein.

Ronja: *Hm, (schüttelt mit dem Kopf) Ich denke, da ist auch 'n Hase und 'n Hund drin.*

P1: Aber wenn ich sage, hier muss ein Hund drin sein, stimmt das dann?

Ronja: *(schüttelt den Kopf und verneint) Ehehm*

E: Warum stimmt 'n das nicht?

Ronja: *(schüttelt den Kopf und grinst) Weil der (zeigt auf die Puppe) manchmal lügt.*

...

## (c)

...

P2: Hier könnte vielleicht, vielleicht – vielleicht ein Hund drin sein

Ronja: *Ehm. Die hat Recht. (nickt)*

E: Die hat Recht? Oder hat die nur ein bisschen Recht?

Ronja: *Die hat Recht! Weil hier ein Hund drin ist und hier.*

...

*Experiment III*

Box I: dog; Box II: dog and doll

(P1 = puppet 1 (Casper); P2 = puppet 2 (girl); E = experimenter)

...

P2: Ich denke, hier muss auf jeden Fall ein Hund drin sein.

Ronja: *Hm. Ja, da hat se Recht.*

P1: Ich denke, hier (zeigt auf die verschlossene Schachtel) kann vielleicht ein Hund drin sein. Vielleicht ein Hund.

Ronja: *Hmmh*

- P1: Ganz richtig oder halbrichtig?  
 Ronja: *Halbrichtig!*  
 Ronja: *Weil der richtig . . .*  
 E: Richtig. Richtig ist muss?  
 Ronja: *Hmh (nickt)*  
 E: Und das ist nur halbrichtig, weil der vielleicht gesagt hat  
 Ronja: *Hmh*  
 P2: Hier (Puppe 2 zeigt auf die verschlossene Box) könnte vielleicht eine Barbie drin sein. Prinzessin, stimmt das?  
 Ronja: *Hmh. Ja, das stimmt.*  
 P2: Da könnte vielleicht eine Barbie drin sein.  
 Ronja: *Ha, doch das stimmt. (lacht) Jetzt hast de mal wieder Recht.*  
 P1: Und ich sage, hier (Kasper zeigt auf die verschlossene Schachtel) kann ein Hund drin sein.  
 Ronja: *Ja, hmhm.*  
 P1: Stimmt das ganz oder stimmt das halb?  
 Ronja: *Stimmt halb.*  
 E: Stimmt halb. Weil da 'n Hund drin sein muss, ne?  
 Ronja: *Hmh*  
 E: Hier (Puppen zeigen auf Box I) ist ja einer und da (Puppen zeigen auf Box II) ist ja einer.  
 Ronja: *Hmmh. (nickt)*  
 . . .

## B.2.4 Ayla Clara (7;9)

### *Training*

- . . .  
 E: Du siehst ja hier in dieser Schachtel oder diesem Container, da ist 'ne Kugel drin  
 Ayla Clara: *(schaut zur ersten Schachtel und nickt)*  
 E: – und hier ist 'ne Barbie und 'ne Kugel drin.  
 Ayla Clara: *(schaut zur zweiten Schachtel und nickt)*  
 E: Und hier (zeigt auf eine leere Schachtel) sollst du das Gleiche rein tun wie hier (zeigt auf Schachtel I: Kugel und Barbie) oder wie hier (zeigt auf Schachtel II: nur Kugel). Du kannst dir hier (zeigt auf Spielsachen, die vor dem Kind auf dem Tisch liegen) Spielsachen aussuchen und in die Kiste tun.  
 Ayla Clara: *(schaut sich die Spielsachen an und überlegt, dann nimmt sie eine Kugel und legt sie in die Schachtel)*  
 E: Ok  
 Ayla Clara: *(greift schnell nach dem Hasen und legt in auch in die Schachtel)*

- E: Ups. – Und das ist das gleiche wie wo?  
Ayla Clara: *Wie da. (zeigt zügig auf Schachtel I: Barbie und Kugel)*  
E: Hm. Was hast du denn da reingetan?  
Ayla Clara: *'ne Kugel (zeigt auf die Kugel) und 'nen Kuschelhasen (zeigt auf den Hasen)*  
E: Und was ist da drin?  
Ayla Clara: *'ne Kugel und 'ne Barbie*  
E: Ist das das gleiche?  
Ayla Clara: *(schüttelt den Kopf)*  
E: Machen wir es noch mal, ja?  
Ayla Clara: *(nickt)*  
...

### B.2.5 Nils (10;0)

#### *Experiment I*

Box I: bear; Box II: bear and rabbit  
(E = experimenter)

- ...
- E: Hier könnte vielleicht ein Hase drin sein.  
Nils: *Nein.*  
E: Nein? Achso. Warum nicht?  
Nils: *Nein, weil nur einer da ist und nicht in beiden, wie der Bär.*  
E: Ja? Ok. Und wenn ich das hier rein tun würde? (stellt die Box mit Hase und Bär auf die verschlossene Box)  
Nils: *Nein, dann wäre ein Hase und ein Bär drin und nicht nur ein Hase.*  
...

### B.3 Letter for the parents

29.08.2008

Liebe Eltern,

ich studiere Deutsch und Englisch an der Georg-August Universität in Göttingen und führe im Rahmen meiner Examensarbeit eine Spracherwerbsstudie durch. Dabei dokumentiere ich Kindersprache und untersuche diese nach typischen Merkmalen. Dazu benötige ich die Mithilfe Ihres Kindes und Ihr Einverständnis!

Ich möchte an ein oder zwei Tagen im September 2008 in den Kindergarten kommen um die Studie durchzuführen. Während der Aufzeichnungen, welche ca. 15 – 20 Minuten dauern, werde ich mit den Kindern Handpuppenspiele oder Frage- und Ratespiele spielen und so in lockerer Atmosphäre meine Untersuchung durchführen. Die Videoaufzeichnungen werden ausschließlich zur Auswertung der Ergebnisse in meiner Examensarbeit benötigt. In meiner Studie werden nur die Vornamen und das Alter der Kinder verwendet. Es erfolgen keine weiteren Angaben, wie z.B. Familienname, Wohnort oder ähnliches.

Wenn Sie es wünschen, bin ich gern bereit Ihnen eine Rückmeldung bezüglich meiner Ergebnisse zu geben.

Ich würde mich sehr freuen, Ihr Kind im Rahmen dieses Projekts kennenlernen zu dürfen. Bei Einverständnis würde ich Sie bitten, den unteren Abschnitt dieses Briefes bis zum **Freitag, den 05.09.2008** im Kindergarten abzugeben.

Sollten Sie noch Fragen haben, bin ich wie folgt zu erreichen:

Ich verbleibe mit freundlichen Grüßen,

Stefanie Röhrig

---

#### Einverständniserklärung

Ich bin damit einverstanden, dass mein Kind an der Spielstunde zum Zweck der Untersuchung des Spracherwerbs teilnimmt und dabei gefilmt wird.

Name des Kindes: \_\_\_\_\_

Alter: \_\_\_\_\_ Jahre und \_\_\_\_\_ Monate

---

Unterschrift Erziehungsberechtigte(r)



# Appendix C

## Tables

### C.1 Results ASC–Kindergarten Göttingen

**Table C.1:** Results of the experiment which was conducted in the ASC-Kindergarten in Göttingen in (February 2008). In this experiment the covered boxes contained a bear only (box I) and a bear and a rabbit (box II).

statement	correct answer	results			
		Hanna (4 years)	Carolin (5 years)	Robin (5 years)	Larissa (6 years)
Muss in der Box ein Bär sein?	ja	ja (right)	nein (wrong)	nein (wrong)	ja (right)
Muss in der Box kein Bär sein?	nein	nein (right)	nein (right)	–	ja (wrong)
Kann in der Box ein Bär sein?	ja	ja (right)	ja (right)	ja (right)	ja (right)
Kann in der Box kein Bär sein?	nein	ja / nein (wrong / right)	nein (right)	–	ein (right)
Muss in der Box ein Hase sein?	nein	unschlüssig	nein (right)	nein (right)	nein (right)
Muss in der Box kein Hase sein?	ja	ja/nein (right / wrong)	nein (wrong)	ja (right)	ja (right)
Kann in der Box ein Hase sein?	ja	ja/nein (right / wrong)	ja (right)	ja (right)	ja (right)
Kann in der Box kein Hase sein?	nein	ja (right)	nein (right)	ja (wrong)	–

## C.2 Truth conditions for the semantic interpretation and the exhaustive reading of the statement

**Table C.2:** Truth conditions for the semantic interpretation and the exhaustive reading of the statement

Logical answer (statements refer to parts of the content); exhaustive interpretation (statements are understood as exhaustive descriptions of the content);

statement	*understatement	
	logical answer	exhaustive interpretation
(1) has to be A	yes	no
(2) does not have to be A	no	yes
(3) might be A	yes*	yes
(4) cannot be A	no	no
(5) has to be B	no	no
(6) does not have to be B	yes	yes
(7) might be B	yes	no
(8) cannot be B	no	yes

## C.3 Noveck's results

**Table C.3:** Noveck's results of his experiment I on modals (Noveck, 2001, table 1)

Source: Ira Noveck 2001. "When children are more logical than adults. Experimental investigations of scalar implicatures". In: *Cognition* 78: 172.

statement	correct answer	results			
		5-year-olds	7-year-olds	9-year-olds	adults
has to be a parrot	yes	75*	90**	88**	100**
does not have to be a parrot	no	72*	75*	75*	100**
might be a parrot	yes	72*	80**	69	35
cannot be a parrot	no	66	80**	100**	100**
total		73**	81**	83**	83**
has to be a bear	no	47	65	88**	100**
does not have to be a bear	yes	66	75*	81**	100**
might be a bear	yes	53	80**	100**	100**
cannot be a bear	no	53	80**	100**	100**
total		55	75**	92**	100**

## C.4 Possible implicatures for the statements

**Table C.4:** Possible implicatures for the ‘normal’ understanding of the statements and the exhaustive interpretation of the statements.

statement	scalar implicatures (adultlike)	child-implicatures (based on the assumption that the statements are exhaustive descriptions of the content)
(1) has to be A	–	No, only if B is in the covered box as well.
(2) does not have to be A	–	–
(3) might be A	No, there has to be A.	Yes, possibly.
(4) cannot be A	–	–
(5) has to be B	–	–
(6) does not have to be B	–	–
(7) might be B	–	No, only if A is in the box as well.
(8) cannot be a B	–	–

## C.5 Overview: Exhaustive interpretations

**Table C.5:** number of interpretations with the implicature that the description of the content of the box must be exhaustive for each age group in percentage.

statement	age (years)		
	5	7	9
muss auf jeden Fall A	41.2	33.3	5.6
kann A	?	?	?
könnte / könnte vielleicht A	?	?	?
könnte vielleicht B	33.3	33.3	16.7

## C.6 Overview: Child-implicatures (early scalar implicatures)

**Table C.6:** average number of calculated child-implicatures out of those children who interpreted the statements in the way that the content of the box must be exhaustive in percentage.

\* :  $p < 0.05$ , \*\* :  $p < 0.01$

statement	age (years)		
	5	7	9
muss auf jeden Fall A	38.9	93.3**	33.3
könnte vielleicht B	100**	72.2	100**

**Table C.7:** average number of calculated child-implicatures for each age group in percentage.

statement	age (years)		
	5	7	9
muss auf jeden Fall A	17.6	29.2	5.6
kann A	?	?	?
könnte / könnte vielleicht A	?	?	?
könnte vielleicht B	33.3	23.8	16.7

## C.7 Results: 5-year-olds

**Table C.8:** number of correct responses of the five-year-olds in experiment I to the modal statements in percentage.

statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	100	–	–
kann A	yes	75	50	–
könnte / könnte vielleicht A	yes	50	33.3	16.6
possible conclusions (item B)				
muss B	no	66.6	33.3	–
könnte vielleicht B	yes	66.6	33.3	–
kann A und B	yes	100	–	–

**Table C.9:** number of correct responses of the five-year-olds in experiment II to the modal statements in percentage.

statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	50	33.3	16.6
kann A	yes	50	25	25
könnte / könnte vielleicht A	yes	66.6	16.6	16.6
possible conclusions (item B)				
muss B	no	50	50	–
könnte vielleicht B	yes	75	–	25
kann A und B	yes	100	–	–

**Table C.10:** number of correct responses of the five-year-olds in experiment III to the modal statements in percentage.

statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	83.3	16.6	–
kann A	yes	50	–	33.3
könnte / könnte vielleicht A	yes	50	–	50
possible conclusions (item B)				
muss B	no	60	40	–
könnte vielleicht B	yes	83.3	16.6	–
kann A und B	yes	100	–	–

## C.8 Results: 7-year-olds

**Table C.11:** number of correct responses of the seven-year-olds in experiment I to the modal statements in percentage.

statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	37.5	25	37.5
kann A	yes	100	–	–
könnte / könnte vielleicht A	yes	75	50	–
possible conclusions (item B)				
muss B	no	–	75	25
könnte vielleicht B	yes	57.1	28.6	14.3
kann A und B	yes	87.5	–	12.5

**Table C.12:** number of correct responses of the seven-year-olds in experiment II to the modal statements in percentage.

statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	75	12.5	12.5
kann A	yes	100	–	–
könnte / könnte vielleicht A	yes	50	37.5	12.5
possible conclusions (item B)				
muss B	no	12.5	75	12.5
könnte vielleicht B	yes	85.7	14.3	–
kann A und B	yes	87.5	–	12.5

**Table C.13:** number of correct responses of the seven-year-olds in experiment III to the modal statements in percentage.

statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	87.5	12.5	–
kann A	yes	83.3	16.7	–
könnte / könnte vielleicht A	yes	50	25	25
possible conclusions (item B)				
muss B	no	50	33.3	16.7
könnte vielleicht B	yes	85.7	–	14.3
kann A und B	yes	100	–	–

## C.9 Results: 9-year-olds

**Table C.14:** number of correct responses of the nine-year-olds in experiment I to the modal statements in percentage.

statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	100	–	–
kann A	yes	50	33.3	16.7
könnte / könnte vielleicht A	yes	33.3	66.6	–
possible conclusions (item B)				
muss B	no	16.7	83.3	–
könnte vielleicht B	yes	83.3	–	16.7
kann A und B	yes	100	–	–

**Table C.15:** number of correct responses of the nine-year-olds in experiment II to the modal statements in percentage.

statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	83.3	16.7	–
kann A	yes	50	33.3	16.7
könnte / könnte vielleicht A	yes	50	33.3	16.7
possible conclusions (item B)				
muss B	no	–	100	–
könnte vielleicht B	yes	83.3	–	16.7
kann A und B	yes	100	–	–



**Table C.16:** number of correct responses of the nine-year-olds in experiment III to the modal statements in percentage.

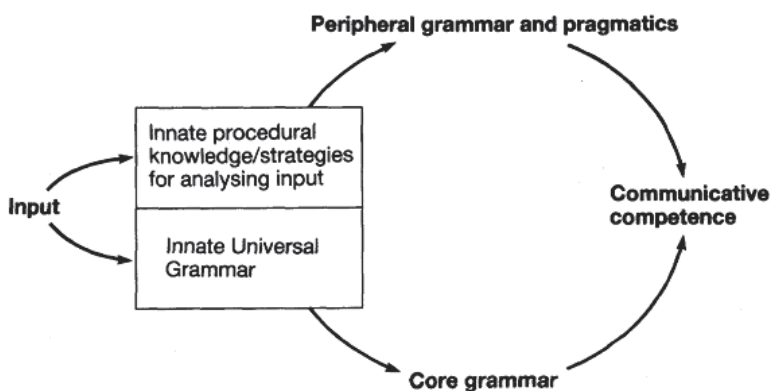
statement	expected answer	given answer		
		yes	no	mixed
necessary conclusions (item A)				
muss auf jeden Fall A	yes	100	–	–
kann A	yes	33.3	50	16.7
könnte / könnte vielleicht A	yes	33.3	50	16.7
possible conclusions (item B)				
muss B	no	–	100	–
könnte vielleicht B	yes	83.3	–	16.7
kann A und B	yes	100	–	–



# Appendix D

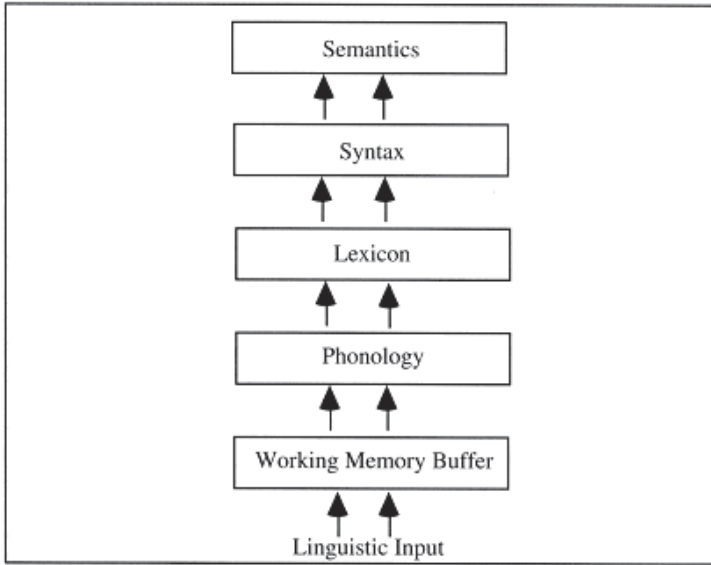
## Figures

### D.1 Foster's model of communicative competence development



**Figure D.1:** Foster's model of communicative competence development  
Source: Foster 1990, fig 20, p. 187. "A simplified model of communicative competence development." In: Susan H. Foster. *The Communicative Competence of Young Children*. New York: Longman.

## D.2 Crain and Lillo-Martin's language module



**Figure D.2:** Crain and Lillo-Martin's Language Module

Source: Crain and Lillo-Martin 1999, fig. 7.1, p. 65. "The Language Module." In: Stephen Crain and Diane Lillo-Martin. *An Introduction to Linguistic Theory and Language Acquisition*. Oxford: Blackwell Publishers.

## D.3 Results: adults

Alter: 21 Geschlecht: ♀	Alter:      Geschlecht:	Alter:      Geschlecht:
Kann in der Box ein Bär sein? <u>ja</u>	Kann in der Box ein Bär sein? <u>Ja</u>	Kann in der Box ein Bär sein? <u>Ja</u>
Kann in der Box ein Hase sein? <u>ja</u>	Kann in der Box ein Hase sein? <u>Ja</u>	Kann in der Box ein Hase sein? <u>Ja</u>
Muss in der Box ein Bär sein? <u>ja</u>	Muss in der Box ein Bär sein? <u>Ja</u>	Muss in der Box ein Bär sein? <u>Ja</u>
Muss in der Box ein Hase sein? <u>nein</u>	Muss in der Box ein Hase sein? <u>Nein</u>	Muss in der Box ein Hase sein? <u>Nein</u>
Alter: 21 Geschlecht: w.	Alter: 22 Geschlecht: w	Alter: 24 Geschlecht:
Kann in der Box ein Bär sein? <u>ja</u>	Kann in der Box ein Bär sein? <u>ja</u>	Kann in der Box ein Bär sein? <u>Ja</u>
Kann in der Box ein Hase sein? <u>ja</u>	Kann in der Box ein Hase sein? <u>ja</u>	Kann in der Box ein Hase sein? <u>Ja</u>
Muss in der Box ein Bär sein? <u>ja</u>	Muss in der Box ein Bär sein? <u>nein ja</u>	Muss in der Box ein Bär sein? <u>Nein</u>
Muss in der Box ein Hase sein? <u>nein</u>	Muss in der Box ein Hase sein? <u>ja nein</u>	Muss in der Box ein Hase sein? <u>Nein</u>
Alter: 25 Geschlecht: w.		
Kann in der Box ein Bär sein? <u>ja</u>		
Kann in der Box ein Hase sein? <u>Nein ja</u>		
Muss in der Box ein Bär sein? <u>ja</u>		
Muss in der Box ein Hase sein? <u>Nein</u>		

Figure D.3: Results of the students who attended the language acquisition seminar on 01.07.2008.

## D.4 Mad Dog Logical Nativism

- 1'. *All logical concepts are either learned or innate.*
- 2'. *If learned, a logical concept is acquired through hypothesis-testing.*
- 3'. *If a logical concept is acquired through hypothesis-testing, neither the formulation of the hypothesis nor the methods used to test it can invoke the concept.*
- 4'. *In determining the meaning of a term denoting a primitive logical concept, learners make use of the concept to be acquired, if not in framing the hypothesis then in testing it.*
- 5'. *So, primitive logical concepts cannot be acquired through hypothesis-testing.*
- 6'. *Therefore, primitive logical concepts are not learned.*
- 7'. *And, therefore, primitive logical concepts are innate.*

**Figure D.4:** Crain and Khlentzos' argument for Mad Dog Logical Nativism  
Source: Crain and Khlentzos 2008, p.51. "Is Logic Innate?" In: *Biolinguistics*.  
2008. Vol 2, No 1: 24-56.

# Appendix E

## Methodical Appendix

For some of the children who took part in my experiment (especially the younger ones) I had to verify my methods of the experiment spontaneously.

First of all, I realized that some of the children seemed to have problems to evaluate the statement *In der Schachtel muss A sein* because they applied a different interpretation (which makes the statement ambiguous) to the statement. In order to help my subjects to interpret the statement in the way it was expected, I slightly helped them by letting them know that in order to answer this question it would not be important whether there was B in the covered box as well or not. After the subject were given this advice, most of them were able to answer the statement correctly and in the way it was expected.

One of the children who attended nursery asked me whether her answers were correct and if other children were more intelligent than her or not. At that moment I just told her that this was just a game and that I would not remember or compare the results with each other in order to see who gave the best answers. However, I kept thinking about that girl's question. When I conducted the same experiment with the seven-year-olds in primary-school I realized that some of the children were a little shy or hesitated to evaluate the statements although all of the children know me and my family and are normally not shy if they meet me. While, I was thinking about this problem, I suddenly remembered what the five-year-old girl had asked me. This is why I got the idea that my subjects might worry about giving a wrong answer and whether a wrong answer would have any further effects for them (because the experiment was conducted in school and my dad is their teacher for mathematics). When this idea came to my mind I quickly told the child (who had triggered this thoughts due to her behaviour) that she should say what she was thinking and that no matter what she would say, there are no wrong answers because this experiment was for university and had nothing to do with her grades at school. To my own surprise that child now seemed to feel more comfortable and more communicative in evaluating the statements.

Concerning the children who attend nursery I found it is helpful to put the toys on the top of the boxes so that they can directly compare the boxes and can see the content of both boxes on the first glance. Apart from that I told them that these toys are "living" in theses "houses". In this way the whole experiment appeared more playful and less complicated to the children. Additionally, it had the positive

side-effect that it helped me to avoid to mention the modal verbs in the explanation of the setting already.

When I conducted the experiment with one child who attended nursery, one of the puppets uttered the statement *In der Schachtel könnte vielleicht A sein*. Since the child did not evaluate the statement and stayed silent for a couple of seconds, the other puppet uttered the stronger equivalent of the statement *In der Schachtel muss A sein*. After both puppets repeated their statement the child suddenly told me that the puppets were arguing. I, therefore, utilised this situation and told the puppets that they could ask the child to mediate. It turned out that this method was quite useful because it showed that this child was able to compute scalar implicature and knew that both puppets were right but that the one who had uttered the stronger term had said it better. From that moment onwards I used this method in all the experiments which followed and found that even the youngest children are actually able to compute scalar implicatures in this kind of situation. Unfortunately, this child was one of the last ones who attended nursery and took part in my experiment. Therefore, I was not able to apply this method to all of the five-year-olds.

Moreover, I realized that it is very important for the children who attend nursery that both puppets utter wrong statements occasionally. At the beginning I did not realize that it was (coincidentally) always the same puppet who uttered a wrong statement. Although I did not realize it, the child did so, and therefore came up with the following explanation for her answer: *Weil der manchmal lügt*.<sup>1</sup> This kind of explanation is of course not desired because it does not help the experimenter to figure out what kind of interpretation the child applied to the statement.

Apart from that, I found that it is not useful to ask the children to reward the puppets. This is because the children did not reward the puppets objectively. Apart from totally forgetting to reward the puppets, some children rewarded the puppets randomly or tended to give the puppet they liked better a bigger reward. One child even gave a puppet more than one reward for the statement and then let me know that we could not carry on with the experiment because there were no rewards left anymore (although I had especially prepared more rewards than utterances). Since this child was also the only child who attended nursery and was not really interested in this experiment and wanted to play different games, it might have been her strategy to come to an end of this ‘game’. Another child (Dalia) also paid attention that in the end both puppets should have an equal amount of rewards. However, I am not quite sure whether the task to evaluate a statement and to reward the puppet for her statement was too complex for the five-year-olds and if this was the reason why some children forgot to reward the puppets.

With respect to organisational issues, it is also advisable to have more children than the actual number of children needed. I found that roughly one out of seven children is either problematic or influenced by other factors such as lunch break, the order of the experiment or the fact that a child does not like this ‘game’ and does not show interest in it.

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<sup>1</sup>see Appendix B.2.3: Ronja (Experiment II (b)), statement: *In der Schachtel muss auf jeden Fall ein Hund drin sein*



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Zusätzlich können in der Reihe Sammelbände beispielsweise mit den Arbeitsergebnissen aus Kolloquien oder Workshops veröffentlicht werden. Die Werke werden auf Deutsch oder Englisch publiziert.

Wer bei „scalar implicatures“ an eine exotische Zierfischart denkt und vor seinem geistigen Auge bunte Segelflosser majestätisch zwischen Steinen und Grünpflanzen dahinschweben sieht, der irrt sich sehr: Scalar implicatures bezeichnen keine Buntbarschart, sondern gehören in den Bereich der Pragmatik. Diese Disziplin der Linguistik untersucht sprachliches Handeln, also sprachliche Äußerungen und die Entstehung von Bedeutung. Insbesondere logische Schlussfolgerungen sind von wissenschaftlichem Interesse. Wer auf die Frage „Have you read Shakespeare’s works?“ mit „I have read some of them“ antwortet, der bejaht einerseits die Frage, schränkt aber – ohne dies ausdrücklich zu sagen – zugleich die Zustimmung ein: some of them heißt nicht all of them. Implikaturen müssen ‚zwischen den Zeilen‘ verstanden werden.

Gewöhnlich wird davon ausgegangen, dass Kinder erst mit etwa 6 Jahren Implikaturen wirklich verstehen und für sich nutzen können. Stefanie Röhrig zeigt in ihrer als Feldstudie angelegten Staatsarbeit, dass diese Lehrmeinung dringend der Überarbeitung bedarf. Denn Kinder, so decken ihre Untersuchungen auf, verfügen sogar über eine ihnen eigene Art der Implikatur.



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