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Early Implicatures by Children and the Acquisition of Scalar Implicatures*

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Abstract. Inquiries into the acquisition of scalar implicatures (SIs) have focussed on the question why children calculate SIs less often than adults. To answer this question several hypotheses, such as the Processing Limitation Hypothesis, the Reference-Set Hypothesis and the Pragmatic Delay Hypothesis have been suggested (Chierchia et al. 2005). All of these studies assume that implicatures are a late acquisition phenomenon, because individual types of implicatures are not distinguished. However, one should not treat all kinds of implicatures in the same way. This study shows that some types of implicatures occur very early and it proves that even 5-year-old children calculate implicatures – although different ones than adults. Based on these findings a new hypothesis on the acquisition of SIs is formulated.

1 Scalar Implicatures

Implicatures are additional and implicit meaning-components beyond the meaning of the explicitly uttered statement. Scalar Implicatures (SIs), a subgroup of conversational implicatures, are computed if scalar terms – terms which can be arranged on a scale according to the degree of their semantic strength and informativeness – occur in an utterance. SIs are based on the fact that the meaning of a weaker term is entailed in the stronger one and that the hearer relies on the Conversational Principles (Grice, 1975) and assumes that once a weaker term of the scale is uttered, the stronger one does not hold. Specifically, Grice's Maxim of Quantity "1. Make your contribution as informative as is required (for the current purpose of the exchange)." and "2. Do not make your contribution more informative than is required." (Grice 1975: 45) are involved in the interpretation of scalar terms and the computation of SIs. Depending on which of these two principles the hearer

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relies on, there are two kinds of scalar implicatures. Upper-bound SIs are inferences from the first Maxim of Quantity, while lower-bound SIs are inferences based on the second Maxim of Quantity.

(1) Some of us have been to the Christmas Market.

The implicature in statement (1) is based on the scale <*all, some, none*>. When hearing (1), the hearer compares the scalar term *some* to *all* and *none*, the stronger and weaker term of the same scale respectively, and infers that it is neiter true that all of the people went to the Christmas Market nore that none of them went there, since otherwise the speaker should have said *all* or *none*. This shows that statement (1) is lower and upper bound at the same time since the hearer expects the speaker to obey the Conversational Maxims and to make his contribution as informative as required but not too informative.

1.1 Acquisition Studies

The acquisition and development of implicatures, especially of SIs, has been widely discussed in literature (Chierchia et al., 2005; Noveck, 2005; Noveck et al., 2007a; Noveck & Sperber, 2007b). One of the first studies concerned with the acquisition of SIs was a study by Noveck (2001) that examined how French children interpret the scalar terms <*must – might*> and <*all – some*>. In this experiment children were confronted with three boxes. Two of the boxes were open, so that the participants could see the content. The third box was closed. 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 Horse + Fish Box) or what's inside this box (experimenter pointed to the Horse-only Box)'" (Noveck, 2001: 172). Based on this information participants had to evaluate statements about the possible and necessary content of the box. Among some neutral statements, which were designed to check whether the task was understood, there was the critical statement *In this box might be a horse*. This statement is under-informative, since there has to be a horse in the box. Noveck expected that participants who calculate SIs should reject this statement, since it is underinformative. Participants who do not draw a SI should accept it.

Noveck's findings were that 7-year-old children are the youngest ones that show overall competence in mastering this task and that 7- to 9-year-old children accept the weaker term of the scale <*must – might*> in a situation where the stronger term is more informative more often than adults. While 72% of the 5-year-old, 80% of the 7-year-old and 69% of the 9-year-old children accepted the statement *In this box might be horse* (the weaker scalar

term) although they knew that *In this box must be a horse* (the respective stronger statement) is more informative in this situation, only 35% of the adults did so. These results show that children accept underinformative statements more often and hence calculate SIs less often than adults.

In the following years, several studies on scalars such as <*all – some*>, <*finish – start*>, <*at least – at most*> and <*and – or*> were conducted in different languages such as English, Italian and Greek (Chierchia et al., 2001, 2005; Papafragou & Musolino, 2003; Guasti et al., 2005; Noveck et al., 2007a; Noveck & Sperber, 2007b). These studies confirm Noveck's findings and support the idea that children enrich underinformative statements less often than adults and thus calculate less SIs. Trying to explain these findings several hypotheses, such as the Processing Limitation Hypothesis and the Pragmatic Delay Hypothesis (Noveck 2001; Chierchia et al. 2005) have been proposed in the literature and will be introduced and discussed in 4.1.

2 German Replication Study

2.1 Linguistic Purpose

A modified replication study of the first experiment of Noveck (2001) was designed and conducted to see whether and from which age on German children calculate implicatures.

In other areas of language acquisition such as semantics and syntax children overgeneralize meanings, grammatical features or rules beyond its use in adult language before they start using it correctly. (cf. Lust, 2006) Over-generalizations are an important component in the process of language acquisition and children's understanding and discovery of how language works. I assume that overgeneralizations, which are part of the learning process, are also important for and part of the acquisition of pragmatics. Participants who overgeneralize the first Maxim of Quantity might interpret statements differently than expected. For example, if participants interpret the utterance heard in this experimental setting as exhaustive description of the content of the box and thus as the most informative statement, then a different kind of implicature might be calculated. Consequently, particular attention was paid to statements which might possibly trigger different kind of implicatures. To figure out, whether children stick to or overgeneralize the Conversational Principles and/or calculate other implicatures than adults (e.g. based on a different reading or understanding of the statements), close attention was paid to participants answers and comments.

Additionally, the formulation of the task was modified, so that it did not contain the conjunction *or*. This was done to avoid the use of a second scalar

term or any other critical term in the experiment since it could have an additional impact on the results of the reasoning experiment.
These changes in the experimental design and evaluation of the resulting data might also be informative with respect to the adequateness of the hypotheses about the acquisition of SIs. If it turns out that children stick to or overgeneralize the Conversational Principles, then the Pragmatic Delay hypothesis (see 4.1) could be rejected.

2.2 Methods

2.2.1 Participants

Seven 5-year-old children, eight 7-year-old children and seven 9-year-old children took part in the experiment. Their mean ages were 5;5 years, 7;6 years and 9;6 years. All participants were native speakers of German and recruited from a kindergarden and primary school in Thuringia.

2.2.2 Materials and Design

The materials were similar to the ones Noveck (2001) used in his study. However, the statements in my experiment were presented in German. Moreover, I only presented the positive statements and added the following additional statements to stress the contrast between the modal verbs *könnte* ('might') and *muss* ('must'): *In der Box muss auf jeden Fall A sein* ('In any case there has to be A in the box'); *In der Box könnte vielleicht A sein* ('There might possibly be A in the box'). This was done to see whether children are more likely to compute SI if the contrast between the statements is stronger. The statement *In der Box kann A und B sein* ('There might be A and B in the box') was added to see whether participants understood and were able to cope with the task. The task was formulated so that it did not contain the scalar term *or*, to avoid possible influences from other scalar terms.

2.2.3 Procedure

The session began with a short conversation and a pre-task. For the pretask participants were presented with two boxes. Box I contained item A, box II contained items A and B. Children were then given another box which was empty and asked to fill it in the way that it contains the same items as box I or box II in the end. The purpose of this pretask was to see whether the task or setting was too difficult for the participants, whether the logical term *or* has an impact on children's calculation of SI in the experiment and to familiarize the children with the situation and task of the experiment.

In the actual experiment subjects were shown three boxes (see figure 1). 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. Participants were given a glove-puppet which was supposed to help the child to evaluate the statements they were going to hear. They were told that the closed box contained the same toys as one of the two open boxes in front of them. Then one of the following six sentences was uttered in terms by two puppets that were controlled by the experimenter: *(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). The puppets were introduced so that the experiment appears like a quiz-game rather than a test to the children. The procedure was repeated so that each child had evaluated three sets of statements with different toys. Children were told to evaluate the statement either as *richtig* ('correct'), *halbrichtig* ('semi-correct') or *wrong* ('wrong').

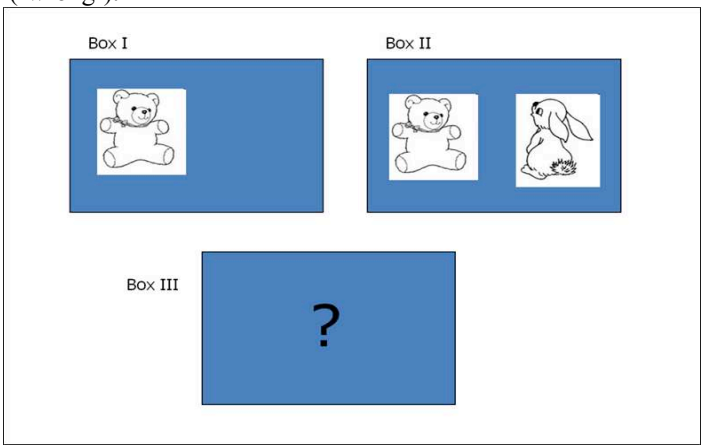

Figure 1**:** depicts the experimental design

To test whether children focus on truthfulness or falsity rather than on appropriateness when evaluating a statement, participants were confronted with an argument of the puppets at the end of the session. One puppet said that the statement *In der Schachtel kann/ könnte A sein* ('There might/ might possibly be A in the box') was true while the other claimed that the statement *In der Schachtel muss A sein* ('There has to be A in the box') was correct. Participants were asked to act as a mediator between the two glove puppets.

2.2.4 Expectations

If participants understood the task properly and in the expected way, they should reject *(1) In der Schachtel muss B sein*. If a statement is true for at least one of the open boxes, then it is also true for the covered box.

Additionally, SIs can be calculated for statement *(4) In der Box könnte vielleicht A drin sein*. If participants accept this statement, it indicates that they consider *könnte (vielleicht)* as compatible with *muss auf jeden Fall*. While the affirmation of this statement would show that the participant did not enrich the meaning of the weaker scalar term, the rejection of the statement in favour of the stronger scalar term would indicate that he computed a SI. If statements (4) and (6) are evaluated as semi-correct, it indicates that participants realized that these statements are underinformative but do not consider this violation as bad enough to reject the statements.

Statement *(6) In der Schachtel kann A drin sein* is a variation of statement *(4) In der Schachtel könnte vielleicht A drin sein*. If participants reject sentence (4) but accept (6), it would indicate that they compute SIs more easily if the distance on the Horn Scale[1] between the uttered scalar term and the most informative scalar term is bigger. Moreover, if SIs are calculated more easily if the distance on the Horn Scale is bigger and the scalar term *kann* ('might') should not be weak enough in this kind of reasoning experiment, then sentence (4) should be rejected while its variation (6) should be accepted.

Different kinds of implicatures may be calculated for some of the statements, if participants consider the statements about the covered box as exhaustive descriptions of its content. For example, if the hearer exploits the meaning of the uttered statements and interprets the utterances as upper-bound (as the most informative utterance), then she or he will, for example, not only focus on item B but also on other items that have to be in the box once B is in the box. This kind of interpretation affects the following statements: *In der Schachtel muss A sein; In der Schachtel kann/ könnte vielleicht A sein; In der Schachtel könnte B sein*.

If participants consider the statements as exhaustive descriptions of the content of the box then they are expected to reject statement *(5) In der Schachtel könnte B sein* because B can only be the content of the box if A is the content of the box as well. Under these circumstances statement *(3) In der Schachtel muss A sein* would also be false, since A alone is only possibly (not

[1] Horn Scales are named after the linguist Laurence Horn. Scalar terms are linearly ordered on this scale according to their semantic strength. The most informative term is presented at the left end of the scale, the weakest one at the right.

necessarily) true for the covered box. The statement *In der Schachtel kann/ könnte vielleicht A sein* is also true under these circumstances since A (alone) is only a possible content of the covered box.

In the puppets argument at the end of the experiment children, who evaluate a statement based on its truthfulness or falsity, rather than on appropriateness, are expected to say that both statements are right. Participants who evaluate a statement according to its appropriateness should say that the statement *In der Schachtel muss A sein* is the better one.

2.3 Results

In the pretask children's interpretation of the scalar term *or* in the setting of the actual experiment was tested. This was done to figure out whether a higher amount of 5-year-olds answered the statement *In der Schachtel könnte vielleicht A sein* of the actual experiment in the affirmative because they understood the task differently than adults. It can be said that nearly all of the participants mastered this pretask well and filled the empty box with the same items as in box I or in box II. The only exception was a 5-year-old girl, who had interpreted the task differently and changed the content of one of the open boxes as well. After the task was explained again she filled the empty box with the correct items. The results show that the vast majority of children interpreted *or* in this task as exclusive-*or* and suggest that young children's reasoning results are not influenced by a different reading of *or* if the disjunction was used in the actual experiment.

With respect to the expectations of the actual experiment mentioned above, it can be said that more SIs were computed for the weaker scalar term *könnte vielleicht* than for the stronger one *kann*. This shows that the distance on the Horn-Scale has an impact on the amount of calculated SIs. Moreover, some participants interpreted the uttered statements as exhaustive descriptions of the content of the covered box and calculated, based on this different interpretation of the statement, a different kind of implicature.

In the situation where participants had to act as mediator because two puppets were arguing whether the statement *In der Schachtel kann/ könnte vielleicht A sein* or the statement *In der Schachtel muss A sein* was right, 83% of the 5-year-old, 81% of the 7-year-old and 80% of the 9-year-old children favoured the more adequate statement *In der Schachtel muss A sein*.

The t-value for proportions was calculated with a non-directional test of significance. The results were then compared with the critical t-value of the t-distribution to see whether the results are significant.

The results of the reasoning experiment for each age-group are depicted in table 1. The answers of the 5-year-olds are significantly above chance level

in three out of six statements. In total the responses for possible conclusions is highly significant and the one for necessary conclusions are highly significant above chance level. This shows that even 5-year-old children are able to master the reasoning task. The 7-year-old children gave answers which are highly significant for four out of six statements. Their answers to necessary conclusions as well as possible conclusions are even highly significant above chance level. The oldest group of participants, the 9-year-old children, gave the expected answers for all of the statements except for *In der Schachtel kann/ könnte vielleicht A sein*. Most of their answers were highly significant above chance level, which shows that they are consistent in their answers and competent enough to master this task.

statement	answer	age (years)		
		5	7	9
necessary conclusions				
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
possible conclusions				
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**

Table 1: shows the average of correct responses. In this table *yes* is considered to be the correct answer to 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. This is because once a statement is true for at least one of the open boxes, it is also true for the covered box. *: $p < .05$; **: $p < .01$

2.3.1 Child-Implicatures

However, if one looks at the responses to the necessary conclusions in table 1, one can see that younger and older children give answers that are highly significant to different types of statements within the group of necessary conclusions. In order to figure out why the statements that got a correct answer, which is significantly above chance level, differ between the age

groups, the results and answers of all participants were looked at in more detail. It turned out that 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.

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

Table 2: average percentage of child-implicatures for each age group

Some participants, especially the 5-year-old children, appeared to consider the statements as exhaustive descriptions of the content of the box, because they believed that the utterance they heard about the covered box was the most informative one to describe its content. This had an impact on their response to *In der Schachtel muss A sein* and *In der Schachtel könnte B sein*. Therefore, they said that the statement *In der Schachtel könnte B sein* is wrong because in any case B can only be part of the content of the box. The statement *In der Schachtel muss A sein* was rejected, because it is only possibly but not necessarily true that there is only A in the box. Especially young children calculated this kind of implicature. Since this kind of early implicatures are especially calculated by young children, they are referred to as child-implicatures in this paper.

The data in table 2 shows that even children at the very young age of five do calculate implicatures, e.g. for the statement *In der Schachtel könnte B sein* and for the statement *In der Schachtel muss A sein*. Although some of the 9-year-old participants still calculate child-implicatures, this kind of implicature decreases with age. Child-implicatures are upper bound scalar implicatures and based on the first Maxim of Quantity (see above).

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

Table 3: percentage of participants who considered the statements as exhaustive descriptions of the content of the box

Table 3 shows the percentage of children who understood the uttered statements as exhaustive description of the content of the box. As mentioned

earlier, this interpretation is the prerequisite for the calculation of child-implicatures. Table 4 shows the percentage of children who calculated child-implicatures out of those children who interpreted the statements in the way that the content of the box must be exhaustive. The results show that children who considered the statements as exhaustive descriptions are – at least for the statement *In der Schachtel kann B sein* – in all age-groups very likely to calculate child-implicatures.

Moreover, some of the 5-year-old children calculated an implicature based on exhaustive reading for the statements *In der Schachtel kann/ könnte vielleicht A sein*. They evaluated the statement as *halbrichtig* because it describes only one of two possible contents of the box. Since this description of the content of the covered box would be wrong if it turns out that there is A and B in the box, they evaluated these utterances as semi-correct. This shows that the children did not only focus on the modal verb of the utterance but on the item mentioned and considered the statements as exhaustive descriptions of the content.

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 4: shows the average amount 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. *: $p < .05$; **: $p < .01$

Since the evaluations *falsch* and *halbrichtig* could indicate both an exhaustive reading of the statement and the calculation of SIs, it could – especially for the *halbrichtig*-answers – not always be clearly distinguished whether an implicature was calculated or an exhaustive reading was applied to the statement. Therefore, it cannot be said clearly how many percent of children understood this statement as exhaustive description. Moreover, only *no*-answers and those answers which came with an explanation and clearly indicated that SIs were calculated were included in the results of table 3.

2.3.2 Scalar Implicatures

Concerning children's calculation of SIs the following can be said: The results of this experiment show that a small but not representative minority of the 5-year-old participants calculated SIs for the statement *In der Schachtel könnte A sein*. This indicates that they are able to calculate SIs for this statement if they apply the expected (not exhaustive) reading to the statement.

The majority (94.7%, see table 1) of the 7-year-old participants did not reject the statement *In der Schachtel kann A sein*. This is a significantly higher amount than the one of the 5- and 9-year-old participants. This might be because they are equivocal between the exhaustive reading of the utterance and the reading that A is possibly part of the whole content of the box but do not calculate SIs. Table 5 shows that indeed only a small amount of 7-year-olds calculated SIs for this statement. However, for the slightly less informative statement *In der Schachtel könnte/ könnte vielleicht A sein*, a higher amount of 7-year-olds calculated SIs. This might be because this statement is even more underinformative and because the exhaustive reading is not as adequate for this statement as it is for the slightly stronger one *In der Schachtel kann A sein*.

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

Table 5: Percentage of scalar implicatures calculated for the modal statements.

The 9-year-olds are the age-group that calculates the highest amount of SIs. This is probably because the vast majority of this age-group does not apply the exhaustive reading to the statements anymore. This realization is a perquisite to the discovery that the statements *In der Schachtel kann/ könnte vielleicht A sein* are underinformative. Therefore, this age-group calculates SIs much more often than the 5- and 7-year-old children do. It can be said that the amount of calculated SIs increases with the age of the participants. When one compares the results of both underinformative statements with each other, it can be said for all age-groups that the critical statement *In der Schachtel könnte/ könnte vielleicht A sein* is more likely to trigger implicatures (see table 5).

When children were asked to act as mediator between the puppets, some of them did indeed consider both statements as right but added that the more informative statement *In der Schachtel muss A sein* was more appropriate. 20% of the 5-year-old, 50% of the 7-year-old and 75% of the 9-year-old participants said that both statements *In der Schachtel kann A sein* and *In der Schachtel muss A sein* are right or that the latter one was more appropriate. The rest of the children said that the puppet who had said *In der Schachtel kann A sein* was wrong. This shows that more children recognize that this

statement is under-informative when they are confronted with both statements at the same time and forced to make a decision.

2.3.3 Scalar Implicatures Compared to Child-implicatures

If one compares the amount of calculated child-implicatures with the amount of calculated SIs among the age-groups (see tables 2 and 5) one can see that SIs are increasing with age, while the amount of calculated child-implicatures decreases. While 5-year-olds calculate child-implicatures more often than SI, roughly the same amount of 7-year-olds calculated SI's for the statement *In der Schachtel könnte A sein* as they considered the statement as exhaustive description of the content of the box and calculated child-implicatures for the statement *In der Schachtel muss A sein*. Moreover, 9-year-old children compute SIs much more frequently than child-implicatures.

The reason for this change in the calculated kind of implicature seems to be that the understanding of the task and the conversational maxims which participants focus on seem to differ. While older children and adults seem to value the second Maxim of Quantity and the third Maxim of Manner in this task and setting most, younger children seem value the first Maxim of Quantity and the second Maxim of Manner more than the other maxims. Therefore, the in this setting expected (adult-like) SIs are upper-bound while child-implicatures are lower-bound SIs.

3 Discussion

Let us finally turn to the question whether the present results support any of the acquisition hypotheses discussed in literature.

3.1 Acquisition Hypotheses

The *Pragmatic Delay hypothesis* states that children have semantic but lack pragmatic knowledge. This hypothesis was first proposed by Chierchia et. al (2001). The data of my study shows that 83% of the 5-year-old, 81% of the 7-year-old and 80% of the 9-year-old children favoured the more adequate statement *In der Schachtel muss A sein*, in a situation where two puppets were arguing whether the statement *In der Schachtel kann/ könnte vielleicht A sein* or the statement *In der Schachtel muss A sein* was right. These results as well as the data from Chierchia et al. (2005) show that children know and use the Maxim of Quantity, which is essential pragmatic knowledge for the calculation of SIs. Children even rely on the Maxim of Quantity and therefore assume that the speaker uttered the most informative statement concerning the content of the covered box. Based on this interpretation children calculate child-implicatures. In order to be able to do so, they have to use pragmatic

knowledge and the Conversational Maxims. The present findings suggest that the Pragmatic Delay hypothesis does not hold for the tested age groups since young children's evaluations are based on the exhaustive interpretation of the statements and not on a lack of pragmatic knowledge.

The *Processing Limitation hypothesis* suggests that children have a limited working memory and hence problems to keep and compare two represen-tations of a statement. Due to this disadvantage children are said to calculate implicatures less often than adults. According to Chierchia (2005), children who fail to compute SIs are expected to achieve worse results in a task that requires a good memory system than children who calculate SIs. On the first glance, the fact that older children, who are thought to have a more advanced working memory, calculate more SI than younger ones seems to support this hypothesis.

However, in connection with a different experiment about pragmatic enrich-ment processes in children, a working memory test was conducted with 5-, 7- and 9-year-old children. Children heard and had to repeat non-words of differing length (amount of syllables) and semantic relatedness to known words. This test measured the ability of repeating new and never heard non-words. In order to be able to repeat these non-words, participants have to memorize them based on their length and semantic relatedness to known words in the phonological working memory. First preliminary results show that there is no interaction between the amount of points that participants gained in the working memory test and the amount of implicatures calculated in the experiment (Röhrig, manuscript in preparation). This indicates that the hypothesis that children calculate less implicatures because they have a limited working memory does not seem to hold.

An *alternative hypothesis by 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. If this thesis was right, then children who are confronted with statements *In der Schachtel kann/ könnte A sein* and *In der Schachtel muss A sein* are expected to say that both of them are right. Indeed, some participants of this study considered both statements to be right. However, they added that the more informative statement *In der Schachtel muss A sein* was more appropriate. These results support Chierchia's hypothesis in the way that they suggest that children do focus on truthfulness and falsity of a statement when making an evaluation. The important point however is that children do not neglect appropriateness in favour of truthfulness or falsity, instead they pay attention to appropriateness at the same time, though to a lesser extent.

3.2 A New Approach to the Acquisition of Scalar Implicatures

Based on the results of the study described in this paper, the following hypothesis is proposed. Before children calculate the expected SIs in the setting of the experiment described above, they calculate child-implicatures, based on exhaustive readings because they value different maxims of the Conversational Principles more than adults. In particular they overgeneralize the first Maxim of Quantity by using it in situations where it is less appropriate and hence interpret statements differntly than expected. This observation indicates that overgeneralizations, which are an important part of the learning process in many areas of languaguage acquisition, also play an important role in the acquisition of pragmatics.

In the first stage children rely on the Cooperative Principle and over-generalize the first Maxim of Quantity. Therefore, they interpret the statements as exhaustive descriptions of the content of the covered box. Moreover, they use a different strategy to solve the task since they try to match the statements heard with one of the open boxes and evaluate the statement as *richtig* ('right') if it is true for one of the open boxes.

In the second stage children still strongly rely on the first Maxim of Quantity and consider the statements as exhaustive description of the content of the covered box. What is new in this stage is that children begin to fully exploit the first Maxim of Quantity by calculating child-implicatures based on this maxim. In this stage children typically reject the statement *In der Box muss A sein* by either just saying *falsch* ('wrong') or by explaining *Nur A also. Das ist falsch* ('So only A. That is wrong.'). This shows that children are capable of calculating implicatures based on the first Maxim of Quantity. However, they are not aware that the speaker applies to the second Maxim of Quantity and says less than actually meant. Children's answers are based on the assumption that the speaker obeys the first Maxim of Quantity.

In the third stage children discover that the speaker violated the first Maxim of Quantity and applied to the second Maxim of Quantity as well as the third Maxim of Manner. This realization helps children to understand the uttered statements in a different way. They do no longer overgeneralize any of the Maxims. For this reason the exhaustive interpretation of the statements becomes less prominent and the amount of calculated child-implicatures decreases. Moreover, children do no longer match the sentences heard to one of the open boxes but consider the items mentioned in the statement as possible or necessary part of the content of the covered box. Children now interpret statements in the same way as adults do, but neglect the first Maxim of Quantity. Therefore, they do not calculate as many SIs as adults do.

In the fourth and final stage children are aware of both maxims of Quantity as well as the third Maxim of Manner. The amount of calculated scalar implicatures increases because children exploit the first Maxim of Quantity.

4 Summary and Outlook

In contrast to current research literature, I found that even young children are able to calculate implicatures given an appropriate setting although the statement which triggers an implicature and the type of implicature are not the same as the ones adults calculate. Child-implicatures are upper-bound SIs in this experiment and setting based on the exhaustive reading of statements. The differences between childlike and 'normal' or adult type of scalar implicatures in this setting, arise because the conversational maxims that children and adults value most differ. While adults seem to value the second Maxim of Quantity and the third Maxim of Manner most, children seem to value the first Maxim of Quantity and the second Maxim of Manner more than the other maxims of Grice's Conversational Principles. Therefore, I suggest that different kinds of implicatures should not be treated in the same way. The present results also suggest that implicatures cannot be considered a generally late acquisition phenomenon, because different types of implicatures, in this case child-implicatures and the 'adultlike' scalar implicatures, are acquired at different ages and thus have to be distinguished from one another.

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