

YOUNG CHILDREN'S UNDERSTANDING OF BELIEF AND COMMUNICATIVE INTENTION

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Four- to 7-year-old children were tested for their ability to explain a story protagonist's action in terms of his truthful or deceptive communicative intentions in a situation where explicit consideration of the protagonist's belief state was necessary. This necessity arose because the protagonist, who intended to correctly inform or deceive another person about the location of an object, himself held a false belief about that location. Most children as young as 4 to 5 years were able to relate the protagonist's action *either* to his communicative intention *or* to his false belief but only very few were able to relate the action to belief and deceptive intention *simultaneously*. This integration of belief and deceptive intention was achieved by a majority of 6- to 7-year-olds. Results are discussed in terms of the conflict in truth values between subject's knowledge, speaker's belief and speaker's deceptive intention.

The aim of this paper is to investigate children's ability to reason about the interrelationship between an actor's intention, belief, and communicative action. That action in general depends on belief and intention has been explicitly stated by Aristotle in his "practical syllogism" and again emphasized by recent action theorists (e.g., Von Wright, 1963).

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Since it is not clear whether the “practical syllogism” is a proper logical syllogism, we prefer to refer to it as Aristotle’s practical inference schema. It characteristically consists of two types of premises, one stating the actor’s intention and the other stating the actor’s knowledge or belief (epistemic state) about the world, from which a conclusion about the actor’s behaviour can be drawn. To use an example relating to our experimental material this can be illustrated as follows:

Max *wants* to get the chocolate. (Intention Premise)

Max *knows* it is in the cupboard. (Epistemic Premise)

Therefore:

Max will open the cupboard. (Behavioural Conclusion)

The two main uses of this practical inference schema are to *predict behaviour* and to *explain behaviour*. First, if one already knows the actor’s Intention and Epistemic State, an inference can then be drawn about the actor’s future *Behaviour*. Alternatively, if one knows only the actor’s Epistemic State and observes his *Behaviour*, an inference can then be made about the actor’s Intention

At first sight both types of inference seem to involve an integration of two premises; that of the actor’s *Epistemic State* combined with either the actor’s *Intention* or *Behaviour*. However, explicit reference to the actor’s epistemic state is not always necessary. For example, if Max is seen opening a cupboard and that cupboard contains only a bar of chocolate, his behaviour may be explained by inferring that his intention is to get chocolate. His *knowledge* that the chocolate is in the cupboard will not normally need to be represented since it can usually be assumed that Max “knows” about relevant aspects of his environment (i.e., that he knows where the chocolate is if he cares about it). In this, and every other case where the actor’s epistemic state matches reality, the epistemic premise “Max *knows* the chocolate is in the cupboard,” can simply be replaced with the factual premise “The chocolate is in the cupboard.” However, there are many situations in which an actor’s belief does not match reality and it is in these cases where epistemic state must be considered

simultaneously with intention to predict or explain behaviour. For example, if Max is seen opening a cupboard which is *empty* how can his behaviour be explained? Similarly, under what circumstances could such behaviour be predicted? If Max's epistemic state is one of *false belief*, then inference of a specific intention or prediction of specific behaviour is possible. For example, let us assume that Max has returned to a cupboard in which he had put some chocolate, unaware that in his absence it had been moved. From his false belief and behaviour a specific intention can be inferred as follows:

Max thinks the chocolate is in the cupboard.
Max opens the empty cupboard.

Therefore:

Max wants to get the chocolate.

Besides knowledge and false belief an actor can also be in a state of ignorance, where he lacks knowledge or any other specific belief. On the basis of an actor's ignorance neither a specific intention can be inferred from behaviour nor can specific behaviour be predicted. For example, Max's behavioural choice, to open the empty cupboard, cannot be specifically predicted or explained if he does not know where the chocolate is. At best a vague explanation could be given that he was looking for the chocolate and hence looked into every suitable location.

Developmental studies have tended to investigate children's ability to reason about epistemic states or intention separately, or assess their ability to integrate epistemic state and intention only on the basis of ignorance rather than false belief. Concerning epistemic states, Marvin, Greenberg, and Mossler (1976) and Mossler, Marvin, and Greenberg (1976) investigated children's understanding of another person's *ignorance* and Johnson and Maratsos (1977) and Wimmer and Perner (1983) investigated children's understanding of another person's *false belief*. Both kinds of studies agreed that children become able to differentiate their own from another person's epistemic state around the age of 4 years, although in direct comparison attribution of ignorance was mastered earlier than attribution of false belief (Hogrefe, Wimmer, & Perner, 1986).

Understanding intention was addressed developmentally only by testing children's judgment of intentionality. One group of studies (Nelson, 1980; Shultz & Wells, 1985; Shultz, Wells & Sarda, 1980; Yuill, 1984) found that children as young as 3 years understood that the outcome of an action was *intended* if the outcome *matched* the actor's explicitly stated intention and that the outcome was *not intended* if it did not match actor's intention.

The group of studies which tested some integration of epistemic state and intention were those dealing with children's reasoning about foreseeability and intentionality. These studies show that children can relate ignorance to action from a remarkably young age. When the experimental material made actor's knowledge or ignorance explicit (Nelson-LeGall, 1985; Yuill, in press) children as young as 3 to 4 years were able to understand that the outcome of an action was *intended* only if the actor *knew* that the outcome would be a consequence of his action (foreseeable outcome), and that the outcome was most likely *not intended* if the actor was *ignorant* about the consequences of his action (unforeseeable outcome). When the actor's ignorance had to be inferred from perceptual inattention then 4-year-olds tended to judge every outcome as intended (Smith, 1978, cf. p. 742, footnote 4) but by the age of 5 years children could make correct judgements even under these conditions (Baldwin & Baldwin, 1970; Berndt & Berndt, 1975; Fincham & Jaspers, 1979; Sedlak, 1979; Smith, 1978).

Smith's study with 4-year-olds demonstrates their use of a standard inference, namely, behaviour and its consequences are *intended* by the actor, i.e., that the actor had an intention to produce the observed outcome. Information about the actor's ignorance, therefore, serves to caution the observer that this standard inference is not warranted. Apart from blocking this inference, however, ignorance does not allow any further inference about intention. Specific intentions can only be inferred on the basis of actor's knowledge or false belief.

Wimmer and Perner (1983) have developed a suitable paradigm for testing young children's understanding of a story protagonist's false belief and its role in predicting the protagonist's

behaviour. In the typical story the protagonist deposited an object in one of two locations ("OLD location"). In the protagonist's absence the object was 'unexpectedly transferred to the other location ("NEW location"). In order to test whether children understood that the protagonist now mistakenly believed that the object was still in the OLD location they were asked where the protagonist thought the chocolate was (Belief question).¹

Furthermore, for those children who understood the protagonist's false belief this story paradigm was also used to assess children's ability to predict the mistaken speaker's communicative action. For this test the story continued by explicitly stating the protagonist's communicative intention to either correctly inform or misinform his sister. The child, then, had to predict on the basis of the protagonist's false belief and stated communicative intention to which of the two locations the protagonist would point (communicative action). The results of this study were that most 6-year-olds but only a minority of 4-year-olds were able to predict the action on the basis of epistemic state and intention.²

The present study extends this finding in 3 ways. Most importantly, children were not only asked to predict the mistaken speaker's utterance but also to infer the speaker's communicative

¹The original form of this question as used by Wimmer and Perner (1983) was not in terms of where the protagonist *thought* the object was, but rather where he would *look for it*. It was *thought that a question about a concrete action, i.e., looking for*, would make the question easier than the more direct mental terminology: "Where does Max *think* the chocolate is?". Perner, Leekam and Wimmer (1986) contrasted these two questions and found no difference in performance.

²This developmental trend was also shown by children's behaviour in hand-guessing games, where they had to guess in which hand the other player had hidden a penny. DeVries (1970), Gratch (1964), and Shultz and Cloghesy (1981) reported that 6-year-olds, but very few younger subjects tended to spontaneously switch to guessing the other hand than the one in which they had found the penny on the previous trial. The switching strategy can be interpreted to indicate that subjects were able to combine an assumption about the other player's *beliefs* about their own action with his *intention* to trick them. Plausibly they might have reasoned the following way: "He *thinks* I will point to his hand where I've found it before. He *wants* to fool me. Therefore, he will hide it in his other hand. Therefore, I should switch to the other hand.

Unfortunately there is an equally successful alternative strategy which does not involve other's epistemic state but subject's own hypothetical move: "If I were to point to his hand where I've found it before, since he wants to fool me, he would hide it in his other hand. So I should point to his other hand." Since this reasoning does not involve a representation of other's epistemic state, yet leads to the same conclusion, it is not clear whether the switching strategy involved reasoning about the opponent's epistemic state.

intention from an observed utterance. For real life situations this direction of inference is more important since a speaker's communicative intention is usually not known (in particular, an intention to deceive) but has to be inferred from what the speaker says and believes. Second, the procedure for testing children's understanding of false belief was improved. In the test by Wimmer and Perner children may have given false answers to the Belief-question because they had difficulty following the story and did not realise that the protagonist did not see the unexpected transfer. This possibility was checked by an explicit question about this fact (cf. Memory Question 3 in Table 1 below). Finally, a third point is taken up in Experiment 2. By drawing children's attention to the crucial aspects of the story the developmental lag between understanding false belief and integrating false belief with communicative intention is explored more fully.

Experiment 1

As a test of children's ability to infer intention from observed action the stories used by Wimmer and Perner (1983) were appropriately modified. Children were told that the protagonist either directed his sister to the OLD or to the NEW location and they were asked whether the protagonist wanted to inform or mislead his sister about the location of the object. Apart from testing children's ability to consider belief and intention simultaneously we wanted to establish first their level of understanding for false belief and intention separately. Since the first part of each story was designed to make plausible how the protagonist came to hold a false belief (*False-Belief Story*) the Belief-question "Where will the protagonist look for the object?" provided a natural test for understanding of false beliefs. In order to also obtain an independent measure of children's understanding of truthful and deceptive intention, subjects were told a *Correct-Belief Story* in which the protagonist always *knew* where the object was located.

METHOD

Subjects

Forty-eight 4-year-old (3;11 [years; months] to 4;9, 24 boys and 24 girls) and 48 6-year-old children (5;7 – 6;8, 31 girls and 17 boys) from kindergartens in Salzburg volunteered for this study.

Material and Procedure

Stories, procedure and stage settings were the same as used by Wimmer and Perner (1983), except that stage settings were scaled down by half and contained only two cupboards. Table 1 gives the exact text of truthful and deceptive version of the Chocolate story as used by Wimmer and Perner for prediction of utterance. In addition, it also shows the necessary modifications for inference of intention (see spanner headings).

Table 1

Chocolate Story

Episode 1:

[Boy doll present; representing Max waiting for his mother.] Mother returns from her shopping trip. She bought chocolate for a cake. Max may help her put away the things. He asks her: "Where should I put the chocolate?" "In the blue cupboard", says the mother, Max puts the chocolate into the blue cupboard ("OLD location"). [A toy chocolate is put into the blue matchbox.] Max remembers exactly where he has put the chocolate so that he could come back and get some later. He loves chocolate. Then he leaves for the playground. [The boy doll is removed.]

Episode 2:

Mother starts preparing the cake and takes the chocolate out of the blue cupboard. She grates a bit into the dough and then she does not put it back into the blue but into the green cupboard. [Toy chocolate is thereby transferred from the blue to the green matchbox ("NEW location").] Max is not around. He doesn't know that the chocolate is now in the green cupboard.

Episode 3:

After a while Max returns from the playground, hungry, and he wants to get some chocolate. [Boy doll reappears.] He still remembers where he had put the chocolate.

BELIEF-QUESTION: "Where will Max look for the chocolate?"

[Subject has to point to one of the 2 boxes.]

Episode 4:

However, before Max has time to get the chocolate, his sister enters into the kitchen. She says to Max: "I've heard mother has bought some chocolate. I would like to have some now. Do you know where it is?"

Prediction of UTTERANCE

truthful

"Yes", says Max, "I am glad to tell you. You can fetch the chocolate and we'll eat it together. The chocolate is in the cupboard." His sister asks: "In which one?"

deceptive

"Good grief", thinks Max, "now my sister wants to eat up all the chocolate. But I would like to eat it all by myself. I will tell her something completely wrong, so that she won't find it, for sure."

Test Question:

UTTERANCE-Question: "Where will Max say the chocolate is

Inference of INTENTION

truthful

Max tells his sister: "The chocolate is in the blue cupboard."

deceptive

Max tells his sister: "The chocolate is in the green cupboard."

Test Question:

INTENTION-Question: "Why did Max say to his sister that the chocolate is in the blue (green) cupboard? Did he say that because he wanted her to find the chocolate, or did he say that because he wanted her *not* to find it?"

Control Questions:

1. "Remember! Max helped his mother unpack the shopping bag. Do you remember where Max put the chocolate?"

2. "Remember! Max told his sister that the chocolate is in the blue (green) cupboard. Is the chocolate really there?"
 3. "Did Max see that his mother put the chocolate into the other cupboard?"
-

Design

Half the children were given an explicit description of the protagonist's intention (truthful or deceptive) and had to predict his utterance, the other half were told what his utterance was (OLD or NEW location) and had to infer his intention (see spanner headings in Episode 4 of Table 1). Within each of these groups half the children were told a False-Belief story with speaker's truthful intention using one story frame (e.g., chocolate story) and a Correct-Belief story with speaker's deceptive intention using the other story frame (e.g., Book). The other half of subjects received a False-Belief story with deceptive intention and a Correct-Belief story with truthful intention. The assignment of story frame (chocolate vs. book) and intention (truthful vs. deceptive) and the order of story presentation were counterbalanced.

RESULTS AND DISCUSSION

The data were analysed in three steps. First, children's understanding of false beliefs, as tested by the Belief-question in the False-Belief story, will be reported. Then, children's understanding of intention in the Correct-Belief stories, where no false-belief complications were involved, will be presented (Test question in Correct-Belief story), and finally, their understanding of intention in relation to a mistaken speaker's false belief will be reported (Test question in False-Belief story).

False Beliefs

Children's ability to understand false beliefs was tested in the False-Belief story, in which an object was unexpectedly transferred to a new location in the protagonist's absence. To test subjects' understanding that after the transfer the protagonist was mistaken about the object's location the Belief-Question was

asked. A correct answer consisted of predicting that the protagonist would search in the OLD location, even though subjects knew that the object was really in the NEW location. Only 46% of 4-year-olds but 94% of 6-year-olds gave correct answers.

In order to assess whether wrong answers were due to a genuine inability to understand false beliefs or a deficiency in comprehension of the complex stories, children's memory for the two most crucial events was tested (cf. Control questions 1 and 3 in Table 1). There were 30 children who gave wrong answers to the Belief-Question. Only four of these did not remember where the protagonist had put the chocolate in the beginning (wrong answer to Question 1).

This replicates the percentage found by Wimmer and Perner (1983) who found that over 80% of children who answered the Belief-Question wrongly (NEW location) still remembered where the protagonist had put the object originally. However, in that study it was *not* tested whether subjects also remembered that the protagonist had not witnessed the transfer. In the present experiment this was tested by Control Question 3. Despite this stricter control only five additional subjects gave wrong answers to control questions. Hence, of the 30 subjects, who answered the Belief-Question wrongly by pointing to the NEW location, 21 (70%) nevertheless remembered correctly that the protagonist had put the object originally into the OLD location (Control 1) *and* that he had not witnessed the transfer to the NEW location (Control 3).

All children who knew where the protagonist would look for the chocolate (correct answers to Belief-Question) also gave correct answers to all three Control questions. In particular, they knew where the chocolate *really* was (Control Question 2), which shows that subjects were always aware of the real state of affairs and did not mistake the protagonist's false belief for it.

In summary, these data replicated the finding by Wimmer and Perner (1983) with stricter controls for younger children's inability to give correct answers to the false belief test. One can rule out that children answered the Belief question wrongly simply because they misinterpreted the story and did not understand that the protagonist failed to observe the unexpected transfer.

Truthful vs. Deceptive Intention

The Correct-Belief story tested children's understanding of truthful and deceptive intent in the usual case where no false-belief complications intervened, and where, therefore, truthful utterances matched reality and deceptive utterances deviated from the truth. The proportion of correct answers to the test question was analyzed by stepwise logistic regression using the BMDP statistical software package (Dixon, Brown, Engelman, Frane, Hill, Jennrich, & Toporek, 1981). Story frame (chocolate vs. book) and subjects' sex were tested as main effects only, without considering their interaction with other effects. For age, intention (cooperative vs. competitive) and type of inference (infer intentions vs. predict utterance) a saturated model including all main and interaction effects was considered. The order of introduction was hierarchical (considering higher order effects only after all component lower order effects had been introduced in the model) and the order was governed by significance levels of individual effects. The standard BMDP inclusion thresholds were used (cf. Dixon et al., 1981, pp. 339–340). The analysis showed two significant main effects: intention and age. The percentages of correct responses are detailed for these two main effects in the upper part of Table 2 together with their improvement— χ^2 , and the associated p -value.

Table 2
Frequency and Percentage of Correct Responses to Test Question
for Statistically Significant Factors in Experiment 1.

Factor and Level	Answer to Test Question		Percent Correct (%)	Improvement prob. χ^2
	+	-		
Knowledgeable Speaker				
Intention				
truthful	47	0	100.0	11.64 $p=.001$
deceptive	40	8	83.3	
Age				
4 years	40	7	85.1	5.97 $p=.015$
6 years	47	1	97.9	
Mistaken Speaker				
Intention				
truthful	31	6	83.8	4.80 $p=0.29$
deceptive	18	12	60.0	

The frequencies of correct responses show that all children gave correct answers in the truthful intention version but that some had difficulty with the deceptive intention version (factor intention). Of course, children's responses to the truthful and deceptive versions should not be interpreted independently, since "correct" responses may be due to some response bias. Both versions together, however, control for any such bias. The percentage on the more difficult version can, therefore, be taken as a reliable indicator of the percentage of children who understood deception. The children who had difficulty with deception were almost all 4-year-olds (factor age).

It has to be emphasised that these statistically significant effects are based on only a small fraction of wrong responses by 4-year-olds. Hence, despite the statistical significance of these effects the results are best described as showing high competence of understanding deceptive intention even among the youngest. About 2/3 of them gave correct responses.³

Since deception involves the creation of a false belief in the listener, it is interesting to see how children's understanding of deceptive intention in the Correct-Belief stories related to their understanding of false beliefs as tested by the Belief-question in the false-belief stories. As expected, there was a positive correlation ($\Phi = .55$) significantly different from zero: $\chi^2 (1, N = 48) = 11, 42; p < .001$.

This correlation is important since it shows that children start understanding at about 4 years of age two different situations in which false belief plays a crucial role. They understand that unexpected changes lead to false belief (Belief question in false

³It should be mentioned that extensive pilot work was necessary to find an appropriate form of the test question when the speaker's intention had to be inferred. In an earlier version children were simply asked: "What do you think? Did Max want his sister to find the chocolate, or not?" This innocuous looking question, however, led to chance responding even in Knowledge stories, which was strong indication that their interpretation of the question was at fault and not their understanding of deception. The intuitive observation of the experimenter was that children failed to recognize that the intended reference of the question was to the intention behind the protagonist's utterance. In the present version of this test question this reference was explicitly included which led to the cumbersome formulation as shown in Table 1 ("Intention-Question"). However, despite its awkwardness this formulation led to dramatic improvement in the Knowledge stories. Of all 48 children tested only two 4-year-olds gave a wrong answer (see Table 2).

belief stories) and they also understand the point about mis-information, that it creates a false belief in another person and prevents that person from finding the object (Test question in correct belief stories).

Intention and False Belief

Information about children's ability to make inferences specific to a speaker's false belief could only be obtained from those 66 subjects who understood that the speaker was mistaken, i.e., who gave correct answers to the Belief-Question. Children who had answered this question incorrectly were thus not included in the further analysis, which resulted in unequal numbers of subjects in the four experimental conditions. However, since up to the Belief-question stories were identical for all four conditions the selection of subjects was not influenced by the experimental manipulations. The four cell frequencies did not differ reliably: $\chi^2(3, N = 66) = 4.35, p > .10$.

The proportion of correct answers to the test question were analysed by logistic regression with story frame (chocolate vs. book) and sex as main factors and a saturated model for factors age, intention (truthful vs. deceptive) and type-of-inference (infer intention vs. predict utterance). Only intention was significant. The frequencies and percentages of correct responses of truthful and deceptive intention stories are shown in the bottom section of Table 2, together with the result of the statistical analysis. In close analogy to their judgement in the Correct-Belief stories children made more mistakes when the mistaken protagonist's intention was deceptive than when it was truthful. This result could be a reflection of the fact that children find standard, truthful communication easier to understand than deception. However, it could be equally due to some response bias leading to more "correct" responses in the truthful than in the deceptive version. For instance, when the protagonist's utterance has to be predicted, an answer to the test question in the truthful version requires simple repetition of the answer given just before to the Belief-Question, while in the deceptive version the test answer has to be different from the answer to the Belief-Question.

This simple repetition effect would not apply when speaker's

intention has to be inferred. However, in these stories children may have applied the plausible strategy: if in doubt attribute *nice* intentions to the speaker, i.e., say he wanted her to find the chocolate. Such a tendency would have shown up as "correct" responses in the truthful version and as incorrect in the deceptive version. One could argue that such a tendency was controlled for by children's responses in the Correct-Belief story where, in fact, not one of the 15 children who responded correctly in the truthful False-Belief story by saying that he wanted her to find the chocolate, showed any sign of such a bias towards "nice" answers in the deceptive Correct-Belief story. There, they all answered quite accusingly that he wanted her *not* to find it. However, this objection can be countered by pointing out that the Correct-Belief story was simpler than the False-Belief story. Children may, therefore, have had no doubt in the Correct-Belief story that the speaker had a deceptive intention and hence did not use this reasoning strategy, whereas the False-Belief story may have been too confusing for some children who then played it safe by opting for a "nice" intention.⁴

The model based on intention as the only significant factor did not yield an impressive fit: goodness-of-fit $\chi^2 = 8.2$, $p = .22$). Yet, none of the other effects would have improved the fit by a significant amount: all p -values $> .11$. Inspection of the data suggested that several other effects might have come out significant had a larger sample of subjects been tested. In particular, the numbers of 4-year-olds in each condition were minimal because so many did not pass the test for false-belief understanding. Experiment 2 aimed at replicating the present experiment but trying to get more 4-year-olds to pass the false-belief test.

Experiment 2

It was puzzling in Experiment 1 that there was no significant

⁴ Another problem with children's intention inferences was that it was not clear whether the percentage of correct responses reflected the fact that a corresponding proportion of children understood the task or whether most of them were guessing. To test this 48 of 67 children who passed the false-belief test, aged 4;1 to 7;1, were tested on two stories. Half of them had to infer truthful, the other half deceptive intention in both stories. Only 4 of the youngest subjects gave inconsistent responses (truthful intention condition) all other subjects gave consistently either correct or incorrect inferences on *both* stories. This frequency distribution differed significantly from what was expected under guessing: $\chi^2(1) = 9.0$, $p > .01$. Wimmer and Perner (1983) reported a similar response consistency for prediction of utterances.

improvement with age in children's ability to reason about a mistaken speaker's intention since the complexity of the latter part of the story introducing deceptive intention on top of a false belief seems remarkably complex and confusing. For this reason one would expect that the younger children would find it much more difficult to cope with that complexity than the older children. The lack of an age trend seems to contradict this plausible expectation, and suggests that the main developmental trend consists in understanding false beliefs, but once children understand that part of the story, age does not matter for how well they understand the additional complexity of a deceptive intention. However, there is a problem of interpretation with the existing data. In order to be able to understand the complex second part of the story children had to be selected for being able to understand the first part, the creation of a false belief in the protagonist. Since much fewer 4-year-olds passed this test (46%) than 6-year-olds (94%), it may be that this selection process covered up any developmental improvement.

A developmental improvement might, therefore, be found if it were possible to avoid such high degree of selectiveness in the younger children. In unpublished work we found that when children were asked leading prompt questions at the end of each episode, then most 4-year-olds could understand false beliefs. The prompt questions probably help the child focus on the relevant information and be less distracted by irrelevant information. This method was adopted for the present experiment.

Furthermore, Wimmer and Perner (1983, Experiment 2) reported that children found it easier to infer a false belief, the more distinct the OLD location was from the NEW location. So, instead of using two cupboards in the same room as in Experiment 1 the two locations were represented by different type furniture in different rooms, e.g., cupboard in the kitchen vs. drawer in the living room. These changes in procedure and material were hoped to raise the proportion of younger children passing the false belief test, so that age groups become comparable for the main test of the mistaken speaker's deceptive intention.

METHOD

Subjects

Twenty-one 4 1/2-year-old children (4;0 to 4;7, 12 boys and 9 girls), 40 5-year-old children (4;8 to 5;6, 19 boys and 21 girls), 33 6-year-old children (5;7 to 6;5, 16 girls and 17 boys) and 34 7-year-old children (6;7 to 7;4, 18 girls and 16 boys) from a First School with nursery class in Brighton, England, participated in this study. There were 11 children (5, 3, 1 and 2 in the four age groups from youngest to oldest) who answered the Belief-question wrongly and were, therefore, not tested on the main part of the story. For the children who were tested on that part an attempt was made to distribute them equally across the four experimental conditions with equal proportions of boys and girls.

Material

The material used was similar to the one used with Austrian subjects in the previous experiment, except that the model had walls arranged in the shape of an "E", where the spaces between the E's crossbars represented two different rooms in a house, furnished with typical appliances. For instance, the model for the Chocolate Story represented the living room and kitchen of a house. Each room contained an identifying doll's house object (cooker, settee) and a hiding location. The hiding locations were a living room drawer and a kitchen cupboard represented by a yellow matchbox and a green cassette container. The other model for the Book Story depicted two rooms of a Nursery School, each also containing a doll's house item (table and chairs, coat hooks) and two hiding locations (a blue playroom cupboard and a brown cloakroom box).

The stories were English versions of the stories told to Austrian subjects (see Table 1). However, in order to direct subjects' attention to the relevant event in each episode, the tape was stopped at the end of each episode and the experimenter asked a leading prompt question. For the chocolate story these prompt questions were the following: "Where did Max put the chocolate?" (after Episode 1). "Where is Max when his mother puts the chocolate in the kitchen cupboard? So did he see her

put it there?" (Episode 2), "What does Max want? Does he want her to find it or does he want her not to find it?" (Episode 4: prediction of utterance), "Where did Max say it was?" (Episode 4: inference of intention). Otherwise procedure and design were as in Experiment 1.

RESULTS AND DISCUSSION

False Belief

As anticipated, the slight modification of stories led to high proportions of children showing understanding of false belief. From youngest to oldest age group 76%, 92.5%, 97% and 94% gave correct responses to the Belief-question by indicating that Max would search in the wrong location.

Intention and False Belief

As in Experiment 1, only subjects who had shown understanding of false belief were considered for this part of the analysis. In order to base the statistical analysis on substantial number of subjects in each experimental condition per age group, the two younger and the two older groups were combined for the analysis. The proportions of correct answers to the test question were analysed by stepwise logistic regression specifying a saturated model for the theoretically interesting factors: age (older vs. younger two age groups) x type-of-inference (infer intentions vs. predict utterance) x intention (truthful vs. deceptive), and main effects for factors: sex and story frame (chocolate vs. book). Three effects were significant. In order of introduction into the model their improvement X^2 were the following: Age ($X^2 = 13.95, p > .001$), Intention ($X^2 = 10.24, p = .001$), and the Type-of-inference x Intention interaction ($X^2 = 11.05, p > .001$).

Table 3 shows the relevant means for these three effects. The percentages of correct responses in the last row show that the interaction between Type-of-inference and Intention was significant because for inference of intention there was no difference between truthful and deceptive versions (first and second column), whereas for prediction of utterance there was a sizeable difference between versions (third and fourth column). Children performed

without error predicting truthful utterances but did rather badly on predicting deceptive utterances. The means in the main body of Table 3 show that this pattern of results was the same for both age groups.

Table 3

Percentage of Correct Answers to Test Question in Experiment 2

Age [years]	Belief Ques- tion %	Type-of-Inference x Intention								Total % (n)	
		Intention truthful % (n)	Intention deceptive % (n)	Utterance truthful % (n)	Utterance deceptive % (n)						
4 & 5	90	54 (13)	60 (15)	100 (13)	29 (14)	60 (55)					
6 & 7	96	94 (16)	88 (16)	100 (16)	75 (16)	89 (64)					
Total		76 (29)	74 (31)	100 (29)	53 (30)						

The result for utterance predictions differed substantially from previous results. The perfect prediction of utterances in the truthful version (by even the youngest children) was surprisingly good (third column in center panel of Table 3) whereas performance in the deceptive intention was unusually low (fourth column). In this version the percentage of correct prediction in relation to *all* subjects tested (i.e., assuming that subjects who did not understand false beliefs would not be able to understand the rest of the story either) was about 25% lower than in Experiment 1 and in Experiments 1 and 3 by Wimmer and Perner (1983).

This pattern of results suggests that subjects may have a restricted view on where the protagonist could reasonably search for the object or direct somebody else to look for it. It is possible that they consider only locations which are similar to the location where he put the object originally, and which are in the vicinity (e.g., same room) of the original location. This hypothesis can explain why a higher proportion of subjects answered the Belief-question correctly when the two critical locations were dissimilar and distant from each other (present experiment and Disappear

condition in Experiment 2 by Wimmer & Perner, 1983). Since in these conditions there was no similar hiding location in the same room as the original location, most subjects answered correctly that the protagonist would look in the original location. For the same reason all subjects in the present experiment correctly predicted in the truthful intention version that the protagonist would direct his sister to that location, and correspondingly they were reluctant to suggest in the deceptive version that the protagonist would send his sister to a location outside that room.

This restriction on what subjects can think of as possible alternatives for the protagonist should not have influenced their inferences of intention since, there, the protagonist's response was determined by the story. Accordingly, percentages of correctly inferring a truthful and a deceptive intention matched very closely (Table 3). An alternative interpretation of this interaction is discussed in footnote 4 below.

The last column in Table 3 shows the expected improvement with age. The data clearly show that when comparable proportions of each age group pass the false-belief test (give correct answers to the Belief-question; see first data column in Table 3) then age groups differ substantially in their responses to questions testing their ability to understand a mistaken speaker's intention. These data, therefore, show that there is a developmental lag between children's ability to integrate speaker's false belief with the communicative intentions to inform or misinform (mastered around 6 or 7 years).

GENERAL DISCUSSION

The results showed that most children at the age of 4 years were able to infer truthful and deceptive communicative intention in the Correct-Belief stories of Experiment 1 which is compatible with results by most previous studies on behavioural intentions (Nelson, 1980; Shultz & Wells, 1985; Shultz, Wells & Sarda, 1980; Yuill, 1984). Under the optimal testing conditions of Experiment 2, 4-year-olds were also able to infer false belief which provided evidence for slightly earlier competence than found by Johnson and Maratsos (1977) and by Wimmer and Perner (1983).

However, the present results also showed that at this young age children had difficulty integrating belief *and* intention in their reasoning about communicative action. Not before the age of 6 years could a majority master the integration of speaker's false belief with communicative intention. This difficulty of 4-to 6-year-olds to integrate an epistemic state (false belief) with intention (inform or misinform) seems to contradict results by Nelson-LeGall (1985) and Yuill (in press) who found that even 3-to 4-year-olds could integrate epistemic state with intention when judging intentionality on the basis of foreseeability. This apparent contradiction can be resolved when one considers that foreseeability requires only understanding of actor's ignorance but not his false belief as tested in our experimental tasks .

Hogrefe et al. (1986) found that ignorance was understood earlier (around 3 years) than false belief (around 4 years), and they argued that the specific difficulty with false belief stems from the necessity to assign conflicting truth values to propositions. For instance, the proposition "Chocolate is in the OLD location" is *false* from subject's point of view yet has to be marked *true* for protagonist's point of view.

In contrast, understanding ignorance requires no such contradictory assignment, since the protagonist believes only true propositions. His ignorance consists in the fact that he is not informed about *all* true propositions, e.g., "Chocolate is in the NEW location" although true and not known to the protagonist it need not be marked as false. Even when ignorance or foreseeability are used to judge intentionality the problem of conflicting values does not arise. We suggest, therefore, that it is for this reason that ignorance and its relevance for intentionality are understood as early as 3 to 4 years (Hogrefe et al., 1986; Nelson-LeGall, 1985; Yuill, in press).

Of course, the difficulty of conflicting truth values encountered in false belief can not account for the present results, since most 4-year-olds in Experiment 2 could understand false belief but had difficulty integrating belief with intention. However, we want to argue that the problem of conflicting truth values was made especially difficult for subject's reasoning about the protagonist's intentions in general and about his deceptive intention in particular.

Subject's task was difficult in the false belief stories since every inference about the protagonist's thoughts was in constant opposition with subject's own knowledge. For instance, if the protagonist wanted his sister to find the chocolate the obvious inference was that he would want to direct her to the "full location". However, the expression "full location" could mean different things. In relation to the protagonist's belief it meant the OLD location, while in reality it referred to the NEW location. This constant opposition between reality and false belief made all stories quite difficult to keep straight. So it is remarkable that a large majority of all children who understood protagonist's false belief were also able to reason correctly about his *truthful* intention and gave correct responses to test questions: 82% and 100% correct (Wimmer & Perner, 1983, Experiments 1 and 3), 84% in Experiment 1 (Table 2) and 88% correct in Experiment 2.

In most experiments (experiment 3 by Wimmer & Perner, 1983; both present experiments) substantial difficulties emerged mostly in the deceptive intention conditions. This difficulty can be attributed to an additional source of conflict. Whereas with truthful intentions there is only conflict between subject's knowledge and protagonist's false belief, deceptive intentions create additional conflict between the protagonist's belief, where "Chocolate is in NEW location" is *false*, and his Communicative intention that he wants "Chocolate is in NEW location" to be thought of as *true* by his sister. On this analysis we obtain a doubly embedded proposition:

"Max WANTS (his sister to THINK that (the chocolate is in the NEW location))"

in contrast to Max' own belief:

"Max THINKS (the chocolate is in the OLD location)".

The doubly embedded proposition about Max' intention to be believed is structurally similar to second-order beliefs studied by Perner and Wimmer (1985, p. 442):

"John THINKS (Mary THINKS (the van is in the park))"

in contrast to John and Mary's actual beliefs:

"John KNOWS (the van is at the church)"

"Mary KNOWS (the van is at the church)".

It is interesting, then, that Perner and Wimmer found that very few 5-, many 6- and most 7- and 8-year-olds were able to infer second-order beliefs when present results indicate that few 4- and 5-year-olds but most 6- and 7-year-olds were able to understand doubly embedded proposition of a mistaken speaker's deceptive intention.

This argument can be refined to fit the significant Type-of-inference x Intention interaction in Experiment 2. Prediction of a truthful utterance was substantially easier than prediction of a deceptive utterance since only deceptive intention created the additional conflict between protagonist's belief and communicative intention. In contrast, inference of truthful and deceptive intention was of comparable difficulty. To explain this one has to remember that even in the truthful intention condition subjects had to consider the possibility of deception, since they were faced with an utterance for which they had to decide whether it was intended as truthful or deceptive.

Unfortunately, although this explanation constitutes a powerful account for an unexpected result, it cannot be considered definite since the relevant interaction was found in Experiment 2 only but not in Experiment 1.

The results can then be summarised as showing that by the age of 4 years most children are able to understand deceptive intention and false belief, both of which involve representation of conflicting truth values. Most of these children seem also able to predict correctly that a mistaken speaker with truthful intentions will pass his mistake on to the listener. This ability is remarkable since this prediction evokes the constant opposition between "truthful" in relation to speaker's false belief and "false" from subject's own point of view. However, up to the age of 6 and 7 years children have greater difficulty reasoning about a mistaken speaker's deceptive intention. One plausible explanation for this difficulty is that here the conflict between subject's knowledge

and speaker's false belief has to be integrated with a second source of conflict between speaker's belief and his deceptive intention.

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