PAPER

Understanding of speaker certainty and false-belief reasoning: a comparison of Japanese and German preschoolers

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Abstract

It has been repeatedly shown that when asked to identify a protagonist's false belief on the basis of his false statement, English-speaking 3-year-olds dismiss the statement and fail to attribute to him a false belief. In the present studies, we tested 3-year-old Japanese children in a similar task, using false statements accompanied by grammaticalized particles of speaker (un)certainty, as in everyday Japanese utterances. The Japanese children were directly compared with same-aged German children, whose native language does not have grammaticalized epistemic concepts. Japanese children profited from the explicit statement of the protagonist's false belief when it was marked with the attitude of certainty in a way that German children did not – presumably because Japanese but not German children must process such marking routinely in their daily discourse. These results are discussed in the broader context of linguistic and theory of mind development.

Introduction

Between 4 and 5 years of age, children begin to solve standard false-belief tasks (Wellman, Cross & Watson, 2001). Typical 3-year-olds, in contrast, perform very poorly. One theoretical approach, the 'conceptual deficit' account, claims that 3-year-olds fail because they have not yet acquired the concept of belief (Perner, 1991; Flavell, Flavell & Green, 1983; Gopnik & Astington, 1988). An alternative proposal is offered by the 'processing deficit' account: young children do have a concept of belief but fail in standard false-belief tasks due to performance factors, mainly because they lack the requisite executive functions, especially inhibitory control (Carlson & Moses, 2001; Roth & Leslie, 1998; Russell, 1997).

Studies using revised false-belief tasks with less processing demands suggest that 3-year-olds' difficulty in the standard false-belief tasks might indeed be due to a lack of capacity to suppress more salient information, i.e. information about current reality (Freeman & Lacohee, 1995; Robinson & Mitchell, 1995; Siegal & Beattie, 1991; Zaitchik, 1991). One problem with the 'processing deficit' explanation, however, is that experimental manipulation of saliency has not turned out to be the panacea for young children's difficulty with false belief: not all of the revised false-belief tasks have successfully facilitated the performance of 3-year-olds (Zelazo & Boseovski, 2001).

One set of such revised false-belief tasks involves explicit verbal presentation of false belief (Flavell, Flavell, Green & Moses, 1990; Perner, Sprung, Zauner & Haider,

2003; Riggs & Robinson, 1995; Wellman & Bartsch, 1988). For instance, Wellman and Bartsch (1988) devised a number of partially revised false-belief tasks, one of which was an 'Explicit False-Belief' task, where the protagonist's false belief was explicitly mentioned by the experimenter, as in the following utterance: 'Jane wants to find her kitten. Jane's kitten is really in the playroom, but *Jane thinks her kitten is in the kitchen*. Where will Jane look for her kitten?' It was originally expected that the Explicit False-Belief task would be easier than the standard tasks, as a child can attribute a false belief to the protagonist on the basis of what she was told, and hence, does not have to infer the protagonist's belief. Contrary to this expectation, however, 3-year-olds' performance was significantly below chance, with young 4-year-olds' performance being at chance level. Furthermore, all the existing studies that used some variation of this Explicit False-Belief task report similar results (Flavell *et al.*, 1990, Exp. 3; Perner *et al.*, 2003), and thus, failure of explicit false-belief utterances to improve 3-year-olds' performance has been persistent.

From the 'conceptual deficit' point of view, the poor performance of the children on this task is due to their inability to understand the character's utterance as an expression of a belief (Perner, 1988). A possible 'processing deficit' explanation is this: for 3-year-olds, a verbal presentation of a false belief is not salient enough to suppress information about current reality. Here, another task in Wellman and Bartsch's study is informative. In this so-called 'Not Own Belief' task, the child was asked

to guess where an object was, and then the protagonist verbally expressed his belief which contradicted the child's guess. In this condition, children successfully predicted where the protagonist would look for the object on the basis of what he said. This seems to speak in favor of the processing deficit account: when a 3-year-old does not have a firm belief of her own at hand which is typically more salient than verbal information, she could attribute a belief to the speaker on the basis of his utterance. To date, however, there is not a single study showing that a child can attribute a belief in an analogous way when she herself knows this belief to be false. Thus, the question of why 3-year-olds, who otherwise are competent communicators, apparently 'dismiss' explicit verbal presentation of the speaker's false belief, remains a mystery.

The aim of the current study was to shed some light on this mystery, by focusing on young children's ability to understand speakers' mental states in communication. It is assumed among communication theorists that utterances are typically used to convey some clues about the speaker's intentions and attitudes (Grice, 1975; Sperber & Wilson, 1986/1995; Tomasello, 1999). In communication, a speaker can use a variety of explicit linguistic clues to express his attitudes towards the main content P (proposition expressed) of the utterance. The representation of the speaker's mental states, also known as propositional attitudes, of 'believing that P' or 'thinking that P', for example, has parallel linguistic representation such as '*I believe that* P' or '*I think that* P', which contain mental state verbs such as *believe* and *think*. Alternatively, the speaker may use attitudinal adverbials such as *definitely* and *certainly* to express his propositional attitude such as 'I am certain that P', or use modal adverbs such as *maybe* or *perhaps* to convey the attitude such as 'I am uncertain that P'. As a more implicit option, an unmarked simple declarative form is typically interpreted to express the propositional attitude of 'believing that P'.

Most 3-year-olds, in their everyday conversation, appear to be capable of attributing to speakers mental states such as intentions, desires and beliefs on the basis of their utterances. Moreover, although not dealing with false-belief understanding *per se*, Roth and Leslie (1991) have shown that normal 3-year-olds, but not autistic children, are capable of attributing mistaken beliefs to a speaker on the basis of his utterance, when it is emphasized or made explicitly relevant. However, previous findings also suggest that 3-year-olds have a clear limitation in understanding linguistic expressions of mental states. For example, it has been shown that English-speaking children typically do not understand the meaning of mental state verbs such as *believe*, *know* and *think* until they reach 4 years of age (Bartsch & Wellman, 1995; Shatz, Wellman & Silber, 1983). Thus, from the viewpoint of belief understanding in verbal communication, 3-year-olds' poor performance in Wellman and Bartsch's Explicit False-Belief tasks can be accounted

for rather differently from the two existing explanations mentioned above: namely, it is due to their inability to understand the particular linguistic expression of mental state used, i.e. the verb *think* in '*Jane thinks her kitten is in the kitchen*'.

In this study, therefore, we investigated 3-year-olds' ability to understand the speaker's false belief on the basis of his utterance by manipulating the mental state expressions used in the utterance. It was hypothesized that there are mental state expressions that can be understood by 3-year-olds, and use of such expressions in experimental stimuli would improve their performance in an Explicit FB task. One interesting proposal is that children's understanding of certain epistemic concepts may develop earlier or later, depending on how their language grammaticalizes the various concepts, and on the frequency with which the corresponding forms are used (Aksu-Koc, 1988; Choi, 1995; Papafragou, Li, Choi & Han, 2007). Evidence for this proposal comes from recent studies with different languages that express (un)certainty either with a grammaticalized system of evidential and certainty marking (e.g. Japanese) or with non-grammaticalized means (e.g. English, German). For example, regarding English-speaking children, Moore, Pure and Furrow (1990) demonstrated that 3-year-olds are incapable of understanding the speaker's attitude of certainty/uncertainty, manifested in the form of 'I know that P' or 'Probably P' (implying that the speaker is certain about P) vs. 'I think that P' or 'Maybe P' (implying that the speaker is uncertain about P). In contrast, regarding Japanese children's understanding of grammaticalized indication of certainty, a recent study by Matsui, Yamamoto and McCagg (2006) showed that Japanese 3-year-olds can comprehend particles of speaker certainty (*yo*) and uncertainty (*kana*), which are used very frequently in conversation, one year earlier than English-speaking children are reported to understand speaker certainty and uncertainty expressed in 'I know' and 'I think', respectively.

Following up on these findings, in the current study we tested whether Japanese and German speaking children can understand beliefs held with different degrees of certainty, with the following predictions. In the present revised Explicit False-Belief tasks, addition of the particle of speaker certainty, *yo*, to the false-belief utterance, which reinforces the speaker's (false) belief will not only facilitate Japanese 3-year-olds' understanding of the speaker's false belief, but also lead them to predict that the speaker with such strong conviction is highly likely to act according to his belief. By contrast, addition of the uncertainty particle *kana* to the utterance will emphasize his belief state in the opposite direction by weakening it, and therefore, if correctly understood, children will rationalize that the likelihood of the speaker's acting according to his weak belief is much lower, and so his action is far less predictable. In order to test for cross-linguistic differences in 3-year-olds' understanding of linguistic indication of speaker certainty/uncertainty

as indicated in previous research, we directly contrasted Japanese 3-year-olds with same-aged German children. In contrast to Japanese (and like English), German does not have a grammaticalized particle system for expressing (un)certainty. The prediction was that in agreement with the Moore *et al.* (1990) findings on English-speaking children, German 3-year-olds would not profit from certainty marking in the false-belief utterance.

Study 1

In this study, we investigated whether Japanese children would profit from the grammaticalized indication of speaker (un)certainty when they attribute false belief to him and predict his consequent action. We hypothesized that when children understand the speaker's attitude of certainty, or strong conviction, towards his main statement, they rationalize that his consequent action is highly predictable and definitive, i.e. his action follows his strong belief. We expected that when children understand the speaker's attitude of uncertainty, by contrast, they would rationalize that the uncertain speaker may not act according to the statement, and so, more likely persist with their reality bias when asked to predict his action. Thus, it was our expectation that a correct understanding of the speaker's attitude of certainty or uncertainty will lead to better performance in the certainty condition than in the uncertainty condition. We also hypothesized that at this age, children are sensitive to grammaticalized indication of speaker attitudes, but not yet to lexicalized equivalents. We tested this possibility by comparing Japanese children with their German counterparts, whose native language does not have grammaticalized expressions of speaker (un)certainty. It was expected that if children are unable to differentiate the attitude of certainty from that of uncertainty, they will make the same prediction about the consequent action for both the certain and uncertain speakers, and as a result, similar performance across the two conditions was predicted.

Method

Participants

Japanese sample. Twenty-four children (2;11–3;10 years; mean age = 3;5; 11 boys, 13 girls) were included in the final sample. Two additional subjects were tested but had to be excluded because they were uncooperative. Children were recruited from urban day-care centers and nursery schools and came from mainly lower middle-class backgrounds.

German samples. Two groups of 24 children each were included in the final sample. Each group was closely matched in age to the Japanese sample. Group 1 (2;11–3;10 years; mean age = 3;5; 12 boys, 12 girls) received one type of false-belief task ('Location false belief' after Wimmer & Perner, 1983). Group 2 (2;11–3;10 years; mean age = 3;5; 11 boys, 13 girls) received another type of false-belief task ('Content false belief', after Perner, Leekam & Wimmer, 1987). Six additional subjects were tested but had to be excluded due to experimental error (*n* = 3), or because they were uncooperative (*n* = 3). Children were recruited in urban day-care centers and came from mixed socioeconomic backgrounds.

Materials and languages

Different puppets and props were used to act out the stories to children. Analogous material was used for the Japanese and German children, with some exceptions where they were culturally necessary (e.g. different sets of puppets had to be used for each sample which were familiar to children).

In Japanese, although a variety of linguistic forms are available to indicate degree of speaker (un)certainty, by far the most frequently used are the two sentence-final particles, *yo* (certainty) and *kana* (uncertainty) (Matsui *et al.*, 2006). The Japanese certainty particle *yo*, when affixed to an assertion, emphasizes the speaker's strong commitment to the truth of the statement. In this way, an utterance marked with the particle is typically interpreted as communicating stronger certainty of the speaker than unmarked assertions in conversation. The uncertainty particle *kana*, on the other hand, expresses strong uncertainty, and hence indicates that the speaker does not commit herself to the truth of the statement. Let us note here, however, that in Japanese casual conversation, in which continuous explicit recognition of the conversational partner, either verbally or non-verbally, is of vital importance for socio-cultural reasons (Kita & Ide, 2007; Maynard, 1990), use of sentence-final particles, which have a function of eliciting a response from the conversational partner, is the stylistic norm (although grammatically optional) and unmarked assertion is rarely used. Unmarked assertions in Japanese are commonly used in the monologue, and so, when they are used in conversation, they tend to be interpreted as communicating extra connotation, such as the expression of detachment (Matsui, 2000; Masuoka, 2001).

By contrast, in German, which has no such grammaticalized system, the pragmatic default to mark certainty is to use straight declarative sentences ('The cat is on the mat'). It is only in non-default cases (e.g. when there has been doubt etc.) that certainty may be stressed with *sicher*, the equivalent of *certainly* ('Certainly the cat is on the mat'). The pragmatic default to mark uncertainty, however, is to use the modal adjunct *vielleicht*, which functions analogously to *maybe* in English. *Vielleicht* is used frequently in child-directed speech from early on, and children themselves use it from their third year on, prototypically in situations that involve uncertainty about future states of affairs ('perhaps she'll bring a present') or where the child is unsure what to do and makes a proposal ('perhaps we should bake a cake').

This makes a clear contrast with rather infrequent use of *sicher* both in early child-directed speech, and in the child's own speech (as the search of a dense CHILDES databank of one German child, Leo, indicates; see Behrens, 2000; MacWhinney, 2000).

Procedure

Children in both countries were tested individually in one videotaped session. Japanese children were tested in a university laboratory. Testing lasted approximately 40 minutes and included 18 tasks. Because this proved too long for German children, two separate samples were tested, each on nine tasks. German children were tested in a separate quiet room of their day-care center. Testing lasted approximately 20–25 minutes.

Measures and design

Two types of false-belief task were used, after the two standard tasks: 'location' tasks after Wimmer and Perner's (1983) 'change-of-location' task, and 'content' tasks after Perner *et al.*'s (1987) 'unexpected content' task. For each type, children got a standard version (without any utterance of the character), and two versions with explicit false-belief utterances by the character, one where his utterance was marked as *sure*, another where it was marked with *maybe*.

To test for cross-linguistic differences in understanding speaker certainty, for the two explicit utterance versions of the false-belief tasks, corresponding baseline tasks were administered which were less complex in structure: rather than understanding false beliefs, only an understanding of knowledge–ignorance was tested. The character made the analogous utterances (e.g. 'the marble is in the box'), but the child now did not know whether they were true or false, i.e. the child was ignorant about the relevant situation (where the marble was).

1. 'Location' tasks. (a) Pre-test: Standard Location false-belief (FB) task: A puppet put a marble at location A, whereupon in her absence it was moved to location B. When the puppet returned, the child was first asked two control questions ((i) where the marble was at that time, and (ii) whether the puppet had seen how it was put there) and was corrected if necessary. Then the test question was asked, where the puppet would look for her marble. Each child received one such task.

(b) Location FB 'sure' tasks: These tasks had the same structure as the Location FB task, but upon her return (after the control questions, and before the test question), the puppet expressed her false belief. In the Japanese version the puppet used the grammaticalized certainty marker *yo* ('The marble is in location A – *yo*, not in location B'). In the German version the puppet said, 'The marble is in location A, not in location B'. Two such tasks were administered to each child, the total score being the correct from both tasks (0–2).

(c) Location FB 'maybe' tasks: These tasks had the same structure as the *sure* tasks, with one difference: the puppet announced the false belief in a modality of uncertainty. In the Japanese version the puppet used the grammaticalized uncertainty marker *kana* ('The marble is in location A – *kana*, not in location B – *kana*'). In the German version the puppet said 'Perhaps the marble is in location A, not in location B'. Two such tasks were administered to each child, the total score being the correct from both tasks (0–2).

(d) Location ignorance 'sure' tasks: The experimenter showed the child two containers and told her that an object (e.g. a marble) was in one of them. The child was then asked to guess in which one. After the child's guess, a puppet came and expressed her belief on the matter – which was always the opposite from the child's guess. In the Japanese version the puppet used the grammaticalized certainty marker *yo* ('The marble is in location A – *yo*, not in location B – *yo*'). In the German version the puppet said, 'The marble is in location A, not in location B'. The test question then was as in the false-belief task: 'Where will the puppet look for her marble first?' Two such tasks were administered to each child, the total score being the correct from both tasks (0–2).

(e) Location ignorance 'maybe' tasks: These tasks had the same structure as the Ignorance '*sure*' tasks, with one difference: the puppet announced her belief in a modality of uncertainty. In the Japanese version the puppet used the grammaticalized uncertainty marker *kana* ('The marble is in location A – *kana*, not in location B – *kana*'). In the German version the puppet said, 'Perhaps the marble is in location A, not in location B'. Two such tasks were administered to each child, the total score being the correct from both tasks (0–2).

2. Content tasks. Analogous to the five types of Location tasks, there were five types of Content tasks:

(a) Pre-test: Standard Content FB task: The child was shown a familiar box (e.g. a candy box) and was asked what was in the box. When the child said, 'Candies', the experimenter opened the box and revealed its unexpected content: e.g. a pencil. The box was closed and two control questions were asked: (i) what was inside the box, and (ii) whether the puppet that was going to come to know that. If the child answered incorrectly, the box was opened again and she was given negative feedback. Then the puppet came and the child was asked the test question, i.e. what the puppet would think was in the box. Each child received one such task.

The same four variations over this task ((b) Content FB *sure*; (c) Content FB *maybe*; (d) Content ignorance *sure*; (e) Content ignorance *maybe*) were constructed as for the Location tasks. In (b) and (c) the puppet had a false belief which she expressed in different modalities. In (d) and (e) she had a belief different from the child's ignorant guess which she expressed in different modalities. Each child received two items of each type of these location tasks (the score each being 0–2).
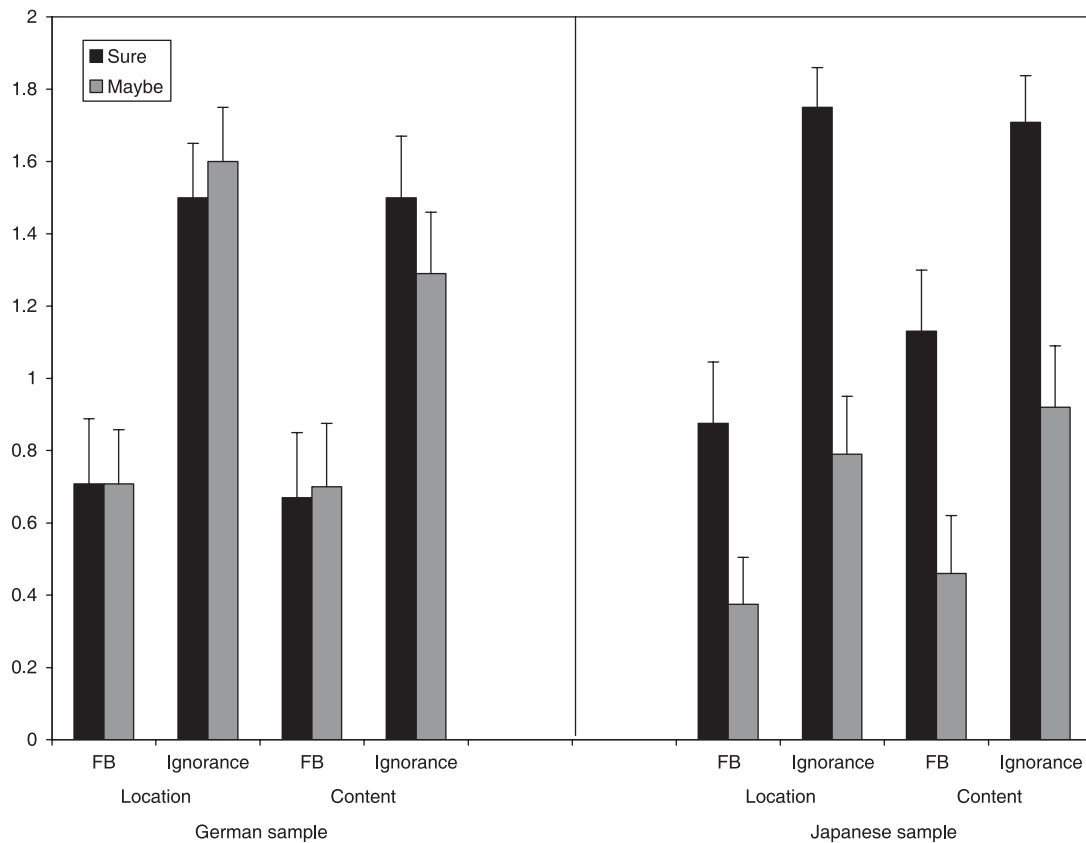
Figure 1 *Mean correct scores on the Ignorance and FB tasks in Study 1.*

Japanese children received first, as pre-tests, the Standard Location and Content FB tasks. Then came a block of the eight 'sure' tasks (two Location Ignorance *sure*, two Location FB *sure*, two Content Ignorance *sure*, two Content FB *sure*) and a block of the eight 'maybe' tasks (two Location Ignorance *maybe*, two Location FB *maybe*, two Content Ignorance *maybe*, two Content FB *maybe*), the order of the blocks being counterbalanced across children.

In the German sample, Group 1 received the nine Location tasks, and Group 2 the nine Content tasks. Each group received, as pre-test, the Standard test first, then came a block of four 'sure' tasks (two FB, two Ignorance tasks, order counterbalanced), and a block of four 'maybe' tasks (two FB, two Ignorance tasks, order counterbalanced); the order of the two blocks was counterbalanced.

Results

First, children's performance on the standard FB tasks was analyzed. This was expected to be close to floor. Second, to test for cross-linguistic effects of different forms of certainty marking, the baseline 'Ignorance' tasks (*sure* and *maybe*) and the FB Modality tasks (*sure* and *maybe*) were analyzed separately. Figure 1 shows the mean scores (0–2) on the Ignorance tasks and the FB Modality tasks for both samples. Finally, to test for the effects of the explicit utterance on children's false belief understanding, their performance on the standard FB

tasks was compared to their performance on the FB Modality tasks.

1. Pre-tests: Standard FB tasks

In the Japanese sample, performance on the Standard FB tasks was at floor: One child solved the Standard Location FB task, and two children passed the Standard Content FB task. In the German samples, five children each solved the Standard Location FB task and the Standard Content FB task.

2. Ignorance tasks

In the Ignorance tasks, the puppet had a belief different from the child's ignorant guess which she expressed in certain or uncertain modality. When children take into account speaker certainty expressed in the speaker's announcement, they should distinguish between the 'sure' and 'maybe' condition, and should perform better on the 'sure' version. For the Locations tasks, a 2 (group: Japanese versus German) × 2 (modality: *sure* versus *maybe*) mixed factors ANOVA was conducted on the mean pass scores. It revealed a main effect of modality, $F(1, 46) = 13.73$, $p < .01$, $\eta_p^2 = .23$, and an interaction effect of group × modality, $F(1, 46) = 19.45$, $p < .01$, $\eta_p^2 = .30$. Planned comparisons revealed that only the Japanese children performed significantly better on the 'sure' than on the 'maybe' tasks: $t(23) = 4.92$, $p < .01$, $\eta_p^2 = .51$.

Table 1 *Contingency between the FB standard pre-test and the FB modality tasks*

(1) Location

		Japanese				German			
		FB 'sure'		FB 'maybe'		FB 'sure'		FB 'maybe'	
		0	1	0	1	0	1	0	1
Standard FB	0	13	10	20	3	14	5	13	6
	1	0	1	0	1	1	4	1	4

(2) Content

		Japanese				German			
		FB 'sure'		FB 'maybe'		FB 'sure'		FB 'maybe'	
		0	1	0	1	0	1	0	1
Standard FB	0	8	14	17	5	15	4	15	4
	1	2	0	1	1	1	4	1	4

These results were replicated with the Content tasks. For the Content tasks, the analogous 2×2 ANOVA yielded a main effect of modality, $F(1, 46) = 13.17$, $p < .01$, $\eta_p^2 = .22$, and an interaction effect of group $\times$ modality, $F(1, 46) = 4.48$, $p < .05$, $\eta_p^2 = .09$. Planned comparisons revealed that only the Japanese children performed significantly better on the '*sure*' than on the '*maybe*' tasks: $t(23) = 3.40$, $p < .01$, $\eta_p^2 = .33$.

3. False-belief tasks

In the false-belief tasks, the puppet had a false belief and expressed it in different modalities. When children are sensitive to the certainty of the speaker, they should be more proficient in predicting his exact consequent action in the '*sure*' than in the '*maybe*' condition. Furthermore, when grammaticalized certainty marking is crucial, Japanese but not German children should be able to do so. To test this, the same kinds of analyses as for the Ignorance tasks were run. For the Locations FB tasks, the 2×2 ANOVA revealed a main effect of modality, $F(1, 46) = 6.90$, $p < .02$, $\eta_p^2 = .13$, and an interaction effect of group $\times$ modality, $F(1, 46) = 6.90$, $p < .02$, $\eta_p^2 = .13$. Planned comparisons revealed that only the Japanese children performed significantly better on the '*sure*' than on the '*maybe*' tasks: $t(23) = 3.40$, $p < .01$, $\eta_p^2 = .33$. These results were replicated for the Content FB tasks: the analogous 2×2 ANOVA yielded a main effect of modality, $F(1, 46) = 5.35$, $p < .03$, $\eta_p^2 = .10$, and an interaction effect of group $\times$ modality, $F(1, 46) = 6.87$, $p < .02$, $\eta_p^2 = .13$. Planned comparisons revealed that only the Japanese children performed significantly better on the '*sure*' than on the '*maybe*' tasks: $t(23) = 2.80$, $p < .01$, $\eta_p^2 = .25$.

4. Relation of FB modality tests to FB Standard pre-tests

To test for differences between the FB Standard pre-tests (one item Location, one item Content) and the FB Modality tests, only the first item of the Modality tests was used for non-parametric comparisons.[1] Table 1 shows the contingency patterns. The only statistical differences found were in the Japanese sample, which performed significantly better on the FB '*sure*' Location task than on the Standard FB location task (McNemar test, $p < .05$), and also significantly better on the FB '*sure*' Content task than on the Standard FB Content task (McNemar test, $p < .05$).

Discussion

The overall results of Study 1 were consistent with our expectations: Japanese children performed significantly better in the certainty condition than the uncertainty condition, whereas German children's performances in the two conditions did not yield significant differences. The contrast between Japanese and German children's performance was clearly shown both in the control 'Ignorance' tasks and the Explicit FB tasks. Thus, it was strongly indicated that Japanese children understood the different degrees of certainty encoded by the two particles, *yo* and *kana*, respectively, and attributed relevant mental states to the speaker accordingly. By contrast, German children did not show any sensitivity to the different strength of certainty expressed by the speaker in each condition. Furthermore, the direct comparison between Standard and Explicit FB tasks revealed that only Japanese children profited from the addition of certainty marking when they inferred the speaker's belief state and predicted his consequent action. By contrast, linguistic indication of different degrees of certainty did not have any significant effect on German children's understanding of the speaker's false belief.

Thus, the overall results of Study 1 confirmed our hypotheses. However, given that the linguistic stimuli used in the two languages were not structurally comparable

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[1] This was a somewhat arbitrary decision necessitated by the data format requirements for such comparisons. Control analyses using the second rather than the first task of each category, however, revealed the exact same pattern of results.

(whereas the stimuli used in the Japanese certainty condition contained explicit linguistic indication of certainty, the German equivalent did not), the possibility remained that the results were due to the presence or absence of explicit linguistic indication of certainty, rather than the contrast between grammaticalized vs. non-grammaticalized indication of certainty. In other words, it was possible that the Japanese stimuli for the certainty condition were much stronger than the German counterparts, and that an addition of an explicit indication of certainty to the German stimuli may improve German children's performance. On the other hand, the result also indicated a different possibility: that the Japanese uncertainty particle conveyed a much stronger attitude of uncertainty than the German modal adjunct *vielleicht*, which may have influenced children's performance. Study 2 was designed with the aim of addressing these issues.

Study 2

Study 2 followed up on Study 1 with the following modifications: The German tasks were modified such that the (un)certainty marking was now stronger and more comparable in explicitness to the Japanese marking in Study 1. The Japanese tasks were also modified such that they were comparable in explicitness to the German marking in Study 1. For the German tasks, two common ways of marking used in English and German were combined: modal verbs (*must* vs. *might*) and modal adjuncts (*in any case* vs. *maybe*, as used separately, for example, by Moore *et al.*, 1990). In the '*sure*' version, the protagonist's belief was expressed by saying, 'It must in any case be in location A . . .', and in the '*maybe*' version the expression was 'It may be in location A . . .'.[2] The rationale was the following: If German children are capable of understanding speaker certainty when indicated explicitly, they should perform better in the certainty condition than in the uncertainty condition, just as Japanese children did in Study 1. If, however, they are not sensitive to non-grammaticalized indications of (un)certainty, as we hypothesized originally, their performance in the 'marked' certainty and the uncertainty conditions should not be significantly different.

   To make the Japanese stimuli more comparable to the German stimuli used in Study 1, a simple declarative was used in the certainty condition while the stimuli for the uncertainty condition remained the same. We hypothesized that if Japanese children's performance in the uncertainty condition is significantly worse than their performance in the 'unmarked' certainty condition, this

indicates that the Japanese uncertainty particle *kana* indeed conveys much stronger uncertainty than the German uncertainty marker *vielleicht*, used in Study 1. If Japanese children's performance across the two contrastive conditions is not significantly different, however (as in the case of German children's performance in Study 1), this would indicate that the degree of uncertainty conveyed by the sentence-final particle *kana* is more or less comparable to the German uncertainty marker *vielleicht*.

Method

Participants

Japanese sample. Twenty-four children (2;11–3;9 years; mean age = 3;5 years; 11 boys, 13 girls) were included in the final sample. Children were recruited from urban day-care centers and nursery schools and came from mainly lower middle-class backgrounds.

German sample. Twenty-four children each were included in the final sample which was closely matched in age to the Japanese samples in this and the previous study and to the German samples of Study 1 (2;11–3;10 years; mean age = 3;4; 11 girls, 13 boys). Two additional subjects were tested but had to be excluded because they were uncooperative. Children were recruited in urban day-care centers and came from mixed socioeconomic backgrounds.

Design and procedure

The basic design and procedure was the same as in Study 1. Children were tested on three types of tasks: standard false-belief tasks, false-belief tasks with the character expressing the false belief (marked in certain/uncertain ways), and control tasks in which a character expressed a belief (but the child was ignorant), again marked in certain or uncertain ways. As the results in Study 1 were analogous for location and content tasks, only location tasks were used in this study.

Japanese sample. The same design and procedure for the 'location' task in Study 1 was used with the following two modifications: (i) to make comparison across tasks easier, children now received two standard FB tasks; (ii) in order to make stimuli sentences more comparable with those in German used in Study 1, we changed the stimuli sentence in the '*sure*' tasks: the protagonist in the '*sure*' tasks used a simple declarative as in 'It is in location A . . .'. In the '*maybe*' tasks, the sentence that the protagonist used was the same as the one in Study 1, being marked by the uncertainty particle *kana*. Children participated in two Standard FB tasks at the beginning[3]

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[2] The exact phrases in German were: 'Es muss auf jeden Fall in A sein . . .'/'Es könnte vielleicht in A sein . . .'. 'Auf jeden Fall' (in any case) was used rather than 'certainly' ('sicherlich') because the latter in German actually pragmatically implicates doubt, it should be noted, which is not the case for 'auf jeden Fall'. Also, 'auf jeden Fall' is more natural in German than 'in any case' is in English.

[3] This was different from the German sample in which children were given one FB task at the beginning and one at the end. However, this difference seems unproblematic given the fact that in the performance of the German sample there was no order/learning effect (McNemar's test, $p = 1.00$).
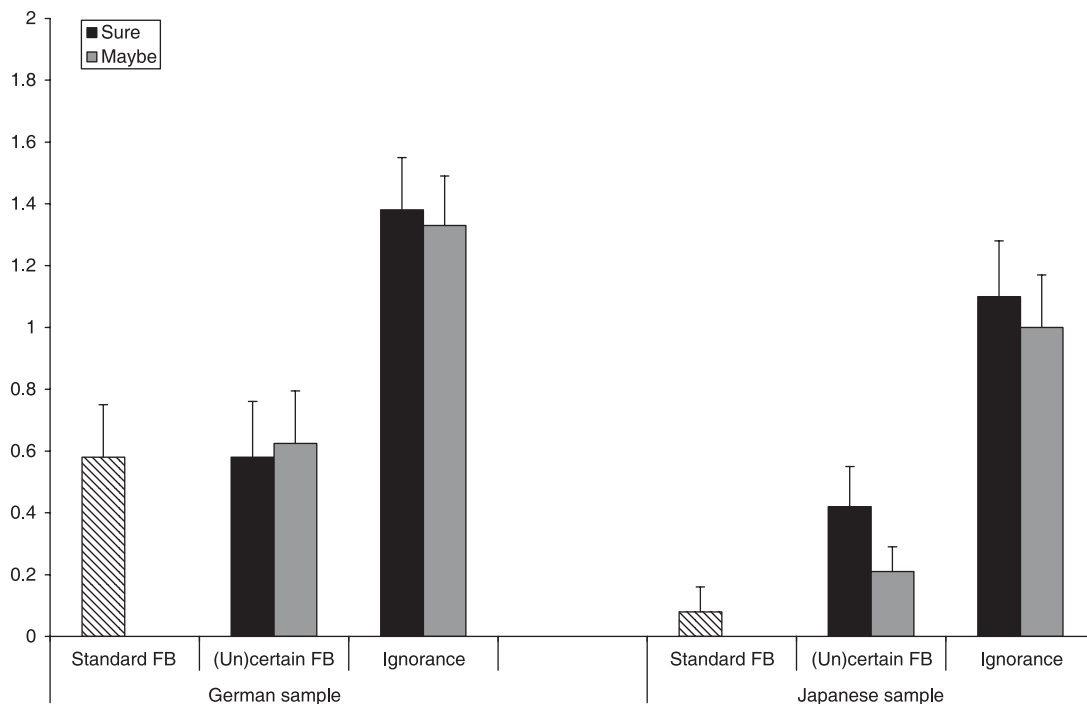
Figure 2   *Mean correct scores on the Ignorance and FB tasks in Study 2.*

and proceeded to a block of four '*sure*' tasks (two FB, two Ignorance tasks, order counterbalanced), and a block of four '*maybe*' tasks (two FB, two Ignorance tasks, order counterbalanced), with the order of the two blocks counterbalanced.

German sample. The design and procedure for the German sample was as in the 'location' group in Study 1, with the following two exceptions: (i) to make comparisons across tasks easier, children now received two standard FB tasks; (ii) the main purpose of this study was to make the (un)certainty marking more comparable in strength to the one used in Japanese in Study 1. Therefore in the '*sure*' tasks the protagonist now expressed his/her belief in the following way: 'It must in any case be in location A . . .'. In the '*maybe*' case she/he said: 'It might perhaps be in location A . . .'. Children participated in the Standard FB tasks at the beginning and the end of the session, in between came a block of four '*sure*' tasks (two FB, two Ignorance tasks, order counterbalanced), and a block of four '*maybe*' tasks (two FB, two Ignorance tasks, order counterbalanced), with the order of the two blocks counterbalanced.

Results

The mean sum scores (0–2) on the five types of tasks are shown in Figure 2. First, to test whether the marking improved children's performance on FB tasks compared to standard ones, repeated measures ANOVAs on the three different types of FB task (Standard, '*sure*' (German sample)/unmarked (Japanese sample); '*maybe*')

were conducted for each sample. They yielded no effects for the German sample, $F(2, 22) = .05$, $p < .94$, $\eta_p^2 = .004$, and a trend for the Japanese sample, $F(2, 22) = 3.12$, $p < .07$, $\eta_p^2 = .22$ (post-hoc comparisons in the Japanese sample revealed no differences between the '*maybe*' and 'unmarked' tasks, $t(23) = 1.30$, $p < .21$, and between the standard and the '*maybe*' tasks, $t(23) = 1.37$, $p < .19$. The only difference was that performance on the unmarked task was better than on the Standard task, $t(23) = 2.30$, $p < .05$).

Second, to test for the effects of different marking in FB tasks and in the simpler Ignorance tasks, 2 (task: FB – Ignorance) × 2 (marking: '*sure*' – '*maybe*') repeated measures ANOVAs on the four (un)certainty tasks were conducted for each sample; they yielded main effects of task only (German sample: $F(1, 23) = 13.50$, $p < .001$, $\eta_p^2 = .37$; Japanese sample: $F(1, 23) = 27.98$, $p < .001$, $\eta_p^2 = .55$).

Discussion

In this study, we found that even the stronger and more explicit certainty/uncertainty marking did not make German children perform differently in the two contrastive conditions. Both in the Explicit FB tasks and the Ignorance tasks, their performance did not seem to be influenced by the explicit marking of speaker certainty/uncertainty. Thus, the results indicate that German 3-year-olds did not profit from any non-grammaticalized indications of speaker certainty when attributing the speaker's belief behind the utterance and predicting his consequent action, regardless of whether they were

explicit or implicit. The result also disconfirmed the possibility that the Japanese uncertainty particle *kana* may convey a much stronger attitude of uncertainty than the German uncertainty marker *vielleicht*, used in Study 1. In the Japanese sample, the reliable difference between the 'sure' and the 'maybe' conditions found in Study 1 disappeared as now the 'sure' condition just used an unmarked declarative (like the one used in the German tasks in Study 1). Nevertheless, and somewhat unexpectedly, the comparison between the standard FB task and the certain/uncertain versions of the FB tasks revealed that the Japanese children profited from the unmarked declarative (but failed to do so on a significant level for the *kana* version) when they attributed a false belief to the speaker. This indicates that children interpreted an unmarked declarative as expressing speaker certainty which is weaker than the certainty expressed in the *yo*-marked declarative, yet much stronger than the utterance marked with the particle *kana*.

General discussion

Overall, our results showed a consistent pattern: Japanese 3-year-olds are sensitive to different degrees of speaker certainty indicated by the two particles; in contrast, German 3-year-olds appear not to be able to distinguish between the attitudes of certainty and uncertainty, regardless of whether these attitudes were marked explicitly by modal expressions (as in Study 2) or implicitly by the form of simple declarative (as in Study 1).

This pattern was first clearly shown in the base-line tasks in Study 1. The results generally replicate previous findings: in experimental conditions where a child participant was ignorant about the reality (as in the 'Not Own Belief' task in Wellman & Bartsch, 1988), she was able to attribute a belief to the protagonist on the basis of an explicit expression of this belief. Our novel finding was that only Japanese children, in contrast to German counterparts, took the protagonists' attitude of (un)certainty into consideration.

Moreover, this pattern was also shown in the Explicit FB tasks in Study 1: Japanese children who managed to attribute a false belief to the protagonist and to predict his consequent action on the basis of his utterance did so according to his degree of certainty expressed by the particles. By contrast, for German children who managed to attribute some belief to the protagonist, the attitude of (un)certainty had no significant effect.

Direct comparisons between Standard and Explicit FB tasks in Study 1 revealed that only Japanese children profited from the explicit expression of the character's false belief, when it was marked with the attitude of (un)certainty. For their German counterparts, no such effects were found. Performance of the German children turned out to be very similar to that of English-speaking children reported in previous studies.

The results of Study 2 confirmed our findings of Study 1. For instance, when the speaker's false belief was not explicitly marked with the certainty particle, but was expressed in the form of a simple declarative, Japanese children took it as expressing a belief with weaker conviction than the conviction expressed in the utterance marked with *yo*. This confirms that for Japanese 3-year-olds, the certainty particle *yo* is the only clear (and salient enough) indication of speaker's strong belief that they could grasp, and even when the belief is apparently false to them, they predict that the speaker is likely to act according to the belief. Furthermore, the comparison between the standard FB task and the explicit FB task indicates that Japanese children were also sensitive to the difference between the weaker certainty (relative to the *yo*-appended utterance) expressed in the simple declarative and strong uncertainty expressed in a *kana*-appended utterance. Thus, overall, our study revealed that Japanese 3-year-olds are capable of attributing a different degree of (un)certainty to the speaker on the basis of the speech form.

One of the important findings of the present studies is that the particular advantage Japanese children showed in the two experiments seems to be local. Although Japanese 3-year-olds' understanding of the linguistically encoded attitude of speaker certainty consistently facilitated their attribution of false beliefs to the protagonist, their performance improved only when the specific linguistic clues to the speaker's attitude were immediately available (as in the Explicit FB tasks). Local facilitative effect of linguistic stimuli, such as mental verbs, on false-belief understanding has previously been suggested (Lee, Olson & Torrance, 1999; Shatz, Diesendruck, Martinez-Beck & Akar, 2003). Our novel suggestion is that such facilitative effect extends to the non-lexical items.

Let us now consider the possible implications of the overall results of this study for the argument between conceptual deficit and processing deficit accounts. It should be noted at the outset that merely task-specific cross-cultural data such as the present ones are consistent with variants of both kinds of accounts (see Wellman *et al.*, 2001). On the one hand, the present results may be considered to support linguistic, 'localist' variants of conceptual change accounts. In contrast to German children, Japanese children, due to the evidential and certainty marking of their native language, have developed some conceptual competencies of ascribing (false) beliefs, but the competencies are local and language-bound in the sense that they are at first essentially tied to a specific form of discourse (Shatz *et al.*, 2003).

On the other hand, the present results are consistent with processing deficit accounts along the following lines: The Japanese 3-year-olds who failed in the standard FB tasks but succeeded in the 'sure' condition of the explicit FB tasks showed that when relevant linguistic indicators of the speaker's propositional attitude are available, they were capable of representing the protagonist's false belief which clearly contradicted their own true belief. One

explanation is that the linguistic indication of speaker certainty may have increased the *saliency* of the protagonist's belief, and in that way allowed children's nascent theory of mind to pop out. For 3-year-olds, whose executive capability is not yet robust enough to suppress the inherent saliency of current reality in standard FB tasks, the increased saliency of a certainty-marked false belief may reduce the executive demands and thus provide a better ground for their theory of mind to operate (Roth & Leslie, 1998).

This line of thinking brings us back to the question of potential advantages young preschoolers may have by having certain mental concepts being grammaticalized in their language. For example, Matsui *et al.* (2006) found that Japanese children acquired the meaning of speaker certainty and hearsay evidence encoded in particles first, before they come to understand the same concept encoded in verbs. Why are grammaticalized markers of speaker certainty potentially easier for preschool children to understand than ungrammaticalized, lexical equivalents? Several explanations are currently available. Grammaticalized items tend to appear with high frequency in child-directed speech, and as such, will receive special cognitive salience in the child's mind (Gopnik, Choi & Baumberger, 1996). Furthermore, in contrast to any other lexical items, Japanese sentence-final particles are almost always used only in conversation, and not in formal writing. They typically encode the speaker's intention *to share his attitudes with the hearer*, and as such, have an inherently 'subjective' or 'intersubjective' nature (Traugott & Dasher 2002). Thus, along the lines of Harris (1999, 2005) and Lohman and Tomasello (2003), we suggest that conversation may function as a 'training' for children between 2 and 3 years of age to interpret their interlocuter as epistemic being. Particles that encode the speaker's epistemic states may potentially work as a beginner's tool kit for them in such a process, not only to understand a variety of propositional attitudes, but also to learn how to respond to them appropriately.

To conclude, the overall findings of the present studies strongly indicate that certain mental state expressions have the potential to bootstrap the ability of young children who fail to pass the standard false-belief tasks to understand the speaker's false belief in verbal communication. The exact nature of the relation between children's understanding of the speaker's belief in verbal communication, where explicit linguistic clues about his mental state are often available, and their more general reasoning about mental states in a context in which no relevant linguistic clues are available, however, remains to be investigated more thoroughly in a further study. Currently, relevant data are rather scarce for children under the age of 4, and the present data are still among the first few regarding younger children's mental state reasoning.

Much richer data are currently available concerning children above 4 years of age, and comparing our findings with the existing data from older children is quite informative, as it indicates a clear difference between mental state reasoning of the two age groups. Previous studies demonstrated that children's acquisition of the non-linguistic concept of belief coincides with the time when they start comprehending mental state verbs such as *believe*, *think* and *know*, sometime between 4 and 5, when they start passing the standard false-belief tasks (Moore *et al.*, 1990). More recently, Matsui *et al.* (2006) found that Japanese children's understanding of mental state verbs significantly correlated to their understanding of false belief in general. Those and other existing findings suggest several interesting possibilities concerning the relation between linguistic competence in mental state discourse and non-linguistic reasoning about mental states in children between 4 and 5 years. For example, some pre-linguistic understanding of beliefs may be a prerequisite for competence in discourse about beliefs (Bartsch & Wellman, 1995). Alternatively, the development of general representational abilities may be essential for both an understanding of beliefs and mental state discourse (Perner, 1991). Another possibility is that some understanding of linguistic representation, or more specifically, understanding syntactic structures associated with mental state verbs, is a prerequisite for understanding non-linguistic representation of belief (de Villiers & de Villiers, 2000). Currently, the issues are subject to ongoing controversy (e.g. Astington & Baird, 2005), but there is one thing which has been accepted without much argument: by the time children pass the standard false-belief tasks, they are capable of understanding representation of belief both linguistically and non-linguistically; in other words, the mapping between the linguistic and the non-linguistic concept of belief is already well established for their cognitive system by then.

Younger children investigated in the current studies, by contrast, showed more limited understanding of the concept of belief, linguistic or non-linguistic. Our finding that Japanese children's false-belief understanding was boosted only when the relevant linguistic stimuli were present was the clearest indication of their limitation. It is also consistent with Matsui *et al.*'s finding that Japanese 3-year-olds' understanding of mental state particles did not correlate with their general false-belief understanding. Those limitations of 3-year-olds seem to us to indicate that the mapping between the linguistic and non-linguistic concept of belief is not readily available to children of this age; rather, some alternative mechanisms are involved in their early understanding of the speaker's belief state in communication. How those alternative mechanisms are to be characterized exactly is a question for future research; but the findings of the present studies at least suggest strongly that such mechanisms are likely to be found in children's experience of verbal communication itself, and that the type of relevant linguistic input (e.g. grammaticalized vs. lexical), as well as frequency and consistency of the input, are among the factors that may influence their early understanding of the speaker's mental states.

Acknowledgements

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