Discourse Particles and Belief Reasoning: The Case of German *doch*

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Abstract

Discourse particles typically express the attitudes of interlocutors with respect to the propositional content of an utterance – for example, marking whether or not a speaker believes the content of the proposition that she uttered. In German, the particle *doch* – which has no direct English translation – is commonly used to correct a belief that is thought to be common ground among those present. We asked whether German adults and 5-year-olds are able to infer that a speaker who utters *doch* intends to be understood in this way. Sixty-four children (4;9–5;3 years) and twenty-four adults participated in a comprehension task in which a speaker explicitly expressed either a positive belief or a negative belief. Subsequently, in both conditions, the speaker checked the truth of her previous belief and corrected her belief with *doch*. In both the group of adults and the group of children, polarity of the speaker’s belief affected hearers’ interpretations of the speaker’s utterance. In a third condition we investigated whether participants could also perform the more difficult task of interpreting the speaker’s utterance with *doch* while inferring the speaker’s belief. Whereas adults showed a similar performance as in the explicit belief conditions, children showed limited abilities in keeping track of the speaker’s belief.

1 INTRODUCTION

In conversational discourse interlocutors not only express propositions, but often also communicate the psychological states with which they entertain these propositions, so called propositional attitudes (Andersen & Fretheim 2000). Examples for the linguistic expression of propositional attitudes typically include mental state predicates (1), evidentials (2), and modal verbs (3).

(1) I *think / believe / know* that he is at home.
(2) *Allegedly*, he is at home.
(3) He *must* be at home, because his door is unlocked.

Recent research in pragmatics, sociolinguistics and conversation analysis has highlighted the role of lexical markers, notably discourse particles, in grounding propositional meaning and conveying epistemic
states (Andersen & Fretheim 2000; Fetzer & Fischer 2007). Discourse particles are commonly characterized as indexical devices for spoken discourse (Diewald 2006). Their primary function is that of relating the propositional content of the utterance that contains them to the set of shared assumptions or information (‘common ground’) that has been established in prior discourse (Levinson 1983; Fischer 2006).¹ One of the languages well known for its rich inventory of discourse particles is German. Studies investigating the German discourse particle system have mainly focused on two central issues: (i) How are discourse particles related to the marking of epistemic states (Doherty 1985; Abraham 1991; Blass 2000) and (ii) What is the role of discourse particles in language comprehension (König & Requardt 1991; König 1997; Fischer 2006)?

Taking the German discourse particle *doch* as a test case we address these questions from the point of language acquisition. By investigating children’s and adults’ interpretation of *doch* in different discourse contexts we provide empirical evidence for the idea that interlocutors use discourse particles to make inferences about mental states. Furthermore, we discuss the role of children’s ability in performing pragmatic inferences for the development of their theory of mind.

1.1 Discourse particles, mental states and common ground

The expression of epistemic modality is grounded in the ability to conceive of states of affairs from different mental perspectives. Many authors have drawn attention to the relation between epistemic modality and discourse particles in German (Doherty 1985), Dutch (Zeevat 2006) as well as non–Germanic languages including Hausa (Blass 2000), Modern Greek (Ifantidou 2000), and Mandarin Chinese (Feng *et al.* 2010). Consider the following example from Blass (2000: 41):

(4) (In a Moslem country)
A: He is wearing shorts.
B: a. German:  *Er ist ja zu Hause.*
   he is after all at home
   ‘After all, he is at home.’
b. English:  *After all, he is at home.*
c. Hausa:  *kasarsu ce mana.*
   living-place–their it is after all
   ‘After all, he is at (their) home.’

¹ Diewald (2006) has argued for German that modal particles like *doch* are a subset of discourse particles. A discussion of her arguments is beyond the scope of this paper and we will use the term ‘discourse particles’ throughout.
Blass argues that German ja, English *after all*, and Hausa *mana* indicate that the speaker takes the propositional content of the utterance to be known (or at least to be inferable) by the hearer, i.e. to be *mutually manifest* in the sense of Sperber & Wilson (1986).

Like the German discourse particle *ja*, the non-accented variant of German *doch* is often described as a marker of common ground (Fisher 2007; Zeevat & Karagjosova 2009). However, the stances speakers take in using the particles *ja* and *doch* are usually not the same. For example, *ja* in (5a) signals that the speaker takes the hearer to be aware of the propositional content of his utterance and thus committing to it. The use of non-accented *doch* in (5b) indicates that the speaker takes the hearer not to be committing to a proposition that is already part of their common ground anymore (Zeevat & Karagjosova 2009). Accordingly, the particle *ja* typically signals that an existing assumption is strengthened, while the discourse function of unaccented *doch* can be described as reminding the hearer of a fact in the common ground.

(5)  

a. *Er ist ja zurückgetreten.*
   he has PRT resigned
   ‘He has resigned, as you know.’

b. *Er is doch zurückgetreten.*
   he has PRT resigned
   ‘He has resigned, don’t you remember?’

In the spoken discourse of German, the particle *doch* is also frequently used with a focus accent. The primary function of the accented variant of German *doch* is that of revising a common ground belief. Consider the natural discourse example in (6), taken from Karagjosova (2009):

(6)  

A1: *es geht nicht*
    it works not
    ‘It doesn’t work.’

B: *du musst die Schraube drehen, […]*
   you must the screw turn
   ‘you must turn the screw.’

A2: *[…] hast recht, es geht DOCH*
    (you) have right, it works PRT
    ‘You are right, it DOES work after all.’

In the accented use *DOCH* *p* signals that the speaker’s current epistemic evaluation of *p* is in contrast with an alternative epistemic evaluation of
p, which is already part of the common ground between speaker and hearer.

Another important aspect of the meaning of doch concerns the discourse status of the common ground belief, i.e. whether it has to be expressed explicitly for successful comprehension. In (6), for example, the belief is made explicit by A’s first utterance. However, as Fischer (2007) points out, “there are also uses [. . . ] that do not refer to anything that has been previously said, but to a proposition that is assumed to be held by both communication partners” (p. 53). Thus, in (6) speaker A could have uttered just the second statement without the preceding negative evaluation and speaker B could have construed a context in which A previously held the belief that ‘it doesn’t work’ without having stated this at all.

1.2 The role of discourse particles in language comprehension

The role of discourse particles in language comprehension, and more precisely in constructing discourse representations, provides an interesting test case for theories of inferential communication. According to the relevance-theoretic view, discourse particles, similar to discourse connectives (e.g. ‘but’, ‘so’, ‘after all’), do not contribute to the truth-conditional meaning of an utterance, but function primarily as constraints on the inferential processes involved in comprehension (Wilson & Sperber 1993).

Based on Blakemore’s analysis of discourse connectives in English (Blakemore 1987), König & Requardt (1991) and König (1997) have characterized the function of German discourse particles with respect to contextual effects in the sense of Sperber & Wilson (1986). According to Sperber & Wilson (1986), “interpreting an utterance involves more than merely identifying the assumption explicitly expressed: it crucially involves working out the consequences of adding this assumption to a set of assumptions that have themselves already been processed” (p. 118). These authors point out that contextualizing new information with respect to a set of old assumptions can give rise to (i) the derivation of contextual implications, (ii) the strengthening of existing assumptions, or (iii) the identification of contradiction and elimination of existing assumptions. König (1997) argues that German discourse particles basically fall into three groups that reflect these contextual effects. Some particles select an appropriate context in which the host utterance has to be processed, i.e. they mark a proposition as a premise, a conclusion, or indicate context change. Other particles specify the degree of evidence a speaker has for the truth of a proposition. Particles of the third
group, such as *doch*, signal inconsistency between new information provided by the host utterances and existing assumptions.

Fischer (2007) outlines an account of German discourse particles that also focuses on their contextual sensitivity. In her analysis, discourse particles function as grounding elements. They relate the propositional content of utterances to what she calls pragmatic pretext, i.e. “a proposition “at hand” which is part of the non-verbal argumentative context” (Fischer 2007: 51). Crucially, the type of relation is specified by the particle’s core semantic content, which can be additive or adversative, for example. Fischer (2007) characterizes the core meaning of accented *doch* as adversative. According to her model, a hearer can construe the pragmatic pretext from an utterance with accented *doch* through “the negation of the situation described in the current utterance” (p. 52).

1.3 The present study

In the current study we examine the two central claims about discourse particles – their reference to mental states and their pragmatic function as inference triggers – from the perspective of language acquisition. Both of these aspects constitute particular challenges for children and contribute to their development of theory of mind.

The acquisition of linguistic constructions that refer to mental states is notoriously difficult for children. The general picture is that full understanding of mental state verbs such as *think, believe, or know* coincides with passing the verbal false-belief task between 4 and 5 years (Moore *et al.* 1990). This observation led some researchers to conclude that the linguistic properties of mental state verbs – sentential complement syntax – provide the necessary representational format for belief reasoning (De Villiers 2007). However, Lohmann & Tomasello (2003) found that training 3-year-olds with sentential complement syntax as well as engaging them in perspective-shifting discourse about deceptive experiences (with and without mental state predicates) equally enhanced young children’s false-belief understanding. Moreover, Papafragou *et al.* (2007) showed that 4-year-old children depend heavily on contextual cues for using complement syntax to infer that a novel verb is referring to a mental state. Specifically, these authors demonstrated that children are most likely to infer the meaning of belief terms in situations where mental states turn out to be incorrect. What these studies suggest is that children grasp the meaning of belief terms typically in situations of contrastive discourse.

Given that accented *doch* is prototypically used in contrastive discourse (and does not require mastery of complement syntax),
we hypothesized that 5-year-old children would comprehend *doch* as a marker of belief correction in contexts where the relevant belief is explicitly at hand.

The second aspect connected to discourse particles, i.e. the ability to perform pragmatic inferences, also shows considerable limitations until late in development. For example, Noveck (2001) showed that children do not master scalar implicatures with modals and quantifiers until the age of seven or eight (for similar findings see Pouscoulous *et al.* 2007). Similarly, children’s sensitivity to givenness-inferences triggered by definite descriptions does not emerge until the age of eight or nine (Karmiloff-Smith 1979). A limiting factor in the latter case seems to be the ability to take into account common ground knowledge (Epley *et al.* 2004).

Thus, if it is correct that the discourse particle *doch* triggers pragmatic inferences by relating the propositional content of utterances with the common ground, we expect children to show limited comprehension of *doch* in situations where using common ground for belief revision increases inferential load. Specifically, we asked whether adults and children show different response patterns when the relevant belief was implicit and thus more difficult to assess.

2 STUDY 1

2.1 Method

2.1.1 Participants. Forty-eight children were included in the final sample (4;9–5;3 years, mean age 4;11 years, 24 girls). All children were recruited in local daycare centers in Leipzig, a mid-sized German city. Children came from mixed socio-economic backgrounds, grew up in monolingual German-speaking homes and had no reported history of speech or language impairment. An additional five children were tested, but had to be excluded from the analysis due to a bilingual background (*n* = 1), reported speech or language impairment (*n* = 2), because they showed a side bias during testing (*n* = 1) or were uncooperative (*n* = 1). As a control group we tested twelve adult native speakers of German (21–36 years, mean age 24;2 years, 7 females).

2.1.2 Materials and procedure

*Explicit belief conditions.* The study was designed as a forced-choice, reference disambiguation task. Participants watched a puppet theater, in
which a hand puppet (the speaker) was searching for a toy that was hidden in one of two boxes. Each box belonged to one of two similar-looking characters, who were introduced as friends of the hand puppet, but whose names were not mentioned. There were six pairs of ‘friends’, i.e. two dogs, two hedgehogs, two mice, two cats, two polar bears, and two rabbits, as well as six pairs of boxes and six different toys. Each pair appeared in succession on the stage. All characters were enacted by E1.

For revision of explicit beliefs, the speaker expressed first either a positive belief or a negative belief concerning whether box A contained the toy (“It’s certainly in this box” vs. “It’s certainly not in this box”). Subsequently, in both conditions, the speaker looked inside box A and uttered the same statement marked with the particle _doch_ and a friend’s name (“The toy is _DOCH_ in [name of friend]’s box”). The English translational equivalent of _doch_ in our example is using contrastive stress indicated by capitals (“The toy IS in [name of friend]’s box” to correct the explicit negative belief, and “The toy is in [NAME OF FRIEND]’s box” to correct the explicit positive belief). The task for the participant was to point to the box that contained the toy by inferring which of the two characters was the referent of the name. In the explicit positive belief condition the true location of the toy was box B (‘other box’ with respect to where the speaker checked). In the explicit negative belief condition the true location of the toy was box A (‘same box’ with respect to where the speaker checked).

Participants were prompted by E2 (“Show me where the toy is!”). Figure 1 depicts the sequences of the scenario. Crucially, neither the hand puppet nor the participant or E2 had witnessed the hiding of the toy, i.e. there was no mismatch between the actor’s knowledge state and the participant’s knowledge state as it is the case in standard false-belief tasks.

**Implicit positive belief condition.** In a third condition, we asked whether comprehension of _doch_ depends on the inferential load involved in belief revision. The procedure was identical to that of explicit negative condition, except that in the implicit positive condition the speaker went looking in box B (rather than A) after having expressed a negative belief about box A. In this condition, participants had to infer the speaker’s positive belief about the content of box B from his previous utterance and thus to entertain and coordinate two alternative epistemic evaluations (see Figure 1, lower panel). In the implicit positive belief condition, the true location of the toy was box A (‘other box’ with respect to where the speaker checked).
Conditions were presented between subjects for children (16 children per condition) and within subjects for adults. The reason for this design was to avoid long testing sessions for children on the one hand, and to be economical in recruiting adult participants on the other. There were six experimental trials in each condition and four different orders of trials. Participants were randomly assigned to one of the orders. In addition to the experimental trials, children were presented with two warm-up trials in order to familiarize them with the procedure. Importantly, the particle *doch* was not used during warm-up. The speaker’s belief was confirmed or disconfirmed by the use of affirmative or negative statements (“It’s in this box!” vs. “It’s not in this box.”).

2.2 Design, coding and reliability

Figure 1  Upper panel (Explicit positive condition): In stage 1 the speaker expresses a positive belief about box A (“It’s certainly in this box.”). In stage 2 the speaker looks inside box A. In stage 3 the speaker utters the belief correction statement (English translation: “It’s in [NAME OF FRIEND]’s box.”). Middle panel (Explicit negative condition): In stage 1 the speaker expresses a negative belief about box A (“It’s certainly not in this box.”). In stage 2 the speaker looks inside box A. In stage 3 the speaker utters the belief correction statement (English translation: “It IS in [name of friend]’s box.”). Lower panel (Implicit positive condition): In stage 1 the speaker utters a negative belief about box A. In stage 2 the speaker switches to box B and looks inside. In stage 3 the speaker utters the belief correction statement (English translation: “It IS in [name of friend]’s box.”). The red arrows indicate the true location of the toy and capitalization indicates contrastive stress.
Children were also given feedback during warm-up to ensure that they knew that the speaker would give reliable information. We counterbalanced the side on which the belief statement was uttered. Half the time the speaker expressed his belief about box A and half the time about box B, but never more than twice on the same side on consecutive trials. Half the participants started with box A, the other half with box B. No feedback about correctness of the choice was given during experimental trials in order to prevent learning effects. Each participant was tested individually in a quiet room. All sessions were videotaped.

Participants’ responses were coded live and independently by E1 and E2. After participants had made their choice in each trial, E1 coded which box the participant had identified (either left or right from E1’s perspective). At the same time, E2 coded which box the participant had identified from her perspective (either left or right). Out of six trials, participants received a score for choosing the uninspected box (‘other-score’). The dependent measure for statistical analysis was the other-score as coded by E2. Scores coded by E1 were used for reliability measures. Reliability measures for the adult data were coded from videotapes. For this purpose, all responses of three randomly selected participants were coded (25% of all responses). Reliability for children’s trials reached Cohen’s Kappa = .97 and adults’ trials Cohen’s Kappa = .96.

2.3 Results and discussion

2.3.1 Adults. A Friedman rank sum test of the main effect of condition was statistically significant, Friedman’s $\chi^2 (2) = 20.46$, $p < 0.001$. Adults showed a clear preference of choice in all three conditions (see Figure 2). We used the Wilcoxon test for pairwise post-hoc comparisons, which revealed the following results: In the explicit positive condition participants chose the uninspected (‘other’) box significantly more often than in the explicit negative condition, $T = 66$, $N = 11$ (1 tie), $p < 0.001$. The same was true for the comparison between explicit negative and implicit positive, $T = 78$, $N = 12$, $p < 0.01$. The preferences in the explicit positive and implicit positive conditions did not differ significantly from each other, $T = 8.5$, $N = 4$ (8 ties), $p = 0.375$. All preference scores were significantly above chance level ($M_{ExpPos} = 5.58$, $T = 66$, $N = 11$ (1 tie), $p < 0.001$; $M_{ExpNeg} = 5.16$, $T = 55$, $N = 10$ (2 ties), $p < 0.01$; $M_{ImpPos} = 5.00$, $T = 64$, $N = 11$ (1 tie), $p < 0.01$).
2.3.2 5-year-olds. A non-parametric test for main effects revealed an effect for condition, Kruskal Wallis $\chi^2 (2) = 15.46, p < 0.001$. We used the Mann–Whitney $U$ test for pairwise post-hoc comparisons. There was a significant difference in children’s preference score for choosing the uninspected (‘other’) box between the explicit positive and negative condition ($U = 39.5, p < 0.001$) and between the explicit positive and implicit positive condition ($U = 54, p < 0.01$). Scores in the explicit negative and implicit positive condition did not differ significantly from each other ($U = 91, p = 0.143$).

An additional comparison revealed that children’s preference scores differed significantly from chance in the explicit positive condition ($M_{ExPos} = 5.44, T = 126, N = 16, p < 0.001$), and marginally in the explicit negative condition ($M_{ExNeg} = 1.75, T = 102.5, N = 16, p = 0.075$). However, children’s scores did not differ significantly from chance in the implicit positive condition ($M_{Impos} = 3.188, T = 60.5, N = 15 (1 tie), p = 1$). Visual inspection of the distribution of children’s responses in the explicit negative and the implicit positive condition indicated a bimodal pattern (see Figure 3). This suggests that children were consistent in their choice strategy rather than choosing randomly on every trial.
2.3.3 **Comparison of adults and children.** We used a permutation test to investigate whether there was a significant interaction between age and condition (Anderson 2001). To determine the significance of the interaction we permuted the data within individuals for the adults and across individuals for the children. We ran a total of 1000 such permutations (into which we included the original data as one permutation).
We estimated the $p$-value as the proportion of permutations revealing an $F$-value at least as large as that of the original data.

The analysis revealed that the interaction was not significant ($p = 0.379$). Post-hoc comparisons confirmed that there were no significant differences between adults and children’s scores in the explicit positive condition ($U = 90$, $p = 0.797$) and the explicit negative condition ($U = 89$, $p = 0.723$). However, whereas adults predominantly chose the uninspected (‘other’) box in the implicit positive condition, children chose the uninspected box significantly less often ($U = 55$, $p < 0.05$).

One possible explanation for the differences in performance could be that the adults made comparisons across conditions due to the within-subjects design, whereas each child only saw one condition. We tested whether adults’ responses in the implicit positive condition were influenced by our experimental design by running only this condition with an additional group of twelve adults (19–41 years, mean age 35.9 years, 7 females). The performance of the control group did not differ from the performance of original adult group ($M_{\text{Control}} = 5.30$, $M_{\text{Exp}} = 5.00$, $U = 61$, $p = 0.53$). Adults in the control group still performed significantly better than children ($U = 149$, $p < 0.01$).

How can we account for children’s performance in the implicit positive condition? One suggestion might be that children generally failed at re-assessing the content of the speaker’s belief statement due to box B being the new focus of attention and randomly chose a strategy of either picking the current box or always picking the other box. Another possibility is that some children inferred the speaker’s belief correctly and some children did not, i.e. they simply chose the box that the speaker looked into because they considered the speaker’s action of switching boxes as more relevant for their choice than his statement of belief correction.

In order to distinguish between these two explanations, we ran a second study (implicit negative belief), in which correct belief reasoning, as well as applying the heuristic of picking the inspected box (the current focus of attention), yielded the same outcome.

3 STUDY 2

3.1 Method

3.1.1 Participants. We tested 16 monolingual German-speaking children (age range: 4.9–5.3 years, mean age 4.11 years, 8 girls).
3.1.2 Materials and procedure. The procedure and material of study 2 were identical to the implicit positive condition in study 1, except that the speaker expressed an affirmative belief about box A before switching to box B and correcting his belief (see Figure 4). In the implicit negative belief condition the true location of the toy was box B (‘same box’ with respect to where the speaker checked).

3.2 Coding and reliability

Counterbalancing and coding were identical to study 1. The dependent measure for statistical analysis was the ‘other-score’ as coded by E2. Reliability in coding reached Cohen’s Kappa = .98.

3.3 Results and discussion

Children’s mean choice of the uninspected box was 65.6%. Children’s preference scores in study 2 did not differ significantly from chance ($M=3.935$, $T=91$, $N=16$, $p=0.22$) and did not differ from those of the implicit positive condition in study 1 ($U=99.5$, $p=0.275$). Instead, children’s responses showed a similar bimodal distribution. This finding speaks against an explanation according to which some children were able to correctly perform the inference of belief correction in the implicit condition in study 1 and some children were not. Taken together, these results suggest that children’s behavior in the implicit condition is likely to reflect developmental limitations in the ability to keep track of a person’s belief.

3.4 Analysis of intonation

An additional factor that is likely to have played a role in the current study is intonation. Since interpretation of doch as a marker of belief revision is only possible when the discourse particle carries a pitch accent, it was crucial that the utterances produced by the speaker contain an accent on doch. A professionally trained phonetician checked 20% of all doch-utterances produced in study 1 and study 2 ($N=122$) for whether the particle was accented and what type of pitch accent was used. The analysis showed that doch was indeed accented in all sentences. However, the distribution of pitch accent types indicated that trials in which the speaker was negatively surprised showed a high proportion of H+L* accents (72.5%), whereas trials in which the speaker was positively surprised showed a high proportion of H* accents (71.7%).

One possible way of explaining the results of the current study is that it was this difference in prosody that primarily drove participants’
choices in each condition. Although it is clear that children and adults are sensitive to intonational information, an explanation of the data based on prosody alone fails to account for the observed divergence in children’s behavior in the explicit and implicit conditions. A comparison of the explicit and implicit positive belief condition (study 1), in both of which the speaker was negatively surprised, revealed no difference in the intonation contours ($\chi^2 = 0.043$, df = 1, $p = 0.836$), but children showed a different behavior in each condition. Similarly, a comparison of the explicit negative condition (study 1) and implicit negative condition (study 2), in both of which the speaker was positively surprised, revealed that children received similar intonation contours ($\chi^2 = 0.28$, df = 1, $p = 0.596$), but showed a different behavior as indicated by their choices. If children had relied mainly on the rising or falling intonation contour as an indicator of positive or negative surprise they should have been equally likely to infer the location of the hidden toy in the explicit as well as in the implicit conditions.

However, these comparisons should not be taken to imply that children dismiss prosodic information when interpreting utterances with *doch*. It is conceivable that children used the prosodic cues in the explicit belief conditions, but due to the additional shift of attention in the implicit negative belief condition and in the control condition children were no longer able to keep track of the speaker’s belief.

4 GENERAL DISCUSSION

4.1 Summary of findings

In summary, the results of the current study support the idea that interpreting utterances containing the discourse particle *doch* involves
inferences about belief states. This conclusion is supported by two major findings. First, manipulation of the speaker’s belief state in the explicit belief conditions led adults and children to interpret the same utterance marked with *doch* in different ways as indicated by their choices in the reference disambiguation task. Second, when the speaker’s belief had to be re-assessed from prior discourse, comprehension of *doch* was more difficult for children than for adults. Adults interpreted the *doch*-utterances similarly in the explicit and implicit belief condition whereas children did not. What remains unclear is the precise role of the information provided by the type of pitch accent realized on accented *doch*. While it seems clear that prosodic information alone did not guide children’s comprehension, the particular influence of intonation can only be addressed in an experimental setting that controls for the effects of prosody by providing identical prosodic cues in both explicit belief conditions.

4.2 Implications for the role of discourse particles in pragmatic inferencing and its development

We suggest that our findings are compatible with accounts which describe the functional role of discourse particles as guiding language comprehension by relating the propositional content of the host utterance to the common ground and inducing an inferential procedure of belief reasoning (e.g. König 1997; Fischer 2007). However, a comparison of the developmental and adult data suggests that assessing the common ground was harder for children than for adults.

Thus, our results indicate that children show limited abilities in recruiting presupposed information in order to interpret ambiguous utterances. This finding is in line with recent research on children’s pragmatic inferences showing that children often acquire a more narrow lexical meaning of words, such as quantifiers, modals, or determiners before they master the full range of pragmatic inferences involved in the use of these expressions (Noveck 2001; Huang & Snedeker 2009). For example, children at the age of three understand that the use of definite articles requires a uniquely identifiable referent (Maratsos 1974). However, they do not fully grasp the pragmatic inference triggered by the definite article, which identifies a referent to be in common ground for both speaker and hearer, until much later in development (Power & Dal Martello 1986).

As mentioned above, the discourse particle *doch* exemplifies an expression that marks a shift in mental perspectives, a concept difficult for children to grasp. What is especially interesting with respect to our
findings is the fact that children showed adult-like and non-adult-like comprehension for one and the same word that expresses a shift in mental perspectives. Children at the age of five have acquired the meaning of the accented discourse particle *doch* as a marker of belief revision. However, increased inferential load in assessing a speaker’s belief leads to limited comprehension in 5-year-old children. From a developmental perspective this suggests that children first learn the meaning of the discourse particle *doch* in contexts where the speaker’s belief is easily inferable.

Similarly, Rakoczy (2010) points out that executive function is correlated with children’s performance in verbal tasks, which essentially involve coordination of, and flexible shifts between, perspectives. Clearly, in the current study there was no first person involvement that could have created a perspective coordination problem as in standard false-belief tasks, since child and speaker were both ignorant with respect to the true location of the toy, and children were not given any feedback during testing. However, the additional attentional shift introduced in the implicit condition might well have created a perspective problem for children. In the explicit conditions, the belief statement and the belief correction statement were made with respect to same focus of attention. In the implicit condition, switching boxes between both statements required participants to shift their attention back to the box that was not in current focus when they heard the *doch*-statement and thus to entertain and coordinate two alternative epistemic evaluations. We suggest that this additional inferential load is what limited children’s comprehension of belief revision.

Interestingly, even some adults showed performance around chance level (see Figure 3). This variation in performance might indicate that adults also found the implicit positive condition more difficult to comprehend than the explicit positive condition. Consequently, difficulty in belief reasoning for children and adults might depend on the inferential load involved in a particular task (for a similar account see Apperly *et al.* 2011). In the current study we used an offline measure, which might not adequately capture whether processing costs were similar for adults in all conditions. It is conceivable that online methods such as reaction time measurements or eye-tracking techniques could reveal processing differences in adults similar to the error patterns found in children’s responses. In fact, such a finding would support the idea that discourse particles encode inferential procedures involved in perspectival shifts. Future studies will have to address these questions in more detail.
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