

To appear in S. Barbiers, F. Beukema & W. van der Wurff, eds. *Modality and its interaction with the verbal system*. Amsterdam: Benjamins.

Modality and theory of mind:

Perspectives from language development and autism

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Abstract

It is widely assumed in the developmental literature that certain classes of modal expression appear later in language acquisition than others; specifically, epistemic interpretations lag behind non-epistemic (or root) interpretations. An explanation for these findings is proposed in terms of the child's developing *theory of mind*, i.e. the ability to attribute to oneself and others mental representations, and to reason inferentially about them. It is hypothesized that epistemic modality crucially implicates theory-of-mind abilities and is therefore expected to depend on prior developments in the child's ability to handle representations of mental representations. In support of this hypothesis, it is shown that autistic individuals (who arguably possess a deficient theory-of-mind mechanism) have difficulty with epistemics.

1. Introduction

It has long been recognized that modal items in natural language are context-dependent expressions. A sample of possible interpretations for some English modal verbs is provided by the glosses below:¹

- (1) He must be back before dark.
 - a. 'He is obliged to be back before dark'.
 - b. 'He will certainly be back before dark'.

- (2) The test should not take longer than 30 minutes.
 - a. 'It is recommended that the test does not take longer than 30 minutes'.
 - b. 'The test is not likely to take longer than 30 minutes'.

- (3) Students may use the sports facilities.
 - a. 'Students are allowed to use the sports facilities'.
 - b. 'It is possible that students will use the sports facilities'.

- (4) John has to have the right solution; he's the expert.

- a. 'John is obliged to have the right solution'.
 - b. 'It is certain that John has the right solution'.
- (5) The bank will give you a new credit card.
- a. 'The bank intends/is willing to give you a new credit card'.
 - b. 'I predict that the bank is going to give you a new credit card'.
- (6) I can ride a bicycle.
- a. 'The circumstances make it possible for me to ride a bicycle'.
 - b. 'I am able to ride a bicycle'.

For purposes of the present paper, I will focus on a distinction that is often drawn in the semantic and syntactic literature, that between *root* and *epistemic* modal meanings. Root meanings include obligation and permission notions (traditionally known as *deontic* modality), as well as the family of concepts dealing with intention/willingness and ability (traditionally known as *dynamic* modality): examples (1a), (2a), (3a), (4a), (5a) and (6a, b) above can be characterized as expressing root modal concepts. Epistemic meanings involve inference from known premises: the examples in (1b), (2b), (3b), (4b), and (arguably) (5b) fall under the category of epistemic modality.

Root and epistemic modality are based on different premises. In the words of Kratzer (1981), 'if we use an epistemic modal, we are interested in what else may or may not be the case, *given everything we know already*'; on the other hand, with non-epistemics, 'we are interested in what can or must happen, *given circumstances of a certain kind*' (1981: 52). An interesting fact, which has been repeatedly pointed out in the psycholinguistic literature, is that root meanings precede epistemic ones in language acquisition. Since in many languages the same class of modal expressions is used to convey both root and epistemic meanings (as is the case with the English modals above), the claim is that modal items initially appear in child language with root interpretations only, while their epistemic interpretations are acquired markedly later.

In this paper, I will survey the evidence standardly adduced to support the acquisitional priority of root over epistemic modal meanings. I will focus on cross-linguistic longitudinal studies and I will also occasionally mention critical experimental results. My main aim is to motivate a specific proposal about the emergence of epistemic modality in language development; according to this proposal, the emergence of genuine epistemic modal uses is closely tied to the development of the child's theory of mind, that is, the ability to understand mental phenomena and to attribute mental states to oneself and to others (see also Papafragou 1998a, 2000). I will explore the explanatory potential of this view with regard to the existing cross-linguistic data on the acquisition of modality and relate these results to developmental findings from mental verbs such as *think*, or *believe*. Finally, I will show how certain data from autism provide some support for the proposed analysis of epistemic modality.

2. The acquisition data

The set of modal data for which we have the most extensive longitudinal studies is probably the class of English modal verbs. According to Shatz and Wilcox (1991), the first uses of the modals in English appear between 1;10 and 2;6, initially in restricted syntactic environments (mainly declaratives) and often with a single negative form such as *can't*. Gradually, both the range of constructions in which modality appears and the type of modal item used become more varied.

Although production does not immediately equal comprehension (a point I will return to below), it appears that quite early on English-speaking children express intention/desire and ability with *will* and *can*, respectively. In Wells' (1979) sample (which consisted of 60 children time-sampled along with their mothers every 3 months from 1;3 to 3;6), it was found that by 2;6 more than half of the sample used *can* to convey both ability and permission; by the same time, children used *will* to communicate intention. In her studies of a single child, Shepherd (1982) has found that *will* extends from volition to prediction between 2;5 and 3;0. *Will* refers to more distant future or events which lie beyond the child's control, while *gonna* takes up the space of events in the immediate future which the child controls (cf. Gee and Savaris 1985). Similarly, Gerhardt (1991) reports on the use of *hafta*, *needta* and *wanna* in the speech of two 3-year-olds: the three quasi-modal verbs have root uses. *Hafta* is used to convey compulsion based on a norm/external source, *needta* communicates compulsion based on an internal source, and *wanna* communicates volition. Later on, a fuller repertoire of root uses comes into play. Between 2;9 and 3;0, the children in Wells' (1985) sample used *must*, *have (got) to* and *should* to communicate obligation and (root) necessity, although these uses stabilized at later developmental stages. As Wells (1985) reports, by 3;3 all categories of root modality had emerged in his sample.

In contrast, the first statements with epistemic modals (*must* and *may*) occur in the second half of the third year, i.e. about six months later than root meanings, and epistemically modalized utterances are extremely rare until the middle of the fourth year (Stephany 1986, 1993; but cf. O'Neill and Atance 2000). In Wells' (1985) population, *may* and *might* were used with an epistemic meaning only by 3;3 years of age. Use of modals to convey certainty emerged even later, since by 5;0 years only 25% of the sample gave evidence of it. Certain epistemic uses of *will* (as in *That will be John*, uttered on hearing the doorbell) appear even later than epistemic uses of *must*. Other research suggests that the development of the epistemic modal system, especially as far as adverbs and adjectives are concerned, continues even between 6;0 and 12;0 years (Perkins 1983).

Young children's comprehension of modal expressions has also been tested experimentally. Hirst and Weil (1982) gave 54 children between 3;0 and 6;6 two different modal propositions of varying 'strength' (e.g. with a possibility vs. a necessity marker). In the epistemic cases, the propositions concerned the

location of a peanut. In the root cases, they were commands by two teachers about the room a puppet was to go to. The child was to indicate in the first case where the peanut was, and in the second where the puppet would go. The strength ordering assumed was *is* > *must* > *should* > *may*. The general result was that children appreciate the relative strength of epistemic modal propositions about a year earlier than root modal propositions (5;0 vs. 6;0 years approximately); moreover, the greater the distance between the modals, the earlier the distinction is appreciated. These results cannot be interpreted as evidence against previous research documenting the developmental priority of root over epistemic interpretations of modals. Children's performance in the deontic tasks was probably influenced by factors other than the relative strength of the modals (for instance, the evaluation of the authority of the persons issuing the command, or the puppet's compliance with the rules). Still, this paradigm shows that children have a good grasp of differences between modals within each major modal class (root or epistemic) by the age of 5;0 or 6;0. Hirst and Weil's original tests were replicated by Noveck, Ho and Sera (1996) with 5-year-olds and Byrnes and Duff (1989) with 3- to 5-year-olds.

There is some evidence that the precedence of non-epistemic meanings of modal expressions in acquisition is attested in other languages as well. Stephany (1993) reports findings which show that, in German child language, *wollen* ('will') and *können* ('can') are the first modals to appear; moreover, she shows that, when *müssen* ('must') and *sollen* ('should') appear, they have root rather than epistemic interpretations. In Polish, expressions of root modality appear before 2;0 and are used with increasing frequency during the third year to communicate obligation/root possibility and prohibition/permission. No epistemic uses of modals are attested for this period, although during the second year certain epistemic modal particles emerge - e.g. *chyba* ('probably'), *na pewno* ('for sure') (Smoczyńska 1993). Data from Mandarin Chinese also follow the developmental ordering of dynamic, deontic and epistemic modality (Guo 1994). Modal data from Modern Greek, Finnish and Turkish seem to pattern in similar ways. Stephany (1986) notes that, in these languages, epistemic interpretations emerge well after the third birthday. In fact, as she notices, a variety of grammatical means for marking epistemic modality other than modal verbs (e.g. the conditional in Finnish, the aorist inflection in Turkish) coincide around the third year.

Even though observational data are not easy to interpret, I will treat them as a useful point of departure in discussing the acquisition of modality. In the next section, I will present the beginning of an explanation for the acquisition facts that draws on the connection between epistemicity and the child's developing conception of the mind.

3. Theory of mind: An overview

One of the most characteristic properties of (adult) human beings is the ability to attribute mental states to oneself and to others, and to use information about human cognition and motivation in understanding and predicting human action. In other words, adults generally assume that people have mental states, a mental life of interconnected beliefs, desires, intentions, ideas; they also assume that people's observable behaviour

stems from and is best understood in terms of the mental states which lie behind overt behaviour. The ability to impute mental states to oneself and others leads humans to try and use the mind and increase its powers, to share inner experiences, to distinguish between imaginary and real events, and to interact with other persons by searching for and reaching out to their underlying mentalities (Butterworth, Harris, Leslie and Wellman 1991a). This everyday conception of the mind (or 'folk psychology') is commonly referred to within recent cognitive science as *theory of mind* (see the contributions in Astington, Harris and Olson 1988, Whiten 1991, Butterworth, Harris, Leslie and Wellman 1991b, Frye and Moore 1991, Hirschfeld and Gelman 1994, Carruthers and Smith 1996).

Although knowledge of 'other minds' has been one of the traditional preoccupations of philosophy, current interest in folk psychology resurfaced after some researchers raised the question of whether certain primates might also possess and use (some form of) mindreading (Premack and Woodruff 1978). This question forced philosophers and psychologists to think more clearly about what is involved in having a theory of mind and to consider cases in which the workings of theory of mind are either absent or very different from the normal adult case (including the cognition of animals, children and atypical individuals).

Recent years have seen a flood of interdisciplinary research on theory of mind, mainly centred around two main issues: (i) What is the nature, and what are the characteristic properties, of normal adult folk psychology?, and (ii) How do folk-psychological abilities develop in children? Both issues are surrounded by considerable debate. For instance, adult folk psychology has been analyzed as a truly theory-like object constructed through general-purpose learning capacities (Gopnik and Wellman 1995), a module underwritten by an innate mechanism (Leslie 1988), or a device for projecting oneself onto other people, thereby simulating their mental states (Gordon 1986). These differences in perspective with regard to the final form and deployment of theory of mind carry over to developmental work: studying what the intermediate (ontogenetic) stages in folk-psychological development look like typically presupposes a stance on the structure and function of the adult folk psychology. In what follows, I present certain core facts about children's performance in theory-of-mind tasks without adjudicating between competing theoretical proposals. The description is meant to highlight some relatively uncontroversial data concerning children's performance; it is also meant to give some background for discussing the data from the acquisition of modality in later sections.

There is some evidence for early understanding of mental life by 2;0 years of age. Very young children are able to pretend and to engage in pretence alongside others (Leslie 1988). They also have an understanding of the causal links between desire or perception and the world: They know that desires can be used in predicting actions (Wellman and Woolley 1990). Two-year-olds also know that they can produce perceptions in others by showing things to them, and by 3;0 they can also deprive others of perception by hiding things (Yaniv and Shatz 1988).

Slightly older children have more sophisticated knowledge about the mind. Three-year-olds can distinguish between real and mental entities. For instance, they know that, when someone is thinking about a cookie, that cookie cannot be eaten, shared, and so on - unlike the situation in which someone actually has a

cookie (Wellman and Estes 1986). They also develop a better understanding of the connection between perception and belief fixation. They realize, for instance, that if an object is hidden in a box, someone who has looked in the box knows what is in there, and someone who has not looked does not know (Pratt and Bryant 1990).

There is a crucial step in cognitive development between 3;0 and 4;0 or 5;0 years which is typically marked by children's ability to pass the so-called *false belief task*. The essence of the task is to check whether children realize that other people may have beliefs which differ from their own. This is important in theory-of-mind development, since it is a reliable way of testing whether children actually attribute beliefs to others or simply assume that others share their own beliefs. In the classic version of the false belief task (Wimmer and Perner 1983), one character puts an object in some place and goes away. In his absence, the object is moved to another place. The first character comes back and wants to retrieve the object. The question is where the actor will look for the hidden object. It turns out that children under 4;0 wrongly predict that the character will look at the correct (new) place, even though the person has had no actual access to the information that the object was moved. In order to pass the test, children have to attribute a false belief to the agent, even though they themselves hold a different (and true) belief.

The results from this test generalize across a broad range of related experimental tasks. If one shows a 3-year-old a familiar candy box and lets her find out that it contains pencils, not candy, then puts the pencils back and asks her what her friend, who has not seen what is in the box, will think about its contents, 3-year-olds typically say the friend will think there are pencils in the box (Perner, Leekham and Wimmer 1987). In the same task, when 3-year-olds are asked what they initially thought was in the box, they reply 'pencils', not 'candy', that is, they do not remember their previous false beliefs (Gopnik and Slaughter 1991). The performance of children over 4;0 in such tasks is considerably better. Other important developments during this period include children's ability to distinguish between appearance and reality (Flavell 1986), and to remember the source of their beliefs (e.g. a sensory modality - Wimmer, Hogrefe and Sodian 1988, O'Neill and Gopnik 1991).

In sum, it seems that, around the age of 4;0 or 5;0, children become capable of successfully handling second-order representations (metarepresentations), that is, representations about their mental states. Moreover, children of this age begin to understand that these representations may vary in reliability, may change over time and may differ across individuals. After 5;0, development related to mindreading continues in a number of directions. For instance, children appreciate that mental state attributions can be multiply embedded ('John thinks that Mary fears that Beatrice suspects...'), and acquire social concepts such as 'duty' and 'commitment' which rely on such complex reasoning.

4. Metarepresentation and modal interpretations

4.1 A proposal

I now want to consider the development of epistemic modal interpretations in the context of the child's theory of mind. Consider the familiar case of the English modal verbs. When using a verb such as *must*, *may*, *might*, *should*, *will*, or *ought to* on an epistemic interpretation, the speaker relativizes possibility or necessity with respect to her set of beliefs. In (7a), for instance, the speaker communicates that it follows from her beliefs that there is a mistake; similarly, in (7b) the speaker conveys that it is compatible with her beliefs that it will rain tomorrow:

- (7) a. There must be some mistake.
b. It may rain tomorrow.

It follows, then, that genuine epistemic interpretations of modals presuppose the ability to reason about mental representations, to assess their accuracy in representing the real world, and to understand that they may be revised with time. All of these abilities fall in the domain of theory of mind.

In this sense, epistemic items closely parallel other so-called mental terms such as *know*, *think*, *forget*, *remember*, etc. As Shatz, Wellman and Silber (1983) point out, the first uses of mental verbs do not make genuine reference to mental states but are rather conversational devices; for instance, the verb *know* initially occurs in standardized phrases such as *You know what?*, *I don't know*. By the end of the third year, however, their subjects were using mental terms with true mental reference (e.g. *Before I thought this was a crocodile; now I know it's an alligator* - Shatz et al. 1983: 309). According to other studies, by 4;0 children recognize the greater reliability of *know* over *think* and similar predicates (Moore and Davidge 1989; see the reviews in Olson and Astington 1986, Moore and Furrow 1991). Recall that epistemic modals also appear by the end of the third year but their first uses are probably incompletely understood: it is not until the age of four or five that children recognize that epistemic *must* is stronger than *may* or *should*.

A strong piece of support for the hypothesis that epistemic modals and mental terms implicate metarepresentational abilities comes from experiments carried out by Moore, Pure and Furrow (1990). These researchers showed that there is a correlation between the comprehension of the relative reliability of *know* vs. *think/guess* and the 'strength' of epistemic *must* vs. *might* on the one hand, and performance on false belief, belief change and appearance-reality tasks. This finding suggests that there is a connection between the ability to distinguish epistemic strength encoded by natural language words and the ability to reason about false beliefs in non-linguistic tasks.

The proposal that epistemic modality relies on theory-of-mind abilities opens up the possibility of studying the acquisition of modal vocabulary in parallel with the development of the child's cognitive resources. This is especially valuable since, as we saw, most of what is known about the early semantics and pragmatics of modal expressions is based on observational data (and is therefore open to interpretation problems). We can therefore use independent cognitive tasks tapping theory of mind as a way to gain insight into the concepts underlying the use of modal and mental vocabulary. For instance, it would be

interesting to compare children's use and comprehension of expressions of epistemic possibility such as *may* or *might* and their understanding of uncertainty or undecidability in non-linguistic tasks.

One area in which this approach can be particularly illuminating is the early modal lexicon. Even though epistemic modal items are largely absent from the speech of two-year-olds learning English, there is some evidence that in languages other than English some epistemic modal expressions occur before 3;0. Based on longitudinal data, Choi (1995) has argued that in Korean a set of sentence-ending evidential suffixes is acquired between 1;8 and 3;0 years, long before the set of epistemic and root modal verbs appears. These suffixes indicate the status of the speaker's beliefs, in terms of either the degree of certainty/commitment to the belief, or its source (e.g. communication, perception, hearsay). Such data have led some researchers (e.g. Shatz and Wilcox 1991) to propose a cognitive (theory-of-mind) constraint which would block the acquisition of epistemic predicates before 2;6 in languages such as English but could be overcome by language-specific input in languages such as Korean

Even though it is not clear what semantic knowledge underlies the use of epistemic expressions in the two-year-olds' vocabulary (or whether these occurrences are truly mentalistic - Papafragou 1998a, 2000), these data raise interesting questions regarding the relation between linguistic and cognitive development. Recall, for instance, that English-speaking children still experience difficulties with non-linguistic tasks involving sources of beliefs till age four or so (O'Neill and Gopnik 1991). One would therefore want to know whether these early occurrences of evidentials are truly metarepresentational in the speech of Korean children and, if so, whether their appearance in the productive vocabulary or grammar of child language correlates with performance in theory-of-mind tasks (e.g. false belief tasks, or simpler tasks investigating understanding of belief sources). Some work in this direction is already under way (Papafragou, Li and Kim in prep.).

What about root modal interpretations? Clearly, at least some of these interpretations do not presuppose sophisticated understanding of the mind. It is perhaps for this reason that ability *can* and volition *will* appear earlier than epistemic (or other root) interpretations. Some of the other early uses of root modals, such as *hafta/have (got) to* which appears around 3;0, are predominantly used to state an obligation and do not particularly involve mental-state understanding. However, it is worth pointing out that the development of theory of mind definitely affects more complex root uses. For instance, in order to use a modal like *must* to impose (rather than simply state) an obligation, some consensus is required among the interlocutors as to social relations, issues of power, authority, duty, commitment and other social concepts which rely heavily on mental state attribution. Furthermore, in order for speakers to use *must* felicitously on this interpretation, they must have the ability to calculate the addressee's desires, preferences and goals. It is probably no coincidence that some of these more sophisticated aspects of root interpretations are not acquired by children until the age of 6;0 or later.

4.2 Further issues

I have argued above that theory of mind can provide a central part of an account of the acquisition of epistemic modality. Naturally, one needs to consider several other factors which also play a role in the acquisition of modal vocabulary. One major consideration relates to input. There is evidence that adults talking to very young children predominantly use root modals. Wells (1979) reports that *can* and *will* were the only modals which were used by all of the mothers in his sample of very young children; they were also the modals with the highest frequency. Shatz, Grimm, Wilcox and Niemeier-Wind (1990) present evidence from American English and German maternal speech to children around 3;0 years of age: They note that fewer than 10% of the modals used were interpreted epistemically (cf. corroborating findings in Shatz, Grimm, Wilcox and Niemeier-Wind 1989).

These results are hardly surprising given the circumstances of production of modal terms. Since parents are likely to tailor their speech to the interests, activities and goals of their children, it is easy to see why desire, ability, obligation and permission interpretations of modals outnumber those of epistemic necessity or possibility in early speech to children. Furthermore, epistemic modals in English, as in other languages, are more formal expressions than closely related vocabulary items such as semi-auxiliaries (*have to*), or mental terms (*think, know*). Their markedness contributes to their restricted distribution in the adult speech to children. In sum, then, it may be that children learning English for a variety of reasons simply do not hear enough modal verbs with epistemic interpretations in their parents' speech - hence they do not have sufficient opportunities to acquire them.

More generally, it may be that epistemic interpretations of modals are harder to acquire than root interpretations because the mapping between the word and the epistemic concept may be hard to construct. That is, regardless of the conceptual difficulty posed by epistemic terms, the task of figuring out that a certain vocabulary item has such an abstract meaning may be hard for the young learner (for a similar argument for mental verbs, see Gillette, Gleitman, Gleitman and Lederer 1999). A full account of how modal interpretations are learned would have to disentangle the precise contribution of conceptual and mapping facts to the acquisition of the meanings of epistemic predicates.²

5. A test case: Autism

5.1 The mindblindness hypothesis

Autism is a severe childhood psychiatric condition which is characterized by a number of social and communicative impairments. Autistic children lack the usual cognitive flexibility, imagination and pretence, and their behavior is marked by a restricted range of interests and activities. Recently, a number of authors have suggested that (at least certain aspects of) autism can be explained as resulting from lack or delay in theory of mind (Baron-Cohen, Leslie and Frith 1985, Leslie and Roth 1993, Leslie and Thaiss 1992, Frith 1989, Baron-Cohen 1995). On this hypothesis, autism is a form of mindblindness with a number of implications for cognitive development. Children who suffer from autism are unable to understand (and

attribute) false beliefs; they cannot appreciate the mind/brain as an organ with mental functions; they are unable to realize that seeing leads to knowing; they experience difficulty with the mental-physical and appearance-reality distinctions. As I mentioned earlier in this paper, these aspects of the human theory of mind are normally acquired around the age of 3;0 or 4;0. Autistic children differ from both normal children and children suffering from various other disorders (e.g. Down's syndrome) in that their mentalizing abilities are selectively impaired.

The mindblindness hypothesis about autism offers a solid testbed for the link which I have sought to establish between epistemicity and mindreading. If, as I have suggested, the development of the metarepresentational machinery responsible for sophisticated mentalizing is a prerequisite for the full-blown and correct production and comprehension of epistemic modal markers, then there should be a severe difficulty with such terms in the language of autism. In the following pages, I want to discuss the findings of a study by de Roeck and Nuyts (1994) which appears to disconfirm this dissociation between autistic language and epistemicity and thus to pose a challenge for my proposal.

5.2 Modal language in autism

De Roeck and Nuyts set out to investigate the use of three markers of epistemic modality in Dutch by four high-functioning autistic adults. The subjects covered an age range between 19;0 and 29;0 years; their total and verbal IQ ratings were 113t (116v), 96.5t (121v), 88t (77v) and 68t (77v) (where t = total and v = verbal IQ). Three modal items were studied on the basis of a corpus of spontaneous speech data: *waarschijnlijk* 'probable/probably' (the item has both adjectival and adverbial uses); *denken* 'think' and *kunnen* 'can/may'.

The results of the study can be summarized as follows. The adjectival use of *waarschijnlijk* is completely absent from the data, a fact which is not particularly surprising given the low rates of occurrence of this use even in normal speech. As for the adverbial use, it occurs rather normally in the speech of two of the four subjects. *Denken* is used by all four subjects, and there is evidence of both its complement-taking and its parenthetical uses. Finally, *kunnen* is used as an epistemic modal with higher frequency than in normal speech (where it is more often used to express simple root/deontic modality). The authors conclude that all four subjects demonstrably use epistemic expressions in ways much similar to normal subjects and therefore appear to engage in metarepresentation quite unproblematically. Consequently, the performance of these high-functioning autistic adults is taken to provide some evidence against the theory-of-mind hypothesis for autism.

As far as I can see, there are various alternative conclusions one might draw from de Roeck and Nuyts' observations (and the authors themselves explore some of them). For instance, one might question the initial assumption that epistemic modality involves metarepresentation. I want to argue for two alternative explanations of their findings, which do not threaten the premise that epistemic predicates involve metarepresentation.

Firstly, one could argue that, in fact, the specific items used by the four autistic adults in the study were not always used to communicate epistemic modality. Even though it is not possible to find compelling evidence simply by inspecting the subjects' spontaneous speech data, there are certain examples which suggest that something less than a fully metarepresentational reading might be available to the speakers. Specifically, one of the subjects seemed to use the same modal construction *'t Kan (ook) zijn dat* ('it may/can (also) be that') as a set phrase (and often in inappropriate circumstances) in the majority of on-line epistemic judgements she produced. This subject was both the youngest (19;0 years old) and the one with the lowest IQ scores of the group (68t, 77v). An actual example is (8), where the subject (T) is talking about her not liking a particular boy:⁴

(8) A: With Bart you don't really like it, do you?

T: No.

A: Why? Do you know?

T: I mean but now it is better already, [...] but you cannot do anything about it, do you, when you don't like it?

A: No.

T: *'t Kan ook zijn da je daar helemaal niets aan kunt doen.*

'It may also be that you cannot do anything about it.'

Apparently genuine cases of epistemic modality in T's speech might have been the product of imitation, or simply an incompletely understood place-holder, as the authors acknowledge:

(9) *'t Kan zijn dat* er in de middelste kast daar, plaklint zit.

'It may be that in the cupboard in the middle there, there is some tape.'

Secondly, and more importantly, the autistic subjects whose linguistic production was studied might belong together with that talented minority of autistic individuals (around 20-30%) who pass the (simple versions of) false-belief tasks, and who have been shown to perform well in a variety of tasks involving metacognition.⁵ Such exceptional competence is usually explained in two ways:

(i) Autism might cause a delay in the operation of human mindreading capacities, rather than a permanent and absolute inability to metarepresent (Eisenmajer and Prior 1991, Baron-Cohen 1995). Depending on the different components which may be taken to form the human mentalizing capacity, delay may affect one or several of them at different time-points.

(ii) In high-functioning cases of autism, subjects may be capable of performing some sort of mentalizing through the usage of alternative strategies. As Leslie and Roth (1993: 103) remark, 'such strategies are arrived at by exercising general reasoning abilities, and hence require a quite high level of such abilities, together with extensive practice and general knowledge, and hence do not appear before

adolescence'. Although the exact nature of these strategies is at present not fully known, it is possible that they rely on an analogy to the pictorial format for the representation of thought. Pictures as a representational medium, unlike mental constructs, are rather well-understood by autistic subjects; evidence for this is provided by good performance of autistics in variations of the 'false belief' task which involve 'false (dated) photographs' and 'false drawings' (see Leekam and Perner 1991, Leslie and Thaiss 1992, and Charman and Baron-Cohen 1992 respectively). Moreover, there is some tentative evidence which suggests that, whereas normal subjects report their inner experience in terms of inner speech, pictures or 'pure thought', very able autistic subjects describe their mental contents entirely in terms of pictures (Hurlburt, Happé and Frith 1994; cf. Hurlburt 1990). In the small group of autistic people studied by Hurlburt et al., ability to report inner experience in terms of pictures correlated closely with performance on standard theory-of-mind tasks, independent of IQ. Overall, then, this evidence suggests that high-functioning autistic people may use their understanding of external representations such as pictures to achieve an understanding of mental representations such as thoughts and beliefs.

Both the age and the high verbal and non-verbal IQ of the subjects in de Roeck and Nuyts' study corroborate an explanation for their performance in terms of compensatory mechanisms for theory-of-mind abilities. In a similar vein, it is worth noting that T., the youngest subject and also the one with the lowest verbal and general intelligence, had markedly greater difficulty in using modal expressions than the rest of the group.

To conclude: de Roeck and Nuyts' (1994) data offer an impressive manifestation of the success of very able autistic subjects to overcome the difficulties in their condition and to engage in normal verbal communication. However, they do not offer a counterexample to the theory-of-mind hypothesis for autism, or an argument for dissociating epistemicity from metarepresentational (more specifically, metacognitive) abilities. A truly critical test case for both hypotheses would be the presence of autistic children between 4;0 and 12;0 spontaneously producing/understanding epistemic expressions. As far as I know, such cases have not been attested in the literature.

Quite on the contrary, and exactly as the theory-of-mind hypothesis for autism predicts, early autistic child language is quite impoverished in the use of mental terms. Tager-Flusberg (1993) reports the results of a longitudinal study, in which six children with autism between 3;0 and 6;0 were followed for between one and two years. Their spontaneous productions were compared to those of a Down's syndrome group of six children of the same productive language level and age. Her findings suggest that, while both groups of children talk about perception and mental states of desire and emotion, autistic children make significantly fewer references to cognitive mental states than children suffering from Down's syndrome. Elsewhere, Tager-Flusberg specifically comments on the use of modal verbs in the language of the two sample groups of the above study (see Tager-Flusberg 1997). It appears that *can* and *will* make up 95% of all modals used by both groups of children, while epistemic uses are overall rare. What is more important for present purposes, though, is that even within the non-epistemic range those uses of *can* and *will* which require some mentalistic understanding (e.g. the volitional/intentional uses of *will*) are very rare in the language of

autism, whereas they occur more frequently in the speech of the children with Down's syndrome. It appears, therefore, that impairments in theory of mind are reflected in the way language is used by children with autism. Moreover, it seems that this is done in a way consistent with the analysis of specific linguistic items (e.g. epistemics or volition markers) in mentalistic terms.

6. Concluding remarks

In this paper, I presented some preliminary arguments to support the hypothesis that the acquisition of epistemic modality presupposes the ability to metarepresent mental representations (e.g. beliefs). I also argued that this metarepresentation hypothesis yields a number of interesting and testable predictions about the connection between early semantic/pragmatic abilities and cognitive growth. Finally, I showed that an impairment in the ability to construct metarepresentations of mental representations - attested in autism - affects the ability to learn and use epistemic predicates.

As it stands, the metarepresentation hypothesis is not committed to a specific model of folk psychology. This is because, regardless of how theories of theory of mind will turn out, they will have to account for the fact that complex metacognitive abilities are the prerequisite for several aspects of linguistic development. Nevertheless, it might be interesting to examine whether linguistic data of the sort I have discussed may be used to tease apart different theoretical proposals about the structure of the human metarepresentational mechanism. This possibility remains open for future research.

Acknowledgements

I wish to thank Annabel Cormack, Helen Tager-Flusberg, Lila Gleitman, Alison Gopnik, Francesca Happé, Nina Hyams, Alan Leslie, Marilyn Shatz, Dan Slobin, Ursula Stephany, and especially Neil Smith and Deirdre Wilson. I am also grateful to the editors for comments and suggestions.

Notes

¹ I will focus on British English throughout.

² I have not dealt in this paper with the development of the syntax of auxiliaries, which is also implicated in an account of the acquisition of modality. For instance, in Italian root *potere* ('can') and *dovere* ('must') appear some time between 1;10 and 2;9, i.e. earlier than their English counterparts, a fact that can be explained on syntactic grounds (Hyams 1986: 117-8).

³ The discussion draws on Papafragou (1998a).

⁴ In all the examples, I give de Roeck and Nuyts' translation into English.

⁵ I am referring to first-order theory-of-mind tasks. Second-order theory-of-mind tasks, which involve multiple attribution of belief (*Jane thinks that her mother believes that Bob is at home*) and present no

difficulty for normal children around 6;0 or 7;0 are hard for most of the members of the talented minority of autistic children.

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