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Teaching Conversational Skills to Children with Autism: Effect on the Development of a Theory of Mind

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This research examined whether children with autism could be trained to improve their conversational skills and whether this led to changes in standard tests of theory of mind (ToM). Three high-functioning children with autism participated in a multiple baseline across participants design. The children were taught how to initiate a conversation, take turns during conversation, listen attentively, maintain a conversation topic, and change a conversation topic appropriately. The children were tested for ToM using False Belief tasks before and after training sessions. Results indicate that the amount of shared interest exhibited by the children with autism during conversation with their caregivers increased during training sessions. The children also made more responses that were appropriate to the context of the conversation. Performance on the False Belief tasks remained constant throughout the study. Results are discussed with respect to the implications of results of performance in standard ToM tasks.

KEY WORDS: Conversational skills; autism; theory of mind.

INTRODUCTION

Often, individuals with autism use language to serve a limited range of communicative functions, such as to gain a desired object or action. Rarely do they use language for a social function, like gaining attention, commenting, questioning, or informing others. Problems with turn-taking and with the interpretation and expression of subtle social cues impair their communicative competence.

Tager-Flusberg and Anderson (1991) studied the development of communicative behavior in normally developing children as well as children with autism and Down syndrome. They concluded that at the early stages of language development, all three groups of children are similar in their ability in topic-related conversation. At later stages of linguistic development, while typically developing children and children with Down syndrome become more contingent in their speech, children with autism lack this.

One current hypothesis is that children with autism are impaired in their acquisition of a "theory of mind" (ToM; Baron-Cohen, Leslie, & Frith, 1985; Frith, 1989). In other words, they show deficits in attributing and understanding the mental states of themselves and others, and so lack the ability to take another person's perspective. In a conversation, the speaker and listener need to adopt each other's perspectives to be effective interaction partners. This is necessary for a conversation to even occur and for that conversation to be relevant to both parties involved. Without this mentalizing ability, it follows that people with autism may talk endlessly about a topic that interests them, thinking that this topic interests their conversation partner as well. They fail to understand that what they are keen on may bore or even irritate the listener, thus making the communicative exchange one-sided and restricted (Ricks & Wing, 1975). Other autistic speech characteristics, such as repetitive questions and statements, inability to take turns in conversation, as well as difficulty in maintaining

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a topic of conversation can also be related to ToM deficits.

Several studies have demonstrated that the above problems are specific to individuals with autism. Research by Frith, Happé, and Siddons (1994) showed that typically developing children and children with learning disabilities succeed in doing standard ToM tasks. These groups of children also show a great deal of "mind-reading" in everyday life. On the other hand, most children with autism failed ToM tests. Of the minority who passed these tests, only *some* demonstrated evidence of ToM in their everyday behavior. Even then, these children were impaired relative to their age and development level.

Several studies have aimed at teaching children ToM skills, such as understanding the concept of false belief (Ozonoff & Miller, 1995; Swettenham, 1996), feelings, or pretense (Hadwin, Baron-Cohen, Howling, & Hill, 1996). However, past research has also shown that acquiring the ability to do ToM tasks after going through teaching programs does not result in enhanced social skills (Hadwin, Baron-Cohen, Howlin, & Hill, 1997).

In Ozonoff and Miller's (1995) study, five normal-IQ adolescents with autism participated in a 4-month-long social skills training program. The participants were taught specific interaction and conversational skills. In addition, the program provided explicit systematic instructions underlying social-cognitive principles necessary in ToM. Pre- and postintervention assessments showed a meaningful improvement in their performance on standard ToM tasks. However, no changes were shown on general parent and teacher ratings of social competence.

The finding that the intervention did not alter outside raters' impression of the participants caused the researchers to question whether the principles of ToM taught during training were extended to social behaviors in everyday life.

Hadwin *et al.*, (1997) looked specifically at communication skills that required a ToM. Their study examined whether teaching children with autism to pass ToM tests had any effects on conversational skills. Specifically, the study focused on the ability to initiate and maintain topics in conversations. In addition, the study also investigated the use of mental state terms in the speech of children with autism before and after mental state teaching. The training package included three areas: understanding emotions, understanding belief, and pretend play. The results showed that through teaching, the children did learn to pass tests regarding emotion and belief understanding. However, they did not show any significant improvement in social communication skills. In particular, there was no improvement in the ability to maintain a conversation topic and no increase in the use of mental state terms in speech.

From the above studies, we conclude that children can be taught ToM principles. However, since this new knowledge does not generalize to everyday social behavior, it can be questioned whether the children *really* understand the mental states they have been taught. If participants truly learned to understand mental states, then their social behavior and the quality of their conversations with others should improve along with ToM measures.

We suggest two possible reasons why competence in performing standard ToM tasks does not translate to social competence in everyday living. First, the participants in the previous studies could have been taught the task, not the ability. They might have learned mental inference skills but failed to apply them to real situations. Somehow, they learned to "hack out" rules and strategies to infer mental states, which sufficed in the performance of standard ToM tasks (cf. Ozonoff & Miller, 1995). It is also possible that children with autism learned *non*mental state rules to arrive at the correct answer, for example, "Sally will always look in the container that is empty" in the Sally-Anne task. These strategies were not adequate or flexible enough to be applied to everyday settings.

The second possible reason is that the ToM is a complex construct, and standard tasks possibly test only *one* aspect of the ToM. ToM-based social skills that apply to real situations constitute another aspect of ToM, which standard ToM tasks fail to measure.

The most commonly used ToM tasks are the False Belief tasks. These involve the participant either watching puppets or people act out a scenario or listening to a story. False Belief tasks require the participant to predict how a character, who believed something that is false, would behave. In contrast to these tasks, some daily activities which require the appreciation of mental states include responding to hints and indirect cues in conversation, recognizing knowledge-base, beliefs, and emotions in others, and initiating and maintaining conversations with others. All these activities require the ability to infer the mental state of other people.

It is, therefore, obvious that daily activities and False Belief tasks are very different in nature. Hence, it should not be surprising that children with autism may learn how to perform False Belief tasks and still not improve in conversational skills.

Past research has shown that conversational skills, in particular, maintaining a topic of conversation, require the understanding of mental states (Frith *et al.*, 1994; LaLonde & Chandler, 1995). Hence, our depen-

dent variables are operationally defined with respect to the number of contextually appropriate utterances made and the amount of shared interest shown by the child during conversation.

In addition, conversational interaction was observed under a naturalistic setting, whereby the child or his caregiver proposed a topic of conversation. The child was free to extend the discourse in any way he wanted.

The objectives of this study were as follow:

1. To investigate whether training children with autism in conversational skills will lead to a quantitative and qualitative improvement in the children's verbal communication.
2. To examine whether performance on standard ToM tasks (here, False Belief tasks) actually change as conversational skills improve (or not).

Based on the first objective, we hypothesized that the frequency of context-related utterances and the percentage of shared interest would increase during and after training. The child should also maintain this improvement in conversational skills when conversing with different people. Also, the qualitative improvement in communication should be revealed in terms of an improvement in the parents' and strangers' ratings of the child's conversational ability after the training has ended.

In line with our second objective, we hypothesized that the child's performance on standard ToM tasks would remain unchanged even though conversational skills improve. If the child showed an improvement in the ability to maintain a conversation topic (thereby showing an ability to appreciate mental states), and if False Belief tasks did not tap this ability, then the child's score on False Belief tasks would remain constant.

METHOD

Participants

Three verbal boys with autism participated in this study. They were diagnosed as autistic according to the DSM-III-R (American Psychiatric Association, 1987) criteria. In general, the children seldom developed their speech during conversation and had difficulties in maintaining a conversation.

Tim. Tim was 5 years 11 months old and had a normal IQ score on the Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1990). He displayed spontaneous speech and had an estimated receptive vocabulary of 300 words. Tim spontaneously requested, described, and instructed in his daily verbal interactions. He did not ask questions spontaneously but could do so when prompted. According to his mother, he tended not to listen to others or maintain a conversation topic. He would often speak endlessly about a topic of his interest. He also sometimes displayed immediate echolalia. Tim enjoyed the training sessions and was generally attentive during testing.

John. John was 7 years 5 months old and had an IQ score that was average on the K-BIT (Kaufman & Kaufman, 1990). He showed spontaneous speech, which was described as "nonsense" by his primary caretaker (a Filipino maid). The content of his speech consisted mainly of phrases from computer games and other incoherent utterances. These utterances were often irrelevant to the social context. He had an estimated receptive vocabulary of 300 words. John responded to questions with one- or two-word answers and seldom maintained eye contact when conversing with others. He was frequently noncompliant throughout the training program. Often, titbits had to be used to encourage him to sit still and attend to the training or False Belief tasks. His overactivity sometimes disrupted the training and testing sessions.

Mike. Mike was 7 years 9 months old and had a normal IQ score on the K-BIT (Kaufman & Kaufman, 1990). He had an estimated receptive vocabulary of 400 words. He displayed some spontaneous speech (mainly requests), and he often gave monosyllabic responses to questions. Otherwise, he seldom spoke. Mike also seldom elaborated his utterances. Nevertheless, his speech was frequently appropriate to the social context. Throughout the program, Mike was generally attentive and compliant.

Primary Caregivers. During training sessions, the children conversed with their primary caregivers. Tim and Mike spoke with their mothers, while John's primary caregiver was a Filipino maid. Each of the three primary caregivers spent at least 12 hours per day with their child.

Peer. The peer who participated as a conversation partner in the generalization sessions was a 6-year 4-month-old boy who attended a mainstream primary school. He had never been diagnosed as having any type of clinical pathology or learning disability.

Raters. Nine students (3 male, 6 female) from the National University of Singapore scored the videotaped recordings of the children's 3-minute conversations with their caregivers. Three raters observed nine sessions of conversation between each child and his caregiver. The raters were naive to the hypotheses of the experiment.

Setting

All baseline and training sessions for each child were conducted in the participants' homes. The setting remained unchanged throughout the study.

Design

A multiple baseline across participants was used to assess the changes in the communicative behavior of the children with autism. The behavior of the children was recorded in terms of the percentage of time the children displayed shared interest with their caregivers and the percentage of responses that were within the context of the conversation topic. To test the acquisition of a ToM, the children's score on False Belief tasks was recorded as intermittent probes.

Each child went through a predetermined number of baseline sessions. These sessions were followed by training sessions. Each child participated in a total of nine sessions.

Procedure

Sessions were conducted twice a week for 1 hour. All sessions were video-recorded. The training was conducted by an Honors student as part of her course of study of psychology in the National University of Singapore.

Baseline. The child was instructed, "(*Mummy*) is going to talk to you now. You talk to her too." If he failed to do so after 10 seconds, the caregiver initiated the conversation by proposing a topic of the child's interest and waited for the child to respond. If the child did not respond after 10 seconds, the caregiver prompted a response by asking a question. Throughout the baseline sessions, the trainer did not intervene.

Training. Following the baseline, five types of conversation skills were taught to the child with autism. Before a new skill was taught, the trainer would ask the child to recall the skill he had learned in the previous session(s) by saying, "Can you remember what we learned the last time?" The child would then be prompted to state the individual steps involved in previously learned skills. Each skill was introduced by either using puppets or playing a game. The script for the puppet story was adapted from Cartledge and Kleefeld's curriculum for teaching social skills, entitled "Taking Part: Introducing social skills to children" (Cartledge & Kleefeld, 1991). After the story, the child took part in a role play, using the puppets to practice the skill that was introduced. The child then practiced the specific target skill by conversing with the trainer. Subsequently, the child practiced the skill with his caregiver for 5 minutes. The child is told, "Now you will talk to (*Mummy*). Talk about anything you want." Again, the caregiver would wait for the child to initiate the conversation. If he did not do so after 10 seconds, the caregiver would propose a topic of interest to the child. This practice was video-recorded. The child then watched the video-recording of the practice session and evaluated his own performance with the trainer's help. Finally, the child was again asked to recall all the conversation skills he had learned and was given the same instruction as during the practice session. The next 3 minutes of conversation were recorded on video. During this recording, no feedback or prompts were given.

Maintenance. To ensure that the children maintained their behavior between training sessions, the caregivers were informed of the targeted skills. They were requested to encourage the children to practice the learned skills and instructed to reward the children whenever they displayed the skills.

Generalization. Generalization sessions were carried out once the child had met acquisition criteria for all five sets of conversational skills. These sessions were presented in the same manner as the baseline sessions. They were conducted with a peer as the conversation partner and carried out in the participants' homes. The topics of conversation employed in training were not the same as those that took place here, unless the child changed the topic to those he talked about during training. The children were told, "Talk about anything you like." If after 10 seconds, the children did not speak, the trainer proposed a conversation topic of relevance to both children (e.g., "Let's talk about school. What did you do in school today?").

Training Skills

Five types of conversation skills were taught in sequence: making a conversation, turn-taking in conversation, listening, maintaining a topic, and changing a topic appropriately. Each training session focused on one skill until criterion performance was reached. Criterion of mastery was specified for the different training skills.

Making a Conversation. The objective of the first training session was to help the child to initiate a conversation and to teach the child the script of introducing himself and asking if he could join in playing a game. This skill included five "steps": going up to a person, saying "hello", smiling, listening to what the person says, and saying something in return. Criterion was met if the child could successfully carry out the social script of introducing himself and asking to join in an activity in a simulated play environment.

Turn-Taking in Conversation. The child was taught to wait and not interrupt until his conversation partner had finished speaking. This was signaled by the partner pausing after a sentence or asking the child a question and looking at the child. This set of skills included paying attention (by looking at the person's eyes

and listening to what s/he says), waiting and not interrupting, and saying something in return. Criterion was met if the child was able to engage in turn-taking during a 3-minute conversation for at least 80% of the time. This was the 3-minute conversation with the caregiver that followed the 5-minute practice.

Listening. The child was taught to listen attentively and to keep quiet while looking at the person. Criterion was met if the child was able to find two hidden gifts after listening to clues regarding their location. The clue for each gift included two objects and two prepositions, e.g., "The gift is *on* (preposition 1) the *sofa* (object 1), *under* (preposition 2) a *book* (object 2).

Maintaining a Conversation Topic. The child learned to identify statements that were "same" or "different" from the topic of conversation. The set of skills taught in this session involved listening carefully, thinking about what the person said, and talking about the "same thing." Criterion for this set of skills was reached when the child successfully maintained the topic in a 3-minute conversation for at least 80% of the time. Again, this was the 3-minute conversation with the caregiver that followed the 5-minute practice.

Changing a Topic Appropriately. The child was taught to inform his conversation partner that he wanted to change the conversation topic and what topic he wanted to talk about. Specifically, the child would say, "Let's talk about something else. Let's talk about (*another topic*)." Criterion was met if the child successfully said this statement every time he changed the conversation topic during the 5-minute practice trial with his parent.

A summary of the training skills and their criteria for mastery is shown in Table I.

False Belief Task Probes

The ToM battery used in this study included two first-order False Belief (FB1) tasks and one second-order False Belief (FB2) task. The FB1 tasks included the version of the "Sally-Ann" task used by Baron-Cohen *et al.* (1985) (see Appendix) and the "Smarties" task of Perner, Frith, Leslie, and Leekam (1989). The FB2 task was the same version as that used by Baron-Cohen (1989) (see Appendix). Tim and John were tested with the FB1 tasks. Mike, who passed the FB1 tasks was tested with the FB2

Table I. Summary of Training Skills and Criteria for Mastery

Skill	Description	Criterion for mastery
Making a conversation	1. Go up to a person 2. Say "hello" 3. Smile 4. Listen to what the person says 5. Respond	Introduces self and asks to join an activity without being prompted.
Turn-taking	1. Pay attention 2. Wait until the person pauses 3. Say something in return	Engages in turn-taking in a 3-minute conversation for at least 80% of the time.
Listening	1. Keep quiet 2. Listen to what the person says 3. Look at the person	Finds two hidden objects after listening to clues regarding their location.
Maintaining a conversation topic	1. Listen carefully 2. Think about what the person says 3. Talk about the same thing.	Maintains a conversation topic in a 3-minute conver sation for at least 80% of the time.
Changing a conversation topic appropriately	1. Keep quiet and listen carefully 2. Wait until the person pauses 3. Say, "Let's talk about something else. Let's talk about_____"	Informs conversation partner of his desire to change the topic of conversation during a 3-minute conversation.

task. The presentation of FB1 and FB2 tasks is illustrated in the Appendix. The same versions of these tasks were used throughout the program. The child was not corrected if he gave a wrong answer during the probes. On average, the time lapse between two probes was 10 to 14 days. In general, the children were attentive to the task, with the exception of John, who tended to fidget and be easily distracted.

Dependent Measures

Assessing Conversational Skills. The 3-minute conversation recordings were analyzed using 10-second time samples by raters who were naive to the hypotheses of the study. The sessions were shown to the raters in random order. The duration which the child and the caregiver engaged in shared interest was assessed. In addition, the frequency of contextually appropriate and inappropriate responses displayed by the child was noted. Data for the two measures of conversational behavior are reported in percentages.

Shared Interest. In this study, shared interest was defined as having occurred when both the child and his caregiver focused their attention on the same conversation topic or activity. Shared interest was also exhibited if the child paid attention to the caregiver in the absence of a verbal response. Raters were told to estimate and note down in each 10-second interval the number of seconds during which there was shared interest. The percentage of time in which shared interest was displayed was computed by dividing the total number of seconds shared interest was exhibited by 180 seconds (3 minutes) and then multiplying by 100.

Contextually Appropriate and Inappropriate Responses. Raters were also instructed to write down the frequency of verbal responses made by the child which were within the context of the conversation topic. "Percentage of contextually appropriate responses" was calculated by dividing the total number of appropriate responses by the total number of appropriate and inappropriate responses and multiplying by 100. Contextually appropriate responses were divided into two types: answer and elaborate utterances. Contextually inappropriate responses included perseverative utterances, unclear utterances as well as no response to the caregiver's verbal initiation. Excluding the "elaborate" and "no response" categories, the operational definitions of the above-mentioned utterances are the same as those found in Hadwin et al.'s (1997) study. An "answer" utterance was defined as a one-word or one-sentence response that was within the context of the conversation topic. A response that expanded on the previous statement said by the other party and included two or more sentences was rated as an "elaborate" utterance. If the child echoed the caregiver's words or repeated an utterance, the response was considered to be "perseverative." An "unclear" response was one that was unrelated to the conversation topic. When a question or statement from the caregiver was not responded to, because the child was not paying attention to or intentionally ignoring the caregiver, this was rated as "no response."

Assessing the Presence of a ToM. In all three false belief tasks, a correct response was scored 1 while an incorrect response was scored 0.

Interrater Agreement

Nine raters viewed the videorecordings with three raters observing each child. Dependent variables were independently scored. The raters were shown the videorecordings of all nine sessions in a random order. Each session consisted of 3 minutes of observation, yielding eighteen 10-second segments per session. The raters were given a 10-second segment to view followed by an 8-second interval to score their observations. Interrater reliability was obtained based on the percentage of intervals scored for the occurrence of the dependent variable, and was calculated as Cohen's kappa.

Social Validation Assessment

A social validation assessment of the effects of the training was conducted. Both the caregivers and the raters filled up a questionnaire based on Antonello's (1996) assessment of conversation skills. These included items such as greeting others, maintaining eye contact while talking to someone, choosing a topic to talk about, and engaging in simple conversations.

The caregivers indicated the child's ability to converse both before and after the training, focusing specifically on the taught skills. The raters rated how well they thought the child fared in specific conversational skills in the first and the last sessions.

RESULTS

Interrater Reliability

Reliability for the presence of joint attention and contextually appropriate responses by the child with autism was assessed independently. 100% of all sessions were taken into consideration in the calculation of interrater reliability. Overall, reliability for each of the variables was acceptable, with majority of the sessions having a reliability of Cohen's $k = .69$ or higher.

Shared Interest

Prior to the training, the mean percentage of time spent in shared interest for Tim, Mike, and John was 23, 62.8, and 67.5%, increasing to 97.9, 87.9, and 85.1%, respectively, after training (Fig. 1). For Tim, the increased amount of time spent in shared interest generalized to his conversation with a typically developing peer.

Contextually Appropriate Responses

Positive changes were also noted regarding the percentage of responses appropriate to the context of the conversation topic. Under baseline conditions, Tim, Mike, and John exhibited mean percentages of 26.92, 52.17, and 45.75%, respectively, increasing to 79.4, 71.48, and 52.29%, respectively, after training (see

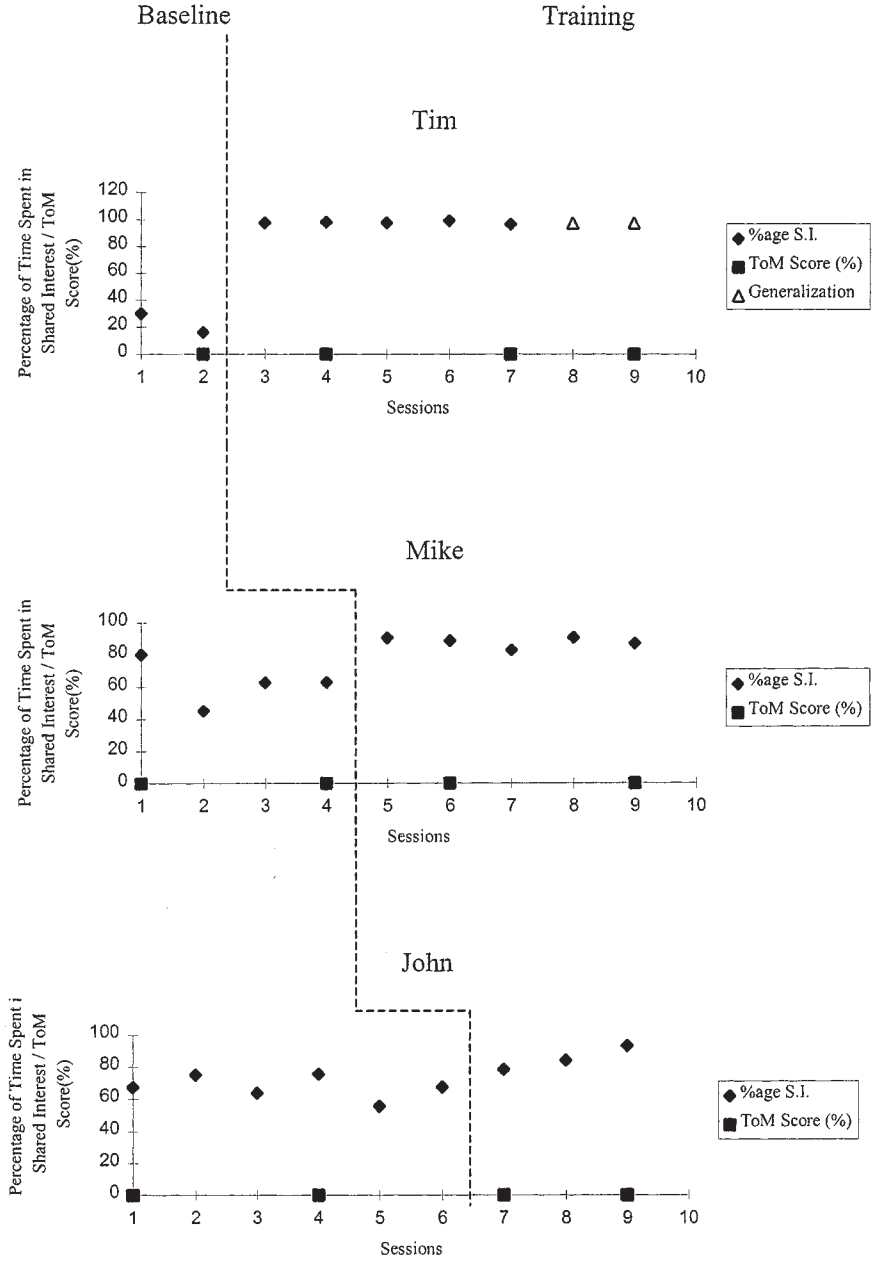

Fig. 1. Percentage of time spent in joint attention.

Fig. 2). For Tim, this increase generalized to his conversations with a typically developing peer.

ToM Scores

The ToM scores are expressed in terms of percentage in Figs. 1 and 2. For all ToM probes throughout baseline and training sessions, all three children consistently scored 0 on first- or second-order False Belief tasks.

Frequency of Different Types of Utterances

The frequency of answer, elaborate, perseverative, and unclear utterances made by the child, as well as the

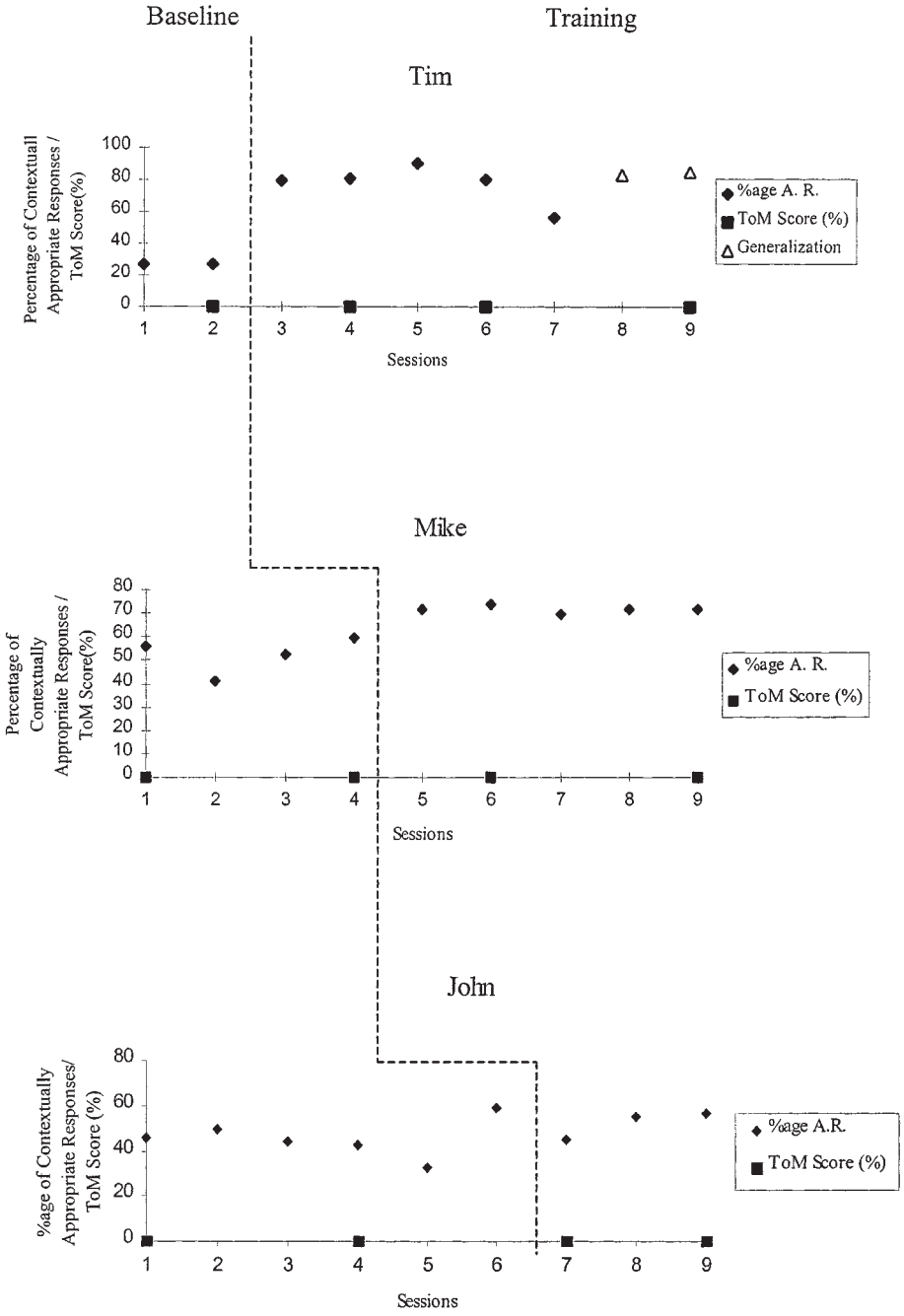

Fig. 2. Percentage of utterances that are contextually appropriate.

frequency of no response occurrences are shown in Fig. 3. Overall, after training, there was an increase in answer and perseverative utterances, and a decrease in the frequency of unclear utterances and no response occurrences. With the exception of John, the other two participants also showed an increase in the number of elaborate utterances they made. This suggests that training the participants in conversational skills resulted in them making more contextually appropriate statements and developing their speech. At the same time, they less frequently ignored the social initiations of their conversation partners.

Social Validation

Based on the data from the parent's questionnaire, all three participants displayed a significant increase in

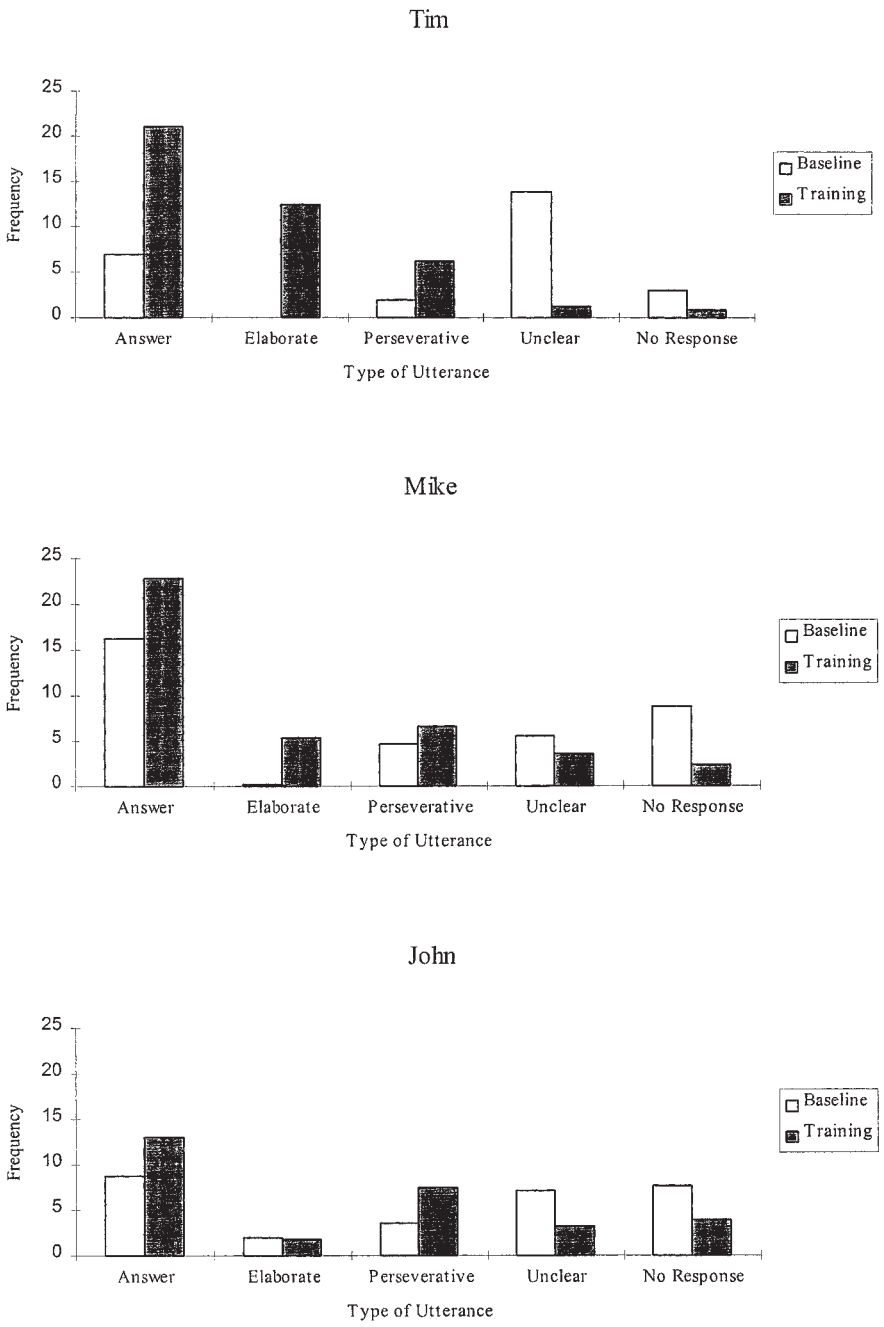

Fig. 3. Frequency of different utterances at baseline and training sessions.

the instances when they exhibited eye contact after training. Parents indicated that the participants showed more eye contact "when introducing themselves" and "when talking to someone." Other behaviors that showed an increase after training include "maintains a topic by giving an answer or statement that is within the context of the topic" and "takes turns during conversation." This implies that the change in communicative behavior of the children were positive, and that the change was obvious to the parents.

Observational data by independent raters supported the above changes: They confirmed an increase in eye contact by the children with autism and an increased frequency of "giving a response to a question," "taking turns during conversations," and "making statements that maintain the topic of conversation."

Table II gives a sample of comments made by the parents on the change in the behavior of the child prior to and after training. Overall, the child with autism was perceived to listen more attentively and stick to the topic of conversation more often. The parents agreed that observable positive changes in their children have occurred. In the case of John, his caregiver commented that his noncompliant behavior decreased. Prior to training, John would often run about when people talked to him and ignore their social initiations. However, after training, he would "sit still more and listen."

DISCUSSION

Our first objective in this study was to assess whether teaching conversational skills to children with autism would result in quantitative and qualitative changes in their communicative behavior. We also examined to see if this change in conversational ability is accompanied by a corresponding improvement in their performance on False Belief tasks. The results show that children, through training, did improve on their conversational ability. Specifically, the percentage of time the child spent in shared interest and the percentage of utterances that were contextually appropriate increased. Hence, the participants showed an improvement in the ability to maintain a conversation topic. In particular, the amount of "answer" utterances generally increased after training occurred.

Table II. Sample of Comments Made by Parents Regarding Observable Changes in Behavior

	Prior to training	After training
Tim	"he doesn't listen to people when they talk."	"(He) pays more attention when someone is talking." "(He shows) more eye-contact."
Mike	"When you talk, he doesn't look at you."	"(He) displays more eye-contact."
John	"Sometimes I don't know what he's talking about. . . . He talks a lot, he talks nonsense. . . . He doesn't listen." "He always runs around."	"his behavior has improved. He can speak to others with eye-contact." "(He) answers what people ask." "He can sit still."

This result confirms previous findings that high-functioning children with autism are proficient at giving a direct answer to a direct question (Tager-Flusberg & Anderson, 1991). The most prevalent response to a question was a one-word, one-phrase, or one-sentence answer. This was the case especially for John and Mike, whose utterances were often contextually inappropriate (i.e., and perseverative, unclear, or no response) during baseline sessions. After training, only a few of their responses developed the conversation, but answer utterances increased. We must be aware that both John and Mike failed to complete all training components even after nine sessions because they did not meet the criterion for particular training sessions. Hence, for them, the training did not proceed beyond a particular point. For example, Mike failed to meet the criterion of listening since Session 6. On the other hand, Tim's display of elaborate utterances increased dramatically after training. Tim's utterances at baseline level were mainly answer types.

The results suggest that the extent to which children with autism can improve on the type of utterances made, and therefore, their conversational competence after training, depends on the quality of their speech at baseline level. Our findings also suggest that a child's quality of speech may develop from predominantly perseverative responses to mainly answer responses and then to increased elaborate responses. Indeed, in normally developing children pragmatic communication seems to develop this way (Schuler, 1980; Tager-Flusberg *et al.*, 1990). However, given the small sample, it is important to use caution in interpreting the results this way.

A closer look at the results reveals that while Tim showed remarkable improvement after training, similar gains are not evident for John and Mike. Taking into account pretreatment variability, only weak treatment effects are shown in Mike and minimal treatment effects in John. This could possibly be due to factors other than the training, such as John's noncompliant behavior, which affected his ability to attend to training and perform False Belief tasks. Another important factor pertains to the caregivers' way of communicating with the children. Tim's mother tended to encourage further

speech by prompting with, "And then?," which gives Tim the opportunity to expand on his earlier statements. On the other hand, Mike's mother tended to ask questions requiring specific answers, such as "Do you like bananas?," thus limiting his speech to answer type utterances. This implies that our measurement of social communication reflect more than just improvement in conversational skills. It is affected by factors external to the training content and procedure.

In spite of this shortcoming, the results of the social validation assessment show that the changes in the behavior of the children with autism (no matter how statistically insignificant) was observable to their parents as well as strangers. In general, the children showed more eye contact and turn-taking behavior during conversation and improved in their ability to maintain the topic of conversation. In Tim's case, the increased social responsiveness generalized to a typically developing peer. The parents of all three participants agreed that the training had been effective. They also felt that the teaching of conversational skills benefits high-functioning children with autism, because it encourages the children "to verbalize and express themselves."

It is theorized that the ability to maintain a topic is a pragmatic manifestation of the presence of a ToM (Frith, 1989; Prizant & Wetherby, 1989). Since the participants' ability to engage in joint attention and make contextually relevant responses increased, we conclude that the children did improve in their ability to maintain a conversation topic. However, it would be erroneous to state absolutely that an increase in shared interest and contextual appropriateness is indicative of advances in ToM. This is because apparent contextual appropriateness may also be attributed to rote memorization. Hence, we can only conclude, the results suggest that in terms of conversational skills, the participants *may* have developed a ToM incidentally during training.

Our second objective was to assess whether a change in conversational ability corresponded with an improvement in the performance of False Belief tasks. Our results show that as the ability to maintain a conversation topic improved, the participants' performance on standard False Belief tasks did not change. In fact, the score of 0 remained constant throughout all sessions. If participants did indeed acquire ToM skills through training in conversational skills, this was not reflected in performance on False Belief tasks.

There are several possible reasons. First, as earlier proposed, the ToM is a complex construct. It is possible that the skills required to perform standard ToM tasks and conversational skills (which are based on the application of ToM principles) are different facets of the ToM construct. False Belief tasks specifically measure the ability to infer false beliefs—*one* aspect of mentalizing in everyday life. Hence, it is possible that standard False Belief tasks fail to test the presence of a ToM in conversational skills. Our results lend support to findings of previous studies. These results show that for children who *receive training* on performing ToM tasks, the presence of a ToM, as reflected in the passing of standard ToM tests, was not simultaneously accompanied by an increase in ratings of social competency (Frith *et al.,* 1994; Hadwin *et al.,* 1997; Ozonoff & Miller, 1995). In contrast, typically developing children and children with autism who pass False Belief tasks *spontaneously* reveal greater social insight (Astington & Jenkins, 1995; Bretherton & Beeghly, 1982; Eisenmajor & Prior, 1991; Frith *et al.,* 1994). Furthermore, in a longitudinal study by Holroyd and Baron-Cohen (1993), participants' scores on False Belief tasks did not change after 7 to 8 years, even though language levels had significantly increased. Our results are also consistent with this finding.

Hadwin *et al.* (1997) showed that children can be taught to pass ToM tasks and still not show improvements in pragmatic conversation skills. We show that the opposite direction may also be true. In other words, a child may acquire a ToM through specific training programmes and still not improve in performance in standard ToM tasks. Together, these findings strengthen the argument that participants in previous studies were not taught the concept of ToM, but rules and strategies to infer mental states of others. This implies that we should be careful in our inference of an individual's social communicative ability based on his or her performance on standard ToM tasks.

Second, our results can be explained in terms of the child's inability to generalize. In particular, the participants were unable to generalize the underlying principles of the conversational skills they learned to False Belief tasks—a broader autism-related difficulty to generalize learned tasks to novel contexts.

To the extent that children with autism have a difficulty in generalizing ToM from one context to another, this means that within any teaching program, there must be explicit teaching across contexts and tasks. In our case, it would mean teaching conversational skills and performance of a *variety* of ToM tasks, not just False Belief tasks, across different settings and persons.

In summary, our hypothesis that the participants' performance of False Belief tasks would not change as conversational skills improve was confirmed. Therefore, we question whether False Belief tasks are sensitive to change in the ToM of participants in terms of pragmatic communication.

However, it would be erroneous to conclude that standard ToM tests are worthless. Past research shows that it is a potential instrument for screening children with autism and for distinguishing them from children with other intellectual disabilities. Our findings only suggest that False Belief tasks do not tap all aspects of the broad construct of ToM, particularly the social communicative aspect. Besides, ToM tests are not restricted to False Belief tasks alone. Other tests of ToM include belief–desire tasks, true belief tasks, seeing-leads-to-knowing type tasks, and so forth.

Past research has also attempted to answer the question of how acquiring a ToM, through mastery of standard ToM tests, might affect the quality of an individual's social adaptability. In this study, we ask the opposite question of whether social experience, specifically in terms of conversation, influences the acquisition of a ToM. We realize that conversational skills can be learned as a set of rules (e.g., "Look at partner," "Say something about what your partner just talked about"). It is thus very possible that the participants learned and applied the set of rules without referring to mental states. Our question of interest is whether the participants have *incidentally* learned about ToM as a result of conversational skills training.

If social experience can indeed influence the acquisition of a ToM, then it is possible that learning conversational skills could have influenced other aspects of ToM than False Belief task performance, because learning conversational skills increases the child's experience of pragmatic communication. Since the ToM is a complex construct, other ToM-based social skills, like symbolic play, could have been affected. It would be interesting if future research addressed the question of whether an improvement in conversational skills influences the quality of another social skill that requires a ToM, such as symbolic play or the use of mental state terms in conversation.

In terms of methodological limitations, note that the criterion set for each component of the training procedure was not used in any of the previous research. Hence, these criteria were chosen on the basis of face validity. This is clearly not optimal, but these criteria were necessary in order to gauge whether the child had learned a particular skill and could move on to acquire related skills that were more advanced. Thus, we can only claim that the child has acquired a skill to the level of proficiency that was tested by the criterion.

We now consider the limitations of the interpretation of our data. First, we are aware that since the treatment and baseline conditions are not truly discontinuous, the changes in performance may not be solely related to treatment.

This problem would have been solved if a control group of children with autism, matched for conversational skills, had been included. The control group would receive the same number of sessions on some other training (e.g., play sessions) than specific conversational skills. This would ensure that an improvement in conversational skills would not be due to mere exposure to one-on-one sessions with a partner.

Second, another limitation comes from the duration of the training program. In this research, training was discontinued after nine sessions, regardless of the level of proficiency or mastery attained. Thus, it may be argued that training terminated too soon to expect changes in performance on False Belief tasks. Now, performance on False Belief tasks is scored in a binary fashion, which is not sensitive to small increments in related ToM skills (i.e., conversational skills in this case), at least not within such a limited time.

Finally, since the study only involves three children, the results can only be descriptive. Our conclusions are tentative and are made at this stage in hope that it might form part of a meaningful data bank as other researchers carry out similar follow-up studies.

The above-mentioned limitations imply that although participants did show an improvement in their communicative behavior, we cannot claim that they are socially as competent as their normally developing peers (Lord, 1984). In studies that look at how normal friendships develop, Lewis and Rosenblum (1977) and Hartup (1975) stressed the importance of reciprocity and positive interaction among individuals, not just the proportion of contextually appropriate utterances.

Future studies could consider probing for ToM across a whole battery of mentalizing tasks, such as the understanding of knowledge, deception, intention, desire, pretense, and misunderstanding. To do this, researchers in future studies might consider using Happé's (1994) advanced test of ToM, since the present and past studies have shown the ineffectiveness of standard False Belief tasks in reflecting ToM in everyday social behavior. Happé's advanced ToM tasks may prove more sensitive.

Researchers replicating this study in future need to address the question of whether greater improvements in communication and correspondingly mental state understanding may be achieved if longer term teaching methods are used. Also, including more participants as well as a control group as mentioned earlier would allow tests of statistical significance to be made. Additional qualitative data, such as overall play behaviors, reciprocity, and affect would provide a wider perspective to this research question.

In conclusion, children with autism can be trained to show shared interest with a conversation partner and make conversational utterances that are appropriate to the context, thereby showing the ability to maintain a conversation topic. They could possibly learn ToM skills incidentally through such training. Yet, while change in conversational skills occurs, performance of False Belief tasks remain constant. Hence, together with findings of past studies, we conclude that caution should be exercised when inferring an individual's social behaviour on the basis of his/her performance in False Belief tasks.

Despite its limitations, this research has shown that the interpretation of test measurements are far more complex than they seem. It also questions the validity of over simplistic reductionist measures (such as scores on ToM tests), and helps us to appreciate the need for longer lasting and comprehensive interventions.

APPENDIX

Scripts for False Belief Tasks

"Smarties" Task

The trainer held up a tube of "Smarties" and said the following: "Look, I've got a tube of something here."

Prompt question (1): What do you think is inside this tube?

Let's take a look. Oh! It's a pencil!

Prompt question (2): What is inside this tube?

Prompt question (3): Is Fozzie Bear here with us?

Prompt question (4): Does Fozzie know that there is a pencil inside this tube?

Here comes Fozzie!

Belief question: What does Fozzie Bear think is inside this tube?

"Sally-Anne" Task

The trainer placed the two boxes and the two figurines in front of the child. The trainer then told the following story, moving the figurines accordingly:

"This is Fozzie Bear and Strawberry Shortcake."

Naming question: Who are these?

Fozzie and Strawberry are good friends. One day, they found a star. They decided to keep it in the grey box.

Prompt question (1): Where did Strawberry and Fozzie keep the star?

Fozzie says, "Excuse me. I need to go to the toilet." So off he goes. Strawberry takes the star out from the grey box and hides it in the colorful box.

Prompt question (2): Is Fozzie here?

Prompt question (3): Did Fozzie see Strawberry hide the star in the other box?

Prompt question (4): Does Fozzie know what Strawberry did?

Fozzie comes back. He says, "I think I will go and get the star."

Belief question: Where will Fozzie look for the star?

This story is shown in schematic form in Fig. A1.

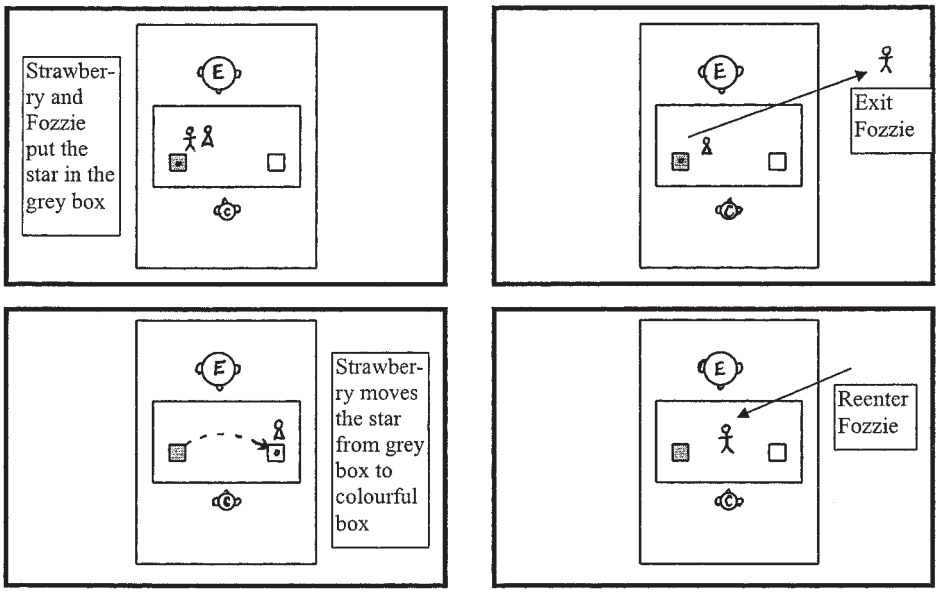

Fig. A1. Scenario of the "Sally-Anne" task.

FB2 Task

The trainer laid out the toy village in front of the child. The trainer then told the following story and moved the figurines accordingly:

"This is Porky Pig and this is Bugs Bunny. They live in this village."

Naming question: Which is Porky/Bugs?

Here they are in the park. Along comes the ice-cream man. Porky would like to buy an ice-cream but he has left his money at home. He is very sad. "Don't worry," says the ice-cream man, "you can go home and get your money and buy some ice-cream later. I'll be here in the park all afternoon. . . " "Oh good,"

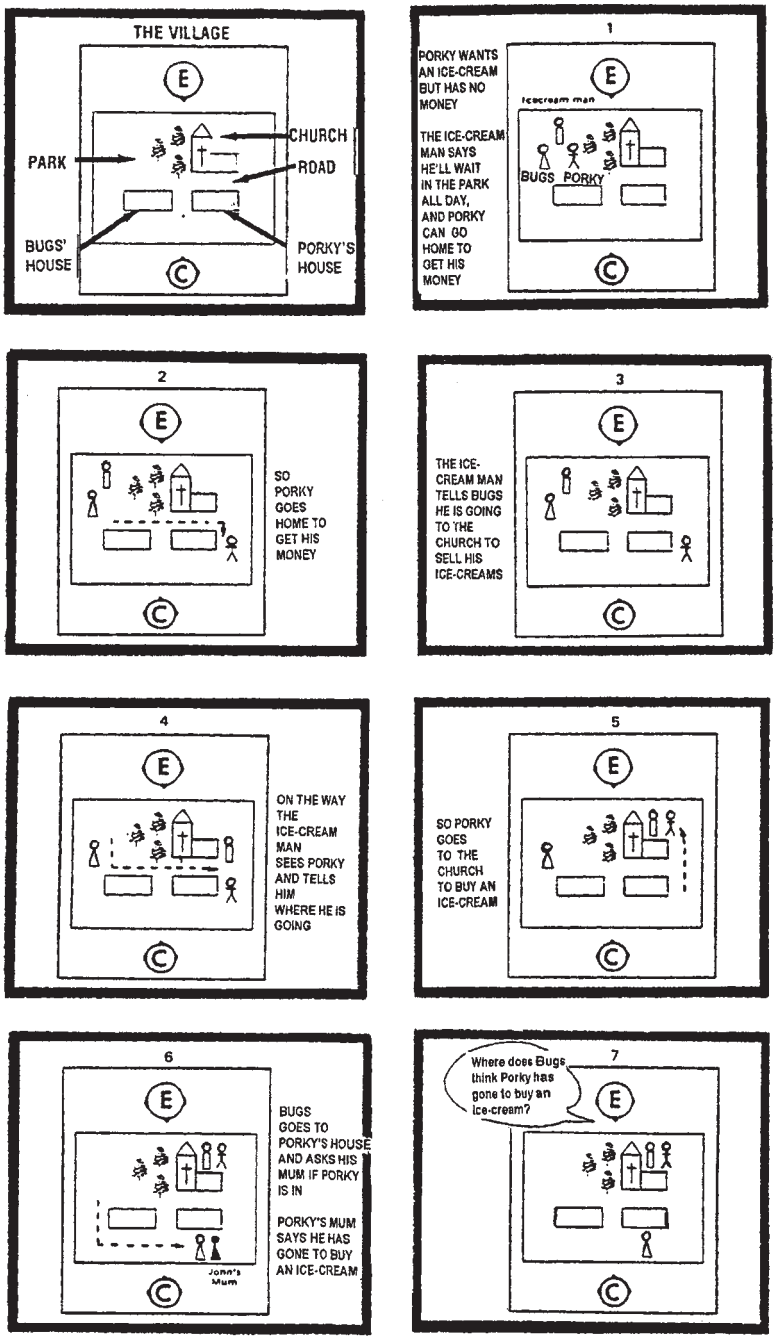

Fig. A2. Scenario of the FB2 task.

says Porky, "I'll be back in the afternoon to buy ice-cream."

Prompt question (1): Where did the ice-cream-man say to Porky he would be all afternoon?

So Porky goes home. He lives in this house. Now, the ice-cream man says, "I am going to drive my van to the church to see if I can sell my ice-creams outside there."

Prompt question (2): Where did the ice-cream man say he was going?

Prompt question (3): Did Porky hear that?

The ice-cream man drives over to the church. On his way he passes Porky's house. Porky sees him and says, "Where are you going?" The ice-cream man says, "I'm going to sell some ice-cream outside the church." So off he drives to the church.

Prompt question (4): Where did the ice-cream man tell Porky he was going?

Prompt question (5): Does Bugs know that the ice-cream man has talked to Porky?

Now Bugs goes home. He lives in this house. Then he goes to Porky's house. He knocks on the door and says, "Is Porky in?" "No," says Porky's mother, "he's gone out to buy an ice-cream."

Belief question: Where does Bugs think Porky has gone to buy his ice-cream?

Reality question: Where did Porky really go to buy his ice-cream?

Memory question: Where was the ice-cream man at first?

This story is shown in schematic form in Fig. A2.

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