Exploring 'theory of mind' in people with schizophrenia

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SYNOPSIS Mentalizing ability was studied in 46 symptomatic schizophrenic patients and 44 non-symptomatic controls. Subjects heard six stories and simultaneously were shown simple cartoon pictures depicting the action sequencing occurring in the stories. All the stories involved false belief or deception, so that it was necessary to infer the mental states of the characters in order to understand their behaviour. After each story, subjects were asked one memory/reality question (concerning an event in the story) and one question that depended on the ability to infer the mental state of one of the characters. Patients with paranoid delusions were impaired on the questions concerning mental states. Patients with behavioural signs (i.e. negative features or incoherence) were also impaired on the mental state questions, but this difficulty was associated with memory impairments. Patients with symptoms of passivity (e.g. delusions of control) and patients in remission did not differ from normal controls. These results are consistent with the hypothesis that certain of the positive symptoms of schizophrenia reflect an impairment in the ability to infer the mental states of others.

INTRODUCTION

A number of recent studies of schizophrenia have shown that signs and symptoms segregate into discrete groups: psychomotor poverty (i.e. negative features), disorganization (i.e. thought disorder and incoherence) and reality distortion (i.e. hallucinations and delusions) (Bilder *et al.* 1985; Liddle, 1987; Mortimer *et al.* 1990; Arndt *et al.* 1991). These syndromes are associated with specific patterns of resting cerebral blood flow (Liddle *et al.* 1992; Ebmeier *et al.* 1993; Kaplan *et al.* 1993) confirming that there is a physiological basis for the classification. The first two syndromes involve manifest behavioural abnormalities and have been shown to be associated with specific cognitive impairments that are clearly related to the clinical signs (Frith *et al.* 1991; Liddle & Morris, 1991; Allen *et al.* 1993). Thus, psychomotor poverty is associated with poverty of production on various tests (e.g. verbal fluency), while disorganization is asso-

ciated with a failure to inhibit inappropriate responses (e.g. the Stroop task). The syndrome of reality distortion does not seem to be allied to impairments on standard cognitive tasks. However, Frith (1992) has suggested that the positive symptoms of hallucinations and delusions result from an impairment in the ability to represent mental states. Within this impairment, two discrete deficits are proposed that relate to the specific nature of the delusion or hallucination expressed. Some symptoms such as thought insertion and delusions of control (i.e. the passivity phenomena) reflect impairments in the ability of the patient to represent his/her own intentions to act (Frith & Done, 1989; Mlakar *et al.* 1994). Symptoms such as delusions of reference and persecution reflect a difficulty of representing the mental states of other people (i.e. a deficit in the ability to mentalize or have a 'theory of mind' (Frith, 1994)).

An earlier study (Corcoran *et al.* 1995) has provided support for the contention that paranoid symptoms are related to disorders of 'theory of mind' using a test which examined the ability of patients to infer intentions behind

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items of indirect speech (e.g. the phrase 'It's very cold in here' meaning 'please shut the window'). This study also indicated that patients with negative features and those with thought disorder also had difficulty with this task although the number of patients with thought disorder was rather small. A number of previous studies have examined social abilities in people with schizophrenia (e.g. Diamond, 1956; La Russo, 1978; Cutting & Murphy, 1990; Good, 1990), but these have not been couched explicitly in terms of 'theory of mind' or mentalizing abilities.

In contrast, there have been many studies of autism that have explicitly investigated the extent to which these patients have a 'theory of mind' (see chapters in the volume edited by Baron-Cohen et al. 1993; Sodian & Frith, 1992; Happé & Frith, 1994). The present study is an attempt to provide further evidence of theory of mind deficits in certain patients with schizophrenia. While we do expect to see difficulties with mentalizing tasks in patients with paranoid symptoms, we do not expect the deficit to resemble exactly that seen in autism. The important difference between these two disorders concerns the age of onset of the illness. In consequence of the early onset, autistic patients may never develop mentalizing abilities. In contrast paranoid patients may lose an ability they once had. Thus, autistic patients will fail to make inferences about the mental states of others, while paranoid patients will make the wrong inferences. In this study patients were asked questions about stories involving false belief and deception at different levels of complexity. A similar paradigm has been used to good effect in the study of mentalizing skills in children with autism by Happé (1994).

METHOD
The tasks

Six theory of mind stories were read to the subjects. These examined the ability of the subjects to appreciate first and second false belief and deception. (In a first order story a character has a false belief about the state of the world. In a second order story one character has a false belief about the belief of another character.) We endeavoured to make the situations depicted in the stories as straightforward

as possible while being at the same time tolerable for adult subjects. Certainly neither patients nor controls complained about the content of the stories (see Appendix 1).

While the stories were read to the subjects, they were shown a series of cartoon drawings that presented the action sequences involved in the stories (see Appendix 2). The stories were repeated once only, if subjects requested this. After each story was read out, two questions were asked (see Appendix 1). The first question could only be answered on the basis of the mental state of one the characters (theory of mind question) and reflected that character's false belief about the situation. In order to understand that a belief is false it is also necessary to know the correct belief. As a measure of comprehension subjects were therefore asked a second question about the reality of the situation (reality question). This question can be answered correctly without any mentalizing abilities. Since many patients with schizophrenia have poor memories (McKenna et al. 1990) particularly for prose passages (Shallice et al. 1991) the second question also served as measure of how well the subject had remembered the story.

All subjects were also given Form One of the Quick Test (Ammons & Ammons, 1962). This is a test of verbal abstraction abilities involving word to picture matching. It can be used to provide a reliable indication of current general ability levels. Raw scores from the task can be converted into WAIS full scale IQ scores. Furthermore, all subjects with schizophrenia were given the Present State Examination version 9 (Wing et al. 1974) on the day of testing. This standard psychiatric interview provides an assessment of current symptoms.

Subjects

In all, 55 patients meeting DSM-III-R criteria for schizophrenia completed the theory of mind stories task. These patients were allocated to one of four groups according to their current signs and symptoms.

(1) Behavioural signs

Any patient with either positive or negative behavioural signs was allocated to this group. These signs include poverty of speech, flattening of affect, incoherent speech and incongruity of

Table 1.   *The demographic details of the subject groups*

Group	N (M:F)	Age (yrs)	Employed (%)	Education achieved Degree (%)	O-levels (%)	IQ
Behavioural signs	12 (8:4)	33·1 (11·2)	17	17	50	97·6 (11·1)
Paranoid	24 (14:10)	33·7 (11·9)	33	21	79	99·3 (9·0)
Passivity	10 (7:3)	31·3 (8·2)	20	10	80	101·0 (12·6)
Remission	9 (7:2)	31·1 (8·3)	11	11	78	103·3 (15·7)
Psychiatric	13 (7:6)	48·1 (17·5)	54	23	69	108·4 (12·4)
Controls	22 (7:15)	32·9 (11·4)	82	36	91	112·1 (6·8)

Table 2.   *Clinical details of the schizophrenic patients*

Group	Age of onset Mean (s.d.)	Duration of illness Mean (s.d.)	On medication Neuroleptics (%)	Anti-cholinergics (%)
Behavioural	23·2 (10·5)	9·8 (10·6)	92	50
Paranoid	21·9 (8·4)	11·8 (9·9)	96	50
Passivity	24·0 (5·1)	7·0 (4·9)	90	50
Remission	21·9 (5·4)	9·3 (5·6)	89	44

affect. There were 12 such patients and we did not consider this a large enough group to subdivide into positive and negative features.

(2) Paranoid symptoms

Of the remaining patients there were 24 who reported delusions of reference, misidentification, and persecution with or without third person auditory hallucinations.

(3) Passivity phenomena

There were a further 10 patients who reported other kinds of positive symptoms. The principal symptoms in this groups were delusions of control or influence, thought insertion, thought withdrawal and second person auditory hallucinations.

(4) Remission

There were nine patients left for whom no symptoms could be elicited on the PSE and who had been symptom-free for at least 2 weeks. These patients were, however, still taking antipsychotic medication, as were the patients in the other three groups.

The four groups were hierarchical in nature such that any patient with either positive or negative behavioural signs would be allotted to

group one regardless of whether or not he/she displayed other symptoms. Similarly, patients were allocated to group two if paranoid delusions were present regardless of whether or not they also showed passivity phenomena. It follows, therefore, that patients in the passivity group had neither behavioural signs nor symptoms of a paranoid nature. They may, however, have been described other more atypical delusions alongside passivity features. The distinction between second and third person hallucinations is made on theoretical grounds after Frith (1992).

We expected that the patients with behavioural signs would have general cognitive impairments, whereas the patients in the paranoid group would have specific problems with infering the mental states of others.

Two other groups of subjects were collected for this investigation. First, a group of 13 non-psychotic psychiatric out-patients completed the task. All of these patients had a primary diagnosis of depression and/or anxiety. Secondly a group of 22 normal subjects were collected from various sources.

The demographic characteristics of these six subject groups are shown in Table 1, and the clinical details of the schizophrenic groups can be seen in Table 2.

RESULTS

1 Demography and clinical details (see Tables 1 and 2)

No differences were found to exist between the schizophrenic subgroups in age of onset and duration of illness, medication status, age, sex, occupational or educational profiles or current IQ. However, some differences did exist between the schizophrenic subjects and the two 'control' groups. First, the psychiatric control group was significantly older than the schizophrenic patients with passivity features, those in remission and patients with paranoid symptoms (one-way ANOVA, $F = 3.39$, $P < 0.01$). This group also proved to be significantly older than the normal control group. This small difference in age is unlikely to affect performance on the theory of mind stories. As is often found, more of the schizophrenic patients were unemployed ($\chi^2(5) = 25.6$, $P < 0.001$) in comparison to the normal control group.

Perhaps the most important demographic difference is that found in the current level of IQ existing between the normal 'control' group, the behavioural signs subgroup and the patients with paranoid symptoms ($F(6, 83) = 4.2$, $P < 0.001$). Given this result, it was important to see to what extent the differences between the groups on performance of the theory of mind stories was a consequence of the differences in IQ. This was achieved by examining the Theory of Mind (ToM) performance of subsamples of schizophrenic and control subjects matched for IQ. The current level of functioning in these subsamples ranged from 97–112 with means and s.d.s of 103 (4.6) and 105.5 (4.4) for the 34 schizophrenic patients and the 17 control subjects (including both psychiatric and normal controls) respectively.

2 Performance on the theory of mind stories

For the first set of analyses, data was combined for the three first order and for the three second order stories. Thus, for the reality questions, each subject was given a score between 0 and 3, which was expressed as a percentage. If the subject gave the wrong answer to the reality question then the answer to the ToM question for that story was ignored. The reason for this was that if a subject has failed to remember a salient feature of the story then his failure on the

'theory of mind' question might reflect a memory or comprehension impairment rather than a defect in mentalizing ability.

Thus, the theory of mind score was based only upon those stories that were correctly remembered. This theory of mind score was also expressed as a percentage. If a subject failed all three reality questions, he/she was excluded from all analyses. For this reason two patients from the behavioural signs group and two patients from the paranoid symptoms group were excluded from analysis of second order stories.

Since there were wide differences in the variances, the performance of the six groups was compared using the Kruskal–Wallis non-parametric test.

(a) First order theory of mind
(i) Reality questions (see Fig. 1)

Highly significant differences were found in the performance of the six groups ($\chi^2(5) = 19.0$, $P < 0.01$). *Post hoc* multiple comparisons showed: (*i*) the behavioural signs subgroup were worse than patients with passivity features, those in remission, and also the two control groups; and (*ii*) paranoid patients were worse than schizophrenic patients in remission and the two control groups.

(ii) ToM questions (see Fig. 1)

Highly significant differences were found for the theory of mind questions also ($\chi^2(5) = 23.8$, $P < 0.001$) even though subjects had answered the reality questions correctly for these items. *Post hoc* multiple comparisons revealed that: (*i*) the behavioural signs group were performing more poorly than the schizophrenic patients with passivity features, those in remission as well as the two control groups; and (*ii*) the paranoid patients were also performing more poorly than these same subgroups of patients.

(iii) ToM questions in the matched IQ subsamples

As in the preceding analyses ToM performance data was taken only from those stories for which the reality responses were correct. A χ^2 analysis revealed no significant difference between the performance on first order theory of mind of the schizophrenic sample and the control group ($\chi^2(4) = 4.865$; NS). It should be noted that the
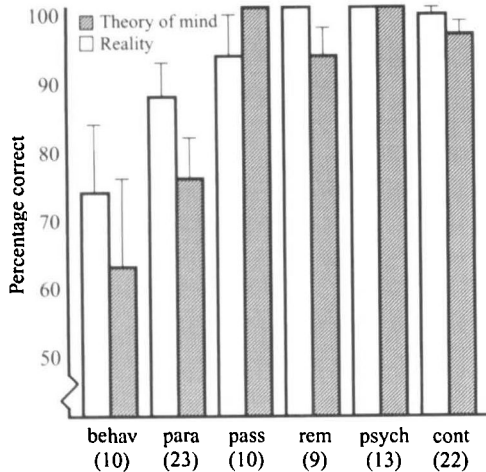
FIG. 1. Performance of subjects passing at least one reality question on the first order stories (behav = negative or disorganized; para = paranoid; pass = passivity experiences; rem = schizophrenic patients in remission; psych = non-schizophrenic psychiatric patients; cont = normal controls).

FIG. 2. Performance of subjects passing at least one reality question on the second order stories (see Fig. 1 for group code).

smaller selected sample size meant that a high proportion of the cells in the contingency table had expected frequencies below 5. This result should therefore be viewed with extreme caution.

(b) Second order theory of mind
(i) Reality questions (see Fig. 2)

The differences found between the groups here became less clear cut, largely because the second order stories required much more information to be retained. The significant difference found using the Kruskal–Wallis procedure suggested that all of the schizophrenic subgroups were failing the reality questions more often than the normal control group ($\chi^2(5) = 19.1$, $P < 0.01$). Within the schizophrenic subgroups, those with behavioural signs and those with paranoid symptoms did appear to be more likely to fail the reality questions than the schizophrenic patients in remission.

(ii) ToM questions (see Fig. 2)

Just as for the reality questions, when the performance on the theory of mind questions was analysed it was found that all of the schizophrenic subgroups and the psychiatric control group performed less well than the normal controls ($\chi^2(5) = 23.7$, $P < 0.001$). As before, this analysis included only items for which the reality question had been answered
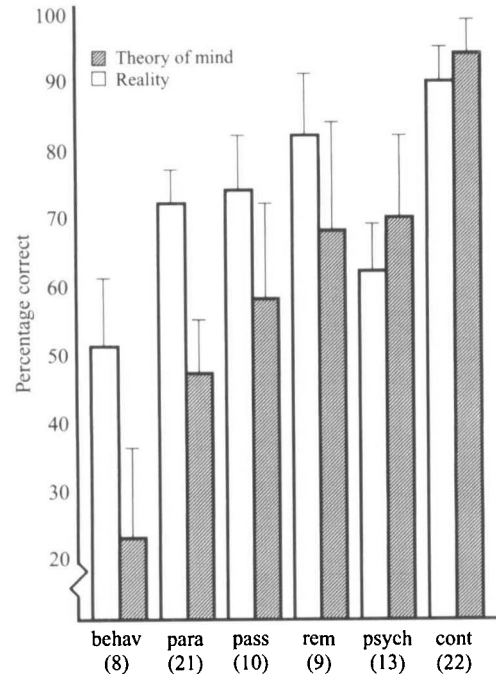
correctly. More specifically, the behavioural signs group was worse than the schizophrenic patients in remission and the psychiatric control group. Furthermore, the paranoid symptoms group also performed more poorly than these same two groups.

(iii) ToM questions in the matched IQ subsamples

A χ^2 analysis revealed a clear difference in the performance of the two selected subsamples ($\chi^2(4) = 9.57$; $P < 0.05$). Furthermore, a subsequent Kruskal–Wallis test with experimental *versus* control group comparisons revealed that the differences lay with the performance of the six behavioural patients *versus* the controls and the 18 paranoid patients who also performed worse than the combined control subsample ($\chi^2(4) = 13.67$; $P < 0.01$).

(c) Mental state inference in patients with no memory deficit
First order stories (see Fig. 3)

In the second stage of the analyses the performance on the ToM questions of only those subjects who answered all of the reality questions
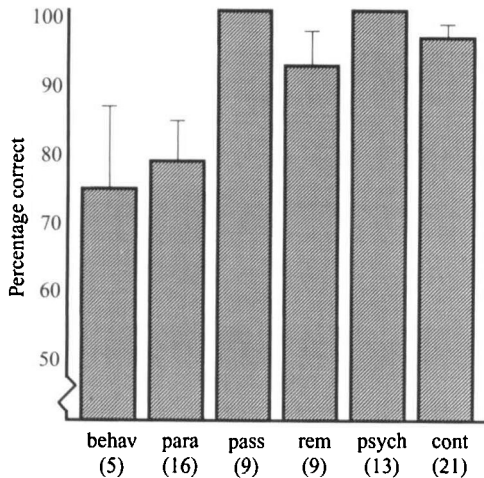
FIG. 3. Performance of subjects passing all reality questions on the first order stories (see Fig. 1 for group code).
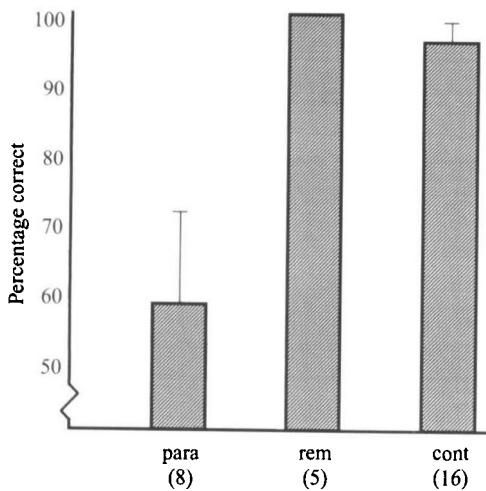

FIG. 4. Performance of subjects passing all reality questions on the second order stories (see Fig. 1 for group code).

correctly was considered. The number of subjects in some of the schizophrenic subgroups was reduced as a result. The behavioural signs group was left with only five members while the paranoid symptoms group fell to 16 members. Nevertheless, the results remained highly significant $(\chi^2(5) = 17\cdot2, P < 0\cdot01)$. The multiple comparisons procedure again revealed that both the behavioural signs group and the group with paranoid symptoms were performing more poorly than the remaining four groups.

Second order stories (see Fig. 4)

When the theory of mind performance was analysed in only those subjects who answered all three reality questions correctly, subgroup numbers fell dramatically. The analysis included data from eight paranoid patients, five schizophrenic patients in remission and 16 normal control subjects. Despite the reduction in numbers, the result was interesting. The Kruskal–Wallis test and subsequent multiple comparisons revealed that the patients with paranoid features were more likely to fail the second order theory of mind questions than were either the schizophrenic patients in remission or the normal control subjects $(\chi^2(2) = 13\cdot7, P < 0\cdot001)$.

DISCUSSION

This study provides evidence that patients with delusions of a paranoid nature (and patients with behavioural signs) have difficulties when they try to appreciate what is going on in the minds of other people. This confirms the results of an earlier study in which the understanding of indirect intentional speech was investigated (Corcoran *et al.* 1995). These findings are unlikely to be a consequence of medication. The patients with symptoms of passivity and the patients in remission were also medicated, but did not show impairments on the ToM questions. The extent to which general intellectual abilities determine performance on these mentalizing stories is a little unclear. We found no significant differences in first order ToM abilities between the controls and the schizophrenic patients in two selected subsamples matched for IQ, but small cell counts made this analysis somewhat unreliable. There are, however, clear trends in the data of these smaller samples indicating greater difficulty in the behavioural and paranoid groups. We would argue that the symptom specific result is unlikely to be due to general cognitive disabilities in the paranoid group since these patients did not differ significantly in IQ from the patients with symptoms of passivity or those in remission. Furthermore, in the selected analysis of subsamples matched for IQ both the paranoid and the behavioural patients performed the second order ToM questions more poorly than the controls.

The situation in relation to memory im-

pairment is more complex. The patients with behavioural signs clearly had problems remembering the stories. In these circumstances it is difficult to interpret their poor performance on the ToM questions despite attempts to deal with this confounding variable by examining ToM performance only when the memory/reality questions were answered correctly. The paranoid patients were also impaired on the reality questions compared with the other groups. Nevertheless, we believe that they have a specific problem with inferring mental states, since, even when patients were selected who had answered all the reality questions correctly, they were still significantly impaired on the ToM questions (Fig. 2). In this study we are unable to draw conclusions about the direction of causality. It may be that the mentalizing difficulty causes the memory problem. In all of the stories, the 'point' was intimately concerned with the mental states of the protagonists. If you can not understand such stories, they will be difficult to remember. If stories could be constructed which were matched for information content, but different in their concern with mental states, we would expect paranoid patients to have more difficulty remembering the mental state stories. In contrast, we would expect patients with behavioural signs to have problems with both kinds of story, because of a more general cognitive impairment.

It would appear that the second order theory of mind stories used in this study present too great a memory load for the majority of the patient groups. There is clearly a need to construct easier versions of this type of story for use with adults.

It is striking that the patients with passivity features (delusions of control, thought insertion, etc.) could answer the theory of mind questions quite well. This was also found by Corcoran *et al.* (1995) who used a different kind of task. We have previously found evidence (Frith & Done, 1989; Mlaker *et al.* 1994) that patients with passivity experiences have problems representing their own intentions to act. The present results suggest that this difficulty does not generalize to inferring the beliefs and intentions of other people.

The proficient performance of patients currently in remission on these theory of mind stories is noteworthy, and again supports Cor-

coran *et al.* (1995). This result implies that the underlying cognitive impairment fluctuates with symptoms and is a state, rather than a trait, variable. Suitable developments of such measures would provide objective markers of certain types of symptoms that could be used in conjunction with studies of various therapeutic interventions.

It is, of course, only a beginning to show that paranoid patients have difficulty with theory of mind tasks. From the present study we cannot tell whether the difficulty is specific to the domain of mental states, or, whether it reflects a more general problem with certain kinds of inferences and deductions. Bentall *et al.* (1991) have suggested that paranoid patients have specific difficulties with social attributions, while Garety *et al.* (1991) argue that deluded patients have more general problems with drawing appropriate conclusions from the evidence presented. For future studies we will need to know how 'theory of mind' and mentalizing abilities relate to representation and metarepresentation (e.g. Leslie, 1987) and more generally, to the acquisition of knowledge and the ability to draw inferences. From an empirical point of view it will be necessary to examine larger groups of patients so that this cognitive deficit can be related to individual symptoms.

In conclusion, we have shown that the presence of paranoid symptoms is associated with poor performance on first and second order theory of mind tasks. This deficit is probably distinct from other cognitive difficulties, appears to be specific to this subgroup of patients and probably disappears as symptoms remit.

APPENDIX 1

The six theory of mind stories used showing the mental state and memory questions asked

First order false belief

John has five cigarettes left in his packet. He puts his packet on the table and goes out of the room. Meanwhile, Janet comes in and takes one of John's cigarettes and leaves the room without John knowing.

ToM question When John comes back for his cigarettes, how many does he think he has left?
Memory question How many cigarettes are really left in John's packet?

First order deception – prediction

Mary has a box of chocolates which she puts in her top drawer for safe keeping. A few minutes later Burglar Bill comes in and asks Mary, 'Where are your chocolates, in the top or the bottom drawer? Mary doesn't want Bill to find her chocolates.

ToM question In which drawer does Mary say her chocolates are, the bottom or the top? Why?
Memory question Where are the chocolates really?

First order deception – explanation

Sarah has saved £1 which she puts in her piggy bank where she thinks it will be safe. A little later Sly Sid comes along and asks Sarah, 'Have you put your £1 in you piggy bank or your money box?'. Sarah answers, 'it's in my money box.'.

ToM question Why does Sarah say that her £1 is in her money box?
Memory question Where is the £1 really?

Second order false belief

Sally and Ian are at the station because Sally has to catch a train home. Sally lives in Homesville but the train does not stop at Homesville station. Sally will have to get off at Neartown and walk. Sally goes to buy a magazine to read on her journey before she buys her ticket. While she is gone there is an alteration to the timetable and the train is now going to stop at Homesville. The guard tells Ian about this change and Ian sets off to find Sally to tell her but before Ian finds her, the guard meets Sally and tells her, 'the train will now stop at Homesville'. Ian eventually finds Sally who has just bought her ticket.

ToM question Which station does Ian think that Sally has bought her ticket for?
Memory question Where has Sally really bought her ticket for?

Second order deception – prediction (Taken from Happé, 1991.)

Burgler Bill has just robbed a bank and is running away from the police when he meets his brother Bob. Bill says to Bob, 'Don't let the police find me, don't let them find me!' then he runs off and hides in the church yard. The police have looked everywhere for Bill except the church yard and the park. When they come across Bob they were going to ask him, 'Where is Bill, is he in the park or the church yard?' But the police recognize Bob and they realize that he will try to save his brother. They expect him to lie and so wherever he tells them, they will go and look in the other place. But Bob who is very clever and does want to save his brother knows that the police don't trust him.

ToM Question Where will Bob tell the police to look for Bill in the church yard or in the park? Why?
Memory question Where is Bill really hiding?

Second order deception – explanation

Peter has bought a can of Coke which he leaves on the table while he goes to answer the phone. While he is gone, Chubby Charles comes in and takes Peter's drink and puts it into his own locker. Greedy Greg who is Chubby Charles's friend sees what Charles has done and so Charles promises Greg half of the drink if he doesn't let Peter know where his Coke is. Meanwhile Peter has gone looking for his can of Coke and he has searched everybody's lockers except for Nasty Nina's and Chubby Charles's. He sees Greedy Greg and he asks him, 'where is my can of Coke, is it in Charles's or Nina's locker?' Peter knows that Greg and Charles are good friends and so he expects Greg to protect Charles. Greg is very cunning though and he says: 'Your Coke is in Charles's locker'.

ToM question Why does Greg tell Peter that his Coke is in Charles's locker?
Memory question Where is the Coke really?

APPENDIX 2
The cartoon drawings that accompanied the second order false belief story.
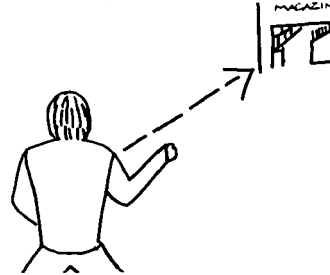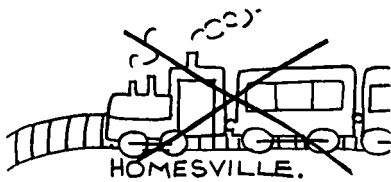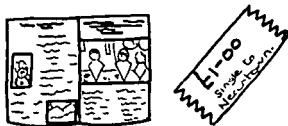

STATION.

1.

2.

SALLY'S
HOMESVILLE

3.

HOMESVILLE.

4.

NEARTOWN.

5.

6.

HOMESVILLE.

7.

MAGAZINES

8.

GUARD.

9.

£1-20
single to
Homesville

10.

single to
???

11.

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