Computer mediated interaction in Asperger’s syndrome: the Bubble Dialogue program

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Abstract

This paper reports the use of a computer application, Bubble Dialogue, with two primary aims: (1) to assess the experience of computer-mediated role-taking on the interpersonal understanding, executive abilities and verbal abilities of two young male adults with Asperger’s syndrome (a diagnosis given to higher functioning individuals with autism); (2) to investigate whether blind raters judged differently between Bubble Dialogue scripts produced by individuals with Asperger’s syndrome and scripts produced by individuals with emotional and behavioural difficulties. The results show that there was no detectable improvement in the interpersonal understanding of the participants with Asperger’s syndrome, but there was an improvement in their executive function scores. Additionally, the blind ratings revealed that only one of the ‘Asperger’ Bubble Dialogue scripts was different from the scripts generated by individuals with emotional and behavioural difficulties. Conceivably, Bubble Dialogue helps to regulate interaction, such that the social impairments characteristics of Asperger’s syndrome are less conspicuous. © 2000 Published by Elsevier Science Ltd.

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1. Introduction

1.1. Overview

The purpose of this study was to investigate the educational value of computer-mediated Dialogue in individuals with Asperger’s syndrome. The application is potentially useful in at least two respects. First, practising Dialogue in a computer-assisted simulation might confer measurable benefits in social functioning and certain aspects of cognitive performance. Second, the dialogues generated in the computer-assisted simulation might allow an opportunity to assess the quality of communication by individuals with Asperger’s syndrome. Such assessments could contribute usefully in building up a profile of skills on which to base a programme of education for individuals with Asperger’s syndrome.

1.2. Computers and autism

Moore, McGrath and Thorpe (2000) argue that despite good evidence for the value of computer assisted learning in individuals with autism, this area remains relatively unexplored. Swettenham (1996) states various reasons why computers are ideal as educational tools for individuals with autism and Asperger’s syndrome. First, computers provide social and emotional distancing by acting as an interface between interactants. Second, the computer accommodates the autistic need for sameness. Third, it allows the individual to take control and work at his or her own speed.

With the aim of assessing and improving interpersonal understanding in individuals with Asperger’s syndrome, we utilized the Bubble Dialogue program (Gray, Creighton, McMahon & Cunningham, 1991). The application creates the experience of role-play in a comic strip world, in which two users each role-play a character (see Fig. 1). The users have opportunity, by clicking on icons, to insert text into a speech Bubble above the head of their character and then to insert text into a thought Bubble which subsequently replaces the speech bubble. The Dialogue thus alternates between the users and each has access to the speech and thoughts generated by the other.

1.3. Autism and Asperger’s syndrome

Autism is a neurodevelopmental disorder characterised by a triad of impairments: communication, social understanding and imagination (Wing & Gould, 1979) as well as sensory and perceptual abnormalities (Happé, 1996; O’Neill & Jones, 1997; Ropar & Mitchell, 1999). Asperger’s syndrome is a diagnosis given to high-functioning individuals with autism who lie at the end of the autistic spectrum which shades into normality. It is a label given to individuals who have subtle manifestations of autism but without severe language problems or mental retardation (Rutter & Schopler, 1987).

1.4. Can the understanding of mental states be taught?

Many studies show that individuals with autism have problems in understanding their own
and other people’s mental states (Baron-Cohen, Leslie & Frith, 1985; Perner, Frith, Leslie & Leekam, 1989). A failure to develop a ‘theory of mind’ may therefore underpin the social and cognitive deficits in autism (see Baron-Cohen 1995; Frith, 1989; Happé, 1994; Mitchell, 1997, for reviews). Accordingly, Svettenham (1996) and Hadwin, Baron-Cohen, Howlin and Hill (1996, 1997) tried to teach rules to children with autism for working out the underlying mental states of others. Hadwin et al.’s (1996, 1997) results showed that children with autism could be taught to pass tests of belief and emotion and these improvements were still apparent two

Fig. 1. Prologue from the first Bubble Dialogue scenario: simple perspective taking.
months later. Participants had to infer another person’s mental state on the basis of that person’s experiences, and thus needed to resist reporting their own beliefs and emotions.

The success of Hadwin et al.’s (1996, 1997) study was limited by the finding that benefits did not generalize to untutored areas. For example, tutoring about belief did not help participants to make more accurate judgements about another person’s emotion. Moreover, the approach adopted in Hadwin et al.’s study is questionable in principle because solely teaching some rules to pass tests may be considered very crude. Children “may have learned to pass the tasks rather than understanding the concepts underlying the rules” (Hadwin et al., 1996, p.359). Indeed, learning rules does not necessarily mean that the children will understand and apply what they have been taught in the context of real life situations. As Frith (1989) wrote, “In order to develop a theory of mind one needs not only the ability to mentalize, but also experience. One needs experience with people who have different relationships to each other, and different personal interests” (p. 166).

1.5. Can an understanding of mental states be learned through experience?

In this study, we aim to introduce a computer-mediated intervention to participants while honouring the fact that clinically normal children acquire an understanding of the mind in the absence of any explicit tutoring. Presumably, their understanding develops through the experience of interacting with other people, perhaps along the lines that Frith (1989) envisioned. Individuals with autism and Asperger’s syndrome are conspicuously impaired in their ability to interact, which could be a symptom of their difficulty in understanding other minds but which also could be an impediment to development in their understanding of the mind (Mitchell, 1996).

The Bubble Dialogue application allows users to reflect on speech as Dialogue and also alerts them to thought content as something distinct from speech. The program regulates turn-taking and serves as an interface between the two users. In this way Bubble Dialogue might allow the meeting of minds to occur as an explicit, engaging and experiential process.

Jones and Selby (1997) used Bubble Dialogue to explore communication in children with emotional and behavioural difficulties. They suggest that Bubble Dialogue can help children to communicate and express their feelings and views when they find it difficult to communicate directly. This virtue of Bubble Dialogue might also apply to individuals with Asperger’s syndrome. Jones and Selby also state that the role-playing element provides an emotional ‘distance’ which allows specific issues in the child’s life to be raised without direct reference. Hence, participants could play characters without having to identify closely with them.

Bubble Dialogue involves a prologue which introduces a particular social situation. Six theory of mind-inspired scenarios were developed for this study, showing an exchange of utterances made by two characters (Fig. 1 shows the prologue of the first scenario). The participant and researcher then assume the roles of these characters and take the Dialogue forward in an entirely open-ended way. The scenarios were developed to give an initial structure to the dialogues, yet are unconstrained and there are no correct or incorrect ways of doing the dialogues.

If participants benefit from Bubble Dialogue, this might be reflected in improvements in their every day social behaviour. To find out, supplementary items devised for the Vineland
Adaptive Behavior Scales by Frith, Happé and Siddons (1994) were administered, prior and post Bubble Dialogue, along with the Wisconsin Card Sorting Test (which tests executive function) and the British Picture Vocabulary Scale (which gives an assessment of receptive verbal comprehension).

The Card Sorting Test taps into aspects of autism which are not easily explained by the theory of mind account. Individuals with autism show a need for sameness, have difficulty switching attention, have a tendency to perseverate and lack impulse control. These symptoms are similar to those shown by individuals with frontal lobe brain injury in a condition known as Dysexecutive Syndrome (Baddeley & Wilson, 1988). Ozonoff, Pennington and Rogers (1991) define executive function “as the ability to maintain an appropriate problem-solving set for attainment of a future goal; it includes behaviors such as planning, impulse control, inhibition of prepotent but irrelevant responses, set maintenance, organized search, and flexibility of thought and action.” (p. 1083). Using tests of executive function, including the Card Sorting Test, Ozonoff et al. (1991) found that high functioning autistic participants showed specific deficits. In the current study, a change in scores in Vineland Adaptive Behavior Scales, but not in the card sort or verbal ability was anticipated because the intervention was conceived specifically to improve interpersonal understanding.

### 1.6. Measuring the character of Dialogue in Asperger’s syndrome

With the aim of constructing a detailed profile of speech and thought in Asperger’s syndrome, blind raters were asked to rate Bubble Dialogue transcripts. This might give further insight into the peculiarities of interpersonal interaction in Asperger’s syndrome and as a point of comparison, we included participants with emotional and behavioural difficulties.

We identified three dimensions on the assumption that they would best elicit the polarities of autism and characteristics associated with emotional and behavioural difficulties. Would the blind ratings reflect differences in the clinical classification of participants involved in the study?

1. Emotionally flat–emotionally charged: this dimension was chosen to access the lack of affect which Hobson (1990) proposes in his socio-affective account of autism. Hobson argues that individuals with autism have specific impairments in understanding people as sentient beings. His argument relates to Kanner’s (1943) original clinical observations by postulating a primary impairment in the ability to form emotional contact with people.

2. Polite–coarse: the participants with emotional and behavioural difficulties attend a residential school almost exclusively for adolescents who had been excluded from mainstream state education because of antisocial and/or criminal disorderly conduct. In contrast, those with Asperger’s syndrome live in residential care homes and attend mainstream colleges of further education. Hence, it was anticipated that the characters played by the individuals with Asperger’s syndrome would be more polite than the characters played by individuals with emotional and behavioural difficulties.

3. Pursuing a topic too little–pursuing topic too much: this dimension was selected to adduce ratings reflecting the autistic tendency for perseveration. For example, individuals with
Asperger’s syndrome are well known for incessantly talking about a single narrow topic (Ghaziuddin & Gerstein, 1996).

It was anticipated that the individuals with Asperger’s syndrome would be rated as emotionally flat, polite and pursuing a topic too much. The reverse was expected for the individuals with emotional and behavioural difficulties.

2. Method

2.1. Participants

Two young adult males with Asperger’s syndrome (D. and N.) and two adolescent males (P. and W.) took part in this study. Both males with Asperger’s syndrome had been diagnosed by experienced clinicians according to standard criteria (DSM-IV, American Psychiatric Association, 1994) and lived in residential care homes. Both adolescents attended a residential school for children with emotional and behavioural difficulties. At the start of testing, D. and N. were aged 23 years 4 months and 23 years and 2 months, respectively; P. and W. were aged 14 years 9 months and 14 years 10 months, respectively.

The form of investigation used in this study lends itself to a case study approach. Hence, a small number of participants were tested over many sessions and a large quantity of data was gathered for each person. A detailed profile of each individual could thus be constructed.

2.2. Materials

The principal piece of hardware was an Apple Macintosh Classic computer installed with Bubble Dialogue (Gray et al., 1991) and Hypercard. Fig. 2, shows the complete scenario ‘Tricia and Sue’, for Bubble Dialogue session 3.

In this scenario, Tricia has a lighter which she keeps in her handbag. While Tricia was away from her bag (in the toilet), Sue takes the lighter from Tricia’s bag (to use it) and then returns it. Crucially Sue puts the lighter in Tricia’s coat pocket, instead of returning it to Tricia’s bag. When Tricia returns from the toilet, both protagonists resume their conversation and Sue asks for a light for her cigarette, whereupon Tricia offers Sue the use of her lighter. When she goes to her bag, Tricia cannot find her lighter. Tricia has a false belief about the location of her lighter because it has been unexpectedly transferred. Tricia’s belief about the lighter has not been updated in accordance with the current state of reality (i.e., the current location of her lighter).

2.3. Measures

The carers most familiar with D. and N. were interviewed using the Vineland Adaptive Behavior Scales supplementary items (Frith et al., 1994). These additional items are composed of two sets: one set of 16 items relating to social behaviours which do not require a theory of mind and the other 16 relating to behaviours which reputedly do. Scores are obtained by
Fig. 2. Complete scenario for the third Bubble Dialogue scenario: false belief.

Tricia and Sue are in the pub. Tricia has just returned from the toilet. While she was gone, Sue took Tricia's lighter from her handbag and put it in Tricia's coat pocket.

That's better. I was desperate for the toilet.

You can have one of mine this time if you like.

Thanks Tricia, have you got a light?

Sorry I borrowed it when you were in the loo and put it in your coat pocket.

Here. I've got one of those cheap lighters in my bag.

That's funny, I'm sure I left that lighter in my bag.
interviewing carers and grading the items 2, 1 or 0 if the behaviours are done habitually, occasionally or never, respectively. Therefore, total scores reflect usage of theory of mind in everyday life.

The Wisconsin Card Sorting Test (Grant & Berg, 1948) is a widely used measure that assesses an aspect of inhibitory control (Baddeley, 1990), which is a defining feature of executive function. In the task, four cards are placed in front of a participant. They vary across three dimensions: colour, geometrical shape and number (e.g., a card may have two blue stars). The participants are asked to sort a deck of cards according to the target cards, but are not informed explicitly of the criterion for sorting. Feedback regarding each attempted match is given. The initial unstated sorting criterion is colour and after ten consecutive correct responses, the criterion is changed to shape, but without informing the participant.

For accurate performance, a recently learned response rule has to be inhibited. Individuals with autism show similarities to those who have frontal lobe damage because they tend to persevere sorting the cards using the previous rule, even when told their responses are incorrect (Ozonoff et al., 1991). Additionally, we used the British Picture Vocabulary Scale (Dunn, Dunn, Whetton & Pintilie, 1982), which provided an assessment of receptive verbal ability.

All three measures were administered to D. and N., both before and after the six Bubble Dialogue sessions. D., N. and their carers were debriefed about the tests after the second administration. P. and W. were not tested and participated in the Bubble Dialogue sessions only.

2.4. Bubble Dialogue sessions

The Bubble Dialogue sessions took about 1 hr each with the frequency of approximately 1 per week for 6 weeks. D. and N. were tested and had the Bubble Dialogue sessions in their own homes. P. and W. had the sessions in their school library.

The theory of mind-inspired scenarios (1)–(6) below, were given the following sequence (see Fig. 2 for an example of a scenario for ‘False Belief’). These scenarios incorporate the principles taught to children with autism in Hadwin et al.’s (1996) study.

1. Simple perspective taking
   Understanding sources of informational access: “seeing leads to knowing”
2. Complex perspective taking
   Understanding implications of physical disability
3. False belief
   Communicating with someone who holds a false belief
4. Deception–Lie
   Lying to a parent about your whereabouts
5. Deception–“White” lie
   Organising a surprise birthday party
6. Making a friend
   Introducing yourself to a stranger
2.5. Procedure

Each participant was shown the scenario for that session and read it as often as he wanted. Once ready, the experimenter clicked on the speech icon for the character he played. The experimenter always played the character whose turn it was to speak next (see Fig. 2). Once the experimenter had inserted into the speech Bubble what he wanted his character to say, he clicked on the thought icon. The speech Bubble disappeared and was replaced by a thought bubble. The experimenter proceeded to type in what his character thought and then clicked on the participant’s character’s speech icon. When the empty speech Bubble for the participant’s character appeared, the previous speech of the experimenter’s character reappeared. When the participant had typed what he wanted to say, the experimenter clicked on the thought icon for the participant and a thought Bubble replaced the speech bubble. Once the participant understood the procedure of clicking on the icons to bring up the thought and speech bubbles, that task was left entirely to him. The participant and experimenter continued the Dialogue until they either ran out of time or had exhausted all the avenues to progress further with the dialogue.

The participant was asked if he wanted to review what he had written. If he did, the experimenter clicked the review icon and both users had an opportunity to go back through the entire Dialogue and change whatever they wanted.

2.6. Rating Bubble Dialogue scripts

The speech and thought Bubble Dialogues for all four participants were transcribed. The scripts resemble play scripts or screen plays (see Appendix A, for example). Additionally, thoughts were italicized, so that raters could easily discriminate them from speech.

Thirty-three ‘blind’ raters were recruited to assess the Dialogue scripts. The raters were psychology third/final year undergraduates following a course in theory of mind. They knew, in advance, that some of the scripts were produced by participants with Asperger’s syndrome, but did not know which. They were randomly assigned to one of three teams (11 in each). Eleven raters rated all the four sets of six scripts (four participants, six scenarios), along one of three dimensions:

1. Emotionally flat–emotionally charged
2. Polite–coarse
3. Pursuing a topic too little–pursuing a topic too much

The raters were asked to rate the dialogues of both characters (one of which was played by the participant and the other played by the experimenter) by circling one line on a six point bipolar scale. The raters were deliberately not given any examples of what constitutes “emotionally flat or charged” and the same was true for the other two dimensions. The basis of interpretation was left to their own judgement and so a large number of raters (relative to the number of participants) were employed to ensure that even small effects would surface.

Since the discourse was between two people, the participants’ scripts should not be rated in isolation. Therefore, the raters were asked to rate the experimenter’s scripts as well. There were two scales, one for each character. The experimenter’s rated scores were then subtracted from
the participant’s. This gave a number which reflected the interaction between both Bubble Dialogue users and was subsequently analysed quantitatively. It reflected, for example, how emotionally flat or emotionally charged the participant’s character was relative to the experimenter’s. A negative value would indicate that the participant was rated emotionally flat relative to the experimenter. The subtracted ratings were then summed across the scenarios.

3. Results

As Table 1 shows, there was no difference before and after the Bubble Dialogue sessions, in the Vineland Adaptive Behavior Scales for D. and only a slight difference for N. Similarly, there was very little difference in the British picture vocabulary scales before and after the Bubble Dialogue sessions for D. and N. However, D. and N. show a striking improvement in Wisconsin Card Sorting Test, in terms of reduced perseverations and an increase in categories they managed to sort correctly.

After the experimenter’s Bubble Dialogue rated scores had been subtracted from the participants’ rated scores, these subtracted ratings were then summed across five scenarios (rather than all six). The scores for scenario number 5, for all four participants, were not included in the aggregation and subsequent analysis because D. only produced one sentence for the entire scenario.

Table 1
Test scores for young adult men with Asperger’s syndrome

<table>
<thead>
<tr>
<th>Test</th>
<th>Score: Pre Bubble Dialogue</th>
<th>Score: Post Bubble Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>For D.</td>
<td>For D.</td>
</tr>
<tr>
<td>Vineland Adaptive behavior scales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active score (Max. 32)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Interactive score (Max. 32)</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Executive function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WCST(^a) perseverations</td>
<td>105</td>
<td>28</td>
</tr>
<tr>
<td>WCST(^a) categories</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Verbal mental age:</td>
<td>14–9</td>
<td>12–5</td>
</tr>
<tr>
<td>Verbal IQ: (standardised score)</td>
<td>76</td>
<td>74</td>
</tr>
<tr>
<td>For N.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vineland adaptive behavior scales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Score (Max 32)</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>Interactive Score (Max 32)</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Executive function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WCST(^a) perseverations</td>
<td>65</td>
<td>9</td>
</tr>
<tr>
<td>WCST(^a) categories</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Verbal mental age:</td>
<td>12–8</td>
<td>14–7</td>
</tr>
<tr>
<td>Verbal IQ: (standardised score)</td>
<td>64</td>
<td>75</td>
</tr>
</tbody>
</table>

\(^a\) WCST: Wisconsin Card Sorting Test.
Fig. 3 shows a graphical representation of the blind ratings for the dimension emotionally flat to emotionally charged. The data were analysed using a one-way within subjects analysis of variance, with four levels: $F(3, 30) = 14.8$, $p < 0.001$. In order to identify the locus of significance, we conducted a series of $t$-tests, which are summarized in Table 2. For effects to count as significant, they had to reach the 0.008 level of

![Graphical representation](image)

**Participant**

![Aggregated scores across scenarios](image)

Table 2

Results of the paired-sample $t$-tests, for the dimension “emotionally flat–emotionally charged”

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$t(df = 10)$</td>
<td>$-5.000$</td>
<td>$-3.454$</td>
<td>$-4.805$</td>
<td>$0.361$</td>
<td>$-1.741$</td>
<td>$-2.119$</td>
</tr>
<tr>
<td>Significance (2-tailed)</td>
<td>0.001</td>
<td>0.006</td>
<td>0.001</td>
<td>0.726</td>
<td>0.112</td>
<td>0.060</td>
</tr>
</tbody>
</table>

Fig. 3 shows a graphical representation of the blind ratings for the dimension emotionally flat to emotionally charged. D. and N. have Asperger’s syndrome and P. and W. have emotional and behavioural difficulties. The top and bottom whiskers show the largest and smallest values which are not extreme scores (i.e., scores which are within 1.5 box lengths above or below the box). The top of the box shows the 75th percentile, the horizontal line shows the median (50th percentile) and the bottom of the box shows the 25th percentile.
probability according to the Bonferoni adjustment (significance level divided by number of paired comparisons, i.e., 0.05 \div 6). D.’s scripts were rated as emotionally flat relative to the three other participants. N.’s scripts were not rated differently from the two individuals with emotional and behavioural difficulties.

Fig. 4 shows a graphical representation of the blind ratings for the dimension polite to coarse. D. and N. have Asperger’s syndrome and P. and W. have emotional and behavioural difficulties.

Table 3
Results of the paired-sample t-tests, for the dimension “Polite–coarse”

<table>
<thead>
<tr>
<th>Pair</th>
<th>D.–N.</th>
<th>t((df = 10))</th>
<th>Significance (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>D.–N.</td>
<td>−4.963</td>
<td>0.001</td>
</tr>
<tr>
<td>Pair 2</td>
<td>D.–P.</td>
<td>−13.668</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Pair 3</td>
<td>D.–W.</td>
<td>−12.000</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Pair 4</td>
<td>N.–P.</td>
<td>−5.682</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Pair 5</td>
<td>N.–W.</td>
<td>−5.391</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Pair 6</td>
<td>P.–W.</td>
<td>2.101</td>
<td>0.062</td>
</tr>
</tbody>
</table>
scenarios by five. Significantly different ratings were made for the four participants: $F(3, 30) = 63.1, p < 0.001$. The $t$-tests summarized in Table 3 reveal that D. and N. are rated as more polite than both participants with emotional and behavioural difficulties. Additionally, D. was rated as more polite than N.

Fig. 5 shows a graphical representation of the blind ratings for the dimension pursuing a topic too little–pursuing a topic too much. D. and N. have Asperger’s syndrome and P. and W. have emotional and behavioural difficulties.

Table 4
Results of the paired-sample $t$-tests, for the dimension “Pursuing a topic too little–too much”

<table>
<thead>
<tr>
<th>Pair</th>
<th>Dimension</th>
<th>$t(df = 8)$</th>
<th>Significance (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>D.–N.</td>
<td>-3.625</td>
<td>0.007</td>
</tr>
<tr>
<td>Pair 2</td>
<td>D.–P.</td>
<td>-5.433</td>
<td>0.001</td>
</tr>
<tr>
<td>Pair 3</td>
<td>D.–W.</td>
<td>-4.839</td>
<td>0.001</td>
</tr>
<tr>
<td>Pair 4</td>
<td>N.–P.</td>
<td>-0.652</td>
<td>0.532</td>
</tr>
<tr>
<td>Pair 5</td>
<td>N.–W.</td>
<td>0.216</td>
<td>0.834</td>
</tr>
<tr>
<td>Pair 6</td>
<td>P.–W.</td>
<td>3.468</td>
<td>0.008</td>
</tr>
</tbody>
</table>
that raters judged the four participants differently: \( F(3, 24) = 11.3, \ p < 0.001 \). The \( t \)-tests summarized in Table 4 indicate that D. was rated as significantly pursuing a topic too little compared with the three other participants. The script ratings for the two participants with emotional and behavioural difficulties were on the cusp of being significantly different.

4. Discussion

4.1. Did the Bubble Dialogue experience facilitate interpersonal understanding?

It seems the experience of Bubble Dialogue, presented through six theory of mind-inspired scenarios, did not induce a detectable change in interpersonal understanding as measured by Frith et al.’s (1994) supplementary items for the Vineland Adaptive Behavior Scales. These results could be interpreted in four ways:

1. The experience of Bubble Dialogue induced an improvement in interpersonal understanding, but was too weak to be detected by any readily available test.
2. The Vineland Adaptive Behavior Scales in particular is not a sensitive enough measure to detect any such change, despite being a widely used clinical tool.
3. D. and N. do not have the ability to mentalize and the experience of Bubble Dialogue could not help to improve their interpersonal understanding.
4. D. and N. already possessed the ability to mentalize and the Bubble Dialogue experience was of no further benefit to them.

The Vineland Adaptive Behavior Scales scores, for both D. and N., were very similar to those of the children with autism who passed both first and second order theory of mind tests in Frith et al.’s (1994) study. Therefore, D. and N. may be amongst those individuals Happé (1993) calls the ‘talented minority’, and hence were able to mentalize in everyday life prior to the experience of Bubble Dialogue. In that case, interpretation 4 would appear plausible.

Irrespective of any measurable benefits, N., P., and W. often commented how engaging and enjoyable they found Bubble Dialogue. Therefore, as well as being interactive, Bubble Dialogue provides a humanistic and socially non-threatening way to engage in role-play and experience other people’s perspectives. D., in contrast, saw the sessions as a piece of creative English language work. At first he articulated a hope that Bubble Dialogue would provide him with a creative imagination, but as he progressed through the sessions he became increasingly disillusioned when he realised this was not going to happen.

4.2. Does Bubble Dialogue provide a link between theory of mind and executive function?

The control measures in the study were the British Picture Vocabulary Scale and the Wisconsin Card Sorting Test. The results, relating to the former, show very little difference in verbal ability before and after the Bubble Dialogues sessions (see Table 1). However, D. and N. show a striking improvement in the Wisconsin Card Sorting Test in terms of reduced perseverations and an increase in the number of categories they managed to sort correctly.
It seems unlikely that there was general improvement in overall functioning because the verbal ability scores are similar for D. and N. before and after the Bubble Dialogue experience. This suggests that there was no ‘across-the-board’ increase in cognitive function arising from either experiencing Bubble Dialogue or developmental changes.

Ferland, Ramsay, Engeland and O’Hara (1998) found that clinically normal male participants showed little evidence of gaining in performance after repeated administrations of the Wisconsin Card Sorting Test. Ferland et al.’s (1998) normal male group ($n = 22$) scored a mean of 11.0 perseverative responses on the first administration of the test and 6.6 on the second. These results suggest that the scores are consistent over repeated testings. Additionally, Ozonoff (1995) found that the Card Sorting Test was extremely reliable in eliciting stable scores, when individuals with autism were re-tested after two years.

Prior to the Bubble Dialogue intervention, D. and N.’s scores (see Table 1) were remarkably like those of Ferland et al.’s (1998) brain injured group. D. and N.’s scores improved on re-test after Bubble Dialogue and notably N.’s scores became almost identical to Ferland et al.’s (1998) normal group.

Interestingly, perseveration may not be characteristic of individuals with Asperger’s syndrome who show normal scores on the Wisconsin Card Sorting Test (as D. and N. do on post-test), because according to Shallice (1988) individuals who do not perform like frontal lobe damaged patients on the Card Sorting Test have an intact Supervisory Attentional System. This is a device which allows a person to switch attention. Norman and Shallice (1986) state that a particular response may be thought of as the outcome of a computer program working through its algorithm, where the Supervisory Attentional System allows that program to change once it has started running. Shallice (1988) uses this computational analogy to explain that once an internal program has been set (e.g., sort by colour) it cannot be changed if there is damage to the supervisory attentional system.

It could be argued that aspects of Bubble Dialogue require executive function because the, “Supervisory attentional system is construed as being necessary for effective control of action in a number of situations: Situations that involve planning or decision making; situations that involve error correction or troubleshooting; situations where responses are not well learned or contain novel sequences of actions; situations judged to be dangerous or technically difficult; and finally situations that require the overcoming of strong habitual response or resisting temptation” (Evans, Chua, McKenna, & Wilson, 1997, p. 636).

When using Bubble Dialogue, thoughts (which are normally private and hidden) become public and visible and so the users have access to the thoughts of each other’s character. The users are literally able to mindread. If a user plays ‘correctly’, then their character will not act upon the knowledge that resides in the private thoughts of the other user’s character. This ability requires the inhibition/impulse control of actions that might stem from knowledge acquired from the other character’s thoughts. Additionally, using Bubble Dialogue requires flexibility of thought and action, along with planning in how next to progress in the dialogue. Hence, it may be the practice of these executive processes, engendered by Bubble Dialogue, which brought about the reduction of perseveration on the Card Sorting Test.

It could be that development in executive function precedes changes in mentalizing and that is why D. and N. showed improved scores in the test of executive function without concomitant improvements in verbal ability. Indeed, there might be a time lag before we see
parallel improvements in measures of verbal ability. Another possibility is that since scores of verbal ability were commensurate with an ability to mentalize, there would be no remaining scope for improvements in executive function to facilitate mentalizing any further.

4.3. Blind ratings of Bubble Dialogue transcripts

The blind rating of transcripts provides a third-party perspective on the formulation of speech and thought by people with Asperger's syndrome. The Bubble Dialogues D. and N. produced were rated as the most emotionally flat of the four participants. These results support Hobson's socio-affective theory and Kanner's original clinical observations that individuals with autism are impaired in their social and emotional connectedness. D. and N.'s Bubble Dialogues were also rated as the most polite of the four participants. These results show that despite their lack of affect, some individuals with Asperger's syndrome can be viewed as polite.

D.'s characters were rated as pursuing a topic too little relative to the experimenter's. This dimension may have been picking up the lack of social reciprocity in D.'s characters, rather than perseveration. The raters might have viewed D.'s characters as not being sensitive or responsive enough, which they characterised as 'pursuing a topic too little'.

The blind rating analyses of the three dimensions, show that although D. and N. have the same diagnostic label of Asperger's syndrome, the Bubble Dialogue scripts they produced were sometimes rated differently from each other. Indeed, N.'s adduced ratings were not significantly different from the adolescents with emotional and behavioural difficulties, along the emotionally flat-charged and pursing a topic dimensions.

Does this mean N. was incorrectly diagnosed? This seems unlikely. The rating differences perhaps highlight that even individuals with the specific label of Asperger's syndrome can vary. It may also be that for some individuals with Asperger's syndrome, Bubble Dialogue elicits social interactions indistinguishable from other populations. The implication is that computers can be used to elicit more 'normal' social interactions in individuals with Asperger's syndrome (cf., Swettenham, 1996).

4.4. The future role of computers in dialogue

Speaking to someone in person requires an enormous amount of information to be processed. We have to attend not only to the words themselves, but also to the person's intonation, their facial expression and so on. A lot of information is, therefore, processed rapidly and seemingly effortlessly by clinically normal people. In contrast, individuals with Asperger's syndrome and autism are known to have sensory-perceptual abnormalities (O'Neill & Jones, 1997) which may result in overload by too much multi-sensory information. Computers slow down the experience of communication, by offering individuals more time to compose a response. Additionally, Bubble Dialogue allows the chance to 'go back' (in review mode) and change what was said; something we cannot (sadly) do in everyday conversations.

Arguably the greatest benefit of computers to individuals with Asperger's syndrome, is that they offer a radically different mode of social engagement. The way people communicate is already changing and potentially this is very beneficial to individuals with autism. Computer-
mediated communication through e-mail, chat rooms and virtual reality environments may allow individuals with Asperger’s syndrome to overcome some of their social problems. Therefore, it would be somewhat ironic if individuals with autism, who are stereotypically thought of as unemotional logic-driven machines, become more integrated into society through information technology.

The results from this study suggest that future research needs to be directed at developing experiential interventions, and investigating their efficacy in improving social understanding in individuals with Asperger’s syndrome. Furthermore, the use of computer software, like Bubble Dialogue, provides an engaging and humanistic way of facilitating this. The methodology of using blind raters is a technique that can be applied to other investigations. It is suitable for experiments where it would be valuable to obtain third party measures of scripts produced by participants from any source. Additionally, more research needs to be carried out detailing the cognitive neuropsychology of autism and using the theory of mind and executive function paradigms to provide a comprehensive theoretical picture of autism.

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Appendix A

Scenario Tricia and Sue are in the pub. Tricia has just returned from the toilet. While she was gone, Sue took Tricia’s lighter from her handbag and put it in Tricia’s coat pocket.

Tricia says “That’s better I was desperate for the toilet.”
Sue says “I need another cigarette.”
Tricia says “You can have one of mine this time if you like?”
Sue says “Thanks Tricia, have you got a lighter?”
Tricia says “Sure I’ve got one of those cheap lighters in my bag. That’s funny. I’m sure I left that lighter in my bag.”
Sue says “Sorry, I borrowed it when you were in the loo and put it in your coat.” (Rate from here onwards)
Tricia says “I could have sworn that lighter was in my bag.”
*Tricia thinks* “I wonder if Sue played a trick on me?”
Sue says "No, I put it in your pocket or maybe you've put it in my pocket? Well, wherever it is I'm not responsible, and you should have seen where you have put it in the first place.'" 

Sue thinks "Boy I feel strange today!'"

Tricia says "Sorry there's no need to get upset. I was just certain the lighter was in my bag and when I looked, it wasn't there anymore.'"

Tricia thinks "Sue is certainly very moody today. I wonder why she is so touchy?'"

Sue says "Are you trying to make me feel guilty for what I've done?'"

Sue thinks "What is she implying?'"

References


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