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Computer mediated imaginative storytelling in children with autism

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Abstract

The imaginative abilities of children on the autistic spectrum are reportedly impaired compared to typically developing children. This study explored computer mediated story construction in children with autism and typically developing peers. The purpose was to explore expressive writing ability, as a measure of imagination. Ten pairs of individually matched children (one typically developing and one child on the autistic spectrum) aged between seven and nine created reality and fantasy based stories using Bubble Dialogue software. The study provided a brief starting point for the stories, relying on the imaginative capabilities of the children to develop the stories beyond the story opening. The study contributes to the literature as an alternative to paper based studies of imagination given the known appeal of technology to most children, particularly children on the autistic spectrum (Gal et al., 2005). This study found that the children with autism were as able as the typically developing children to engage with the task, although qualitative differences in their responses were recorded.

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Keywords: Autism; Computer mediated storytelling; User experience

1. Introduction

Defining imaginative thought is both a difficult and context dependent task. Some definitions of imagination involve the formation of mental images, states of mind such as daydreaming, planning possible courses of action, and creating novel or original ideas. These are the requisite abilities for good story telling, that is to imagine what another person might be thinking and the ability to visualise being in a fantasy context, such as possessing super-hero powers (Ward, 1994). In previous work capturing imaginative thought has been achieved through studies of spontaneous and elicited pretend play, and investigating imaginative drawing and poetry (Brechet et al., 2007; Ford and Rees, 2008). However, much of this work has been with typically developing children; there is more limited research on the use of the story telling technique with individuals with autistic spectrum disorders (ASD) who are diagnosed according to difficulties in communication, social skills and imagination (Frith, 1989).

It can be argued that storytelling should be considered as an effective method of tapping into the imagination of children with an ASD for several reasons. One of the main reasons is that as an everyday day activity it is a naturalistic methodology, and as such is likely to benefit individuals on the autistic spectrum (Bara et al., 2001; Yirmiya et al., 1998).

There are various definitions of story; here a story is defined as a temporal sequence of events involving purposeful characters (Bruner, 2002; Dautenhahn, 2002; Porter Abbott, 2008). The presentation of a story (also known as narrative) may be achieved through many media (for example, through spoken or written word and pictures) and involves perspective taking and meaning making (Davis, 2008). In the current research, children’s imaginative story telling abilities were explored through a computer based task. Children with ASD have regularly been observed to find computers highly motivating (Davis et al.,...
A number of computer programs have been designed to elicit narratives from children. For example, Aylett et al. (2005) have designed a virtual storytelling platform to deliver a school based anti-bullying intervention. Davis et al. (2006) have developed an interactive game (TouchStory) to assess the understanding of narrative comprehension in children with autism using picture stories, and Ho et al. (2009) report on an extension of the TouchStory project in which a virtual reality interactive interface encouraged narrative storytelling by children on the autistic spectrum. In the current study, the program used is Bubble Dialogue (Cunningham et al., 1992). This program has been used to investigate a number of populations with additional needs, with a focus on children with emotional and behavioural difficulties and autistic spectrum conditions. For example, Jones et al. (1998) used Bubble Dialogue to explore conflict resolution strategies in children with, and without, emotional and behavioural difficulties (EBD).

Bubble Dialogue creates the experience of role-play in a comic strip environment, with two users each role-playing a character to develop a narrative. The program regulates turn taking and serves as an interface between users as they type their dialogue into conversational bubbles. Two modes of conversation are permitted, public speech and private thoughts, allowing each user to reflect on speech as dialogue and thought content as something distinct from speech. One advantage of the Bubble Dialogue software is that it can reveal the extent to which children on the autistic spectrum understand the speech/thought distinction. To create a successful dialogue, it is important that users understand the concept of public and private speech. To complete a successful dialogue, participants must not act on the knowledge gained from reading what the other character is thinking. They must ignore this information and continue with their dialogue, acting only upon what is said between the characters (Diehl et al., 2006). To achieve such appropriate responses, the child needs to exercise restraint; that is s/he must inhibit inappropriate responses. This is similar to withholding a response to the “go/no-go” trials widely used to test stop-signal inhibition (a go/no-go test requires a participant to perform an action given certain stimuli, for example, to press a button (to go), and inhibit that action under a different set of stimuli, for example, not to press that same button (no-go)).

Inhibiting responses is critical to optimal cognitive and behavioural function across many domains. Several studies have found impaired voluntary response inhibition by participants with autism on a go-no-go task (Luna et al., 2007; Ozonoff et al., 1994), although Luna and her colleagues did show a robust developmental improvement for such individuals, indicating a capacity for improving voluntary response inhibition. In addition, the ability to understand the speech and thought bubble distinction is predicted by the theory of mind hypothesis to be more difficult for the children with autism than for the typically developing children (Wellman et al., 1996), although this has been challenged by Parsons and Mitchell (1999, 2002), who have confirmed the understanding of thought bubbles in children with autism.

Flower and Hayes’ (1981) cognitive model of writing defines story construction as a problem solving activity that is, in part, dependent on the task context. Here, a key consideration of the importance of the environment and task structure is the nature of the dyad using the Bubble Dialogue; that is whether children are paired alongside other children, or whether they are paired with an adult. Rogoff (1990) has outlined the impact that the nature of a group has on learning outcomes in any collaborative endeavour. She suggests that children maximise their developmental potential (within their zone of proximal development, Vygotsky (1978)) with the support of experienced social partners through guided participation in a culturally valued activity. She offers evidence to show that the benefits of such peer tutoring are task dependent. For tasks such as learning to plan, or for memorising lists, children benefit from the tutoring available when working with a more skilled partner. Such tutoring is beneficial whenever the learner needs to acquire information or skills that fall within their current conceptual reach. If the learner is required to come to an understanding of new principles, then interaction with equal peers will prove more beneficial.

Lave and Wenger’s (1991) apprenticeship model of learning suggests that apprentices learn to think, argue, act and interact in increasingly knowledgeable ways with people who do something well, by doing it as legitimate peripheral participants. The pairing of children with autism alongside typically developing peers has proved to be successful for children with autism in other studies (Jordan, 2003). Gal et al. (2005) have reported similarly positive results from a collaborative computer based story construction task, which is important for this study.

1.1. Aims and hypotheses

Two core hypotheses were explored here. The first concerned the ability of children on the autistic spectrum to produce expressive text when engaged in a computer-based story construction task alongside a typically developing peer. There is a large, although equivocal body, of previous research exploring imagination in autism that suggests an overall deficit in this ability (Boucher, 2009). Based on findings from previous research it was expected that the input towards each story would be rated as less imaginative across a range of measures for the children with autism compared to the typically developing children. However, basic text production measures (such as the
length of narrative and narrative coherence) were not expected to vary significantly by group.

Based on evidence that children on the autistic spectrum can have executive function difficulties, it was also hypothesised that the target children will show poorer inhibitory control than the controls and that this would manifest itself in the misuse of the thought bubbles.

2. Method

2.1. Design

The 2 × 2 mixed design consisted of one within subjects variable with two levels; story context (fantasy, reality) and one between subjects variable with two levels; group (autistic, typically developing).

2.2. Participants

Twenty children participated in this study, ten high functioning children with autism and ten typically developing children. The often cited difficulties in maintaining interpersonal relationships and working alongside others meant that the choice of typically developing peer selected was of critical importance as a mismatch could result in underperformance of the child with autism (see Jordan and Howlin, 2005; Warreyn et al., 2005).

Ten dyads based on established friendship patterns (advised by the parents of the children with autism) were created. These consisted of one child with autism and one typically developing child. There was no sex, chronological or verbal mental age constraint placed on the dyad formations. This resulted in one all girl dyad, six all boy dyads and three mixed sex dyads in which the boys had received a diagnosis of autism and the girls were the typically developing peers. None of the control children had ever received a diagnosis of an autistic spectrum condition and had no other known conditions that would affect the results of this study. All the children with autism had received a diagnosis from a trained clinician prior to this study. Although no formal matching procedures were implemented, since the experimental task required some degree of language ability, in order to ensure that any differences between the groups were due to differences in task performance rather than to a priori discrepancies in language abilities (Burack et al., 2004), verbal mental age for each child was calculated using the Test for the Reception of Grammar (Bishop, 1983).

Group characteristics are presented in Table 1. Despite the lack of overt matching according to chronological age or verbal mental age, there were no statistically significant differences between the groups for these measures, indicating that both groups were operating at a verbal mental age similar to their chronological age, and that both groups were operating at approximately similar levels of verbal mental age. Analyses also revealed no significant differences within each of the pairs, that is no differences were found between the target and control child for any pairing across age or verbal mental age.

2.3. Apparatus and materials

The Bubble Dialogue software was presented on an Apple Macintosh ibook laptop computer. Two story scenarios were created, a reality based story of friends visiting each others houses after school, and a fantasy based story about aliens living on an unknown planet. Libby and Aries (1989) have shown that girls tend to tell stories about other girls, and boys mainly about boys. The software enables the characters presented to the user to be changed according to the needs of the research. Thus, all children took on the role of a same sex character as themselves in the reality based scenarios. This was not an issue for the fantasy based scenarios as the characters were designed to be unisex. The pictorial representations of each character were kept simple in an attempt to avoid constraining the children’s developing dialogues (Spinillo and Pinto, 1994). Figs. 1 and 2 show examples of the first and subsequent screens that the users see. They show the relatively simple interface design, which Grynszpan et al.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Chronological age ((\text{mean (S.D)})))</th>
<th>Verbal mental age ((\text{b, mean (S.D)})))</th>
<th>Centile ((\text{c, mean (S.D)})))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children on the autistic spectrum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>8.96 (1.28)</td>
<td>8.4 (3.56)</td>
<td>50.41 (33.96)</td>
</tr>
<tr>
<td>Male=9</td>
<td>Female=1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typically developing children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>8.60 (0.90)</td>
<td>9.07 (1.86)</td>
<td>54.50 (29.59)</td>
</tr>
<tr>
<td>Male=6</td>
<td>Female=4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Age and verbal mental age in years and months.

\(^b\) Measured by the test for the reception of grammar (TROG).

\(^c\) Centile indicates where the groups lie in relation to test norms on the TROG.
(2008) have shown to be more effective with individuals with high functioning autism than more complex interfaces.

Fig. 2 shows the second screen that the children saw. It clearly shows the thought and speech bubbles for each character before any text is entered. In this example, the bubbles have the word ‘new’ inserted into them. This disappears once a bubble is selected for use, and does not appear on subsequent screens that the children see. This is an integral feature of the software that cannot be altered and was used as a way to explain to the children how to proceed with the task. Once selected, the bubble of choice increased in size to both allow text to be entered, and to provide the children with a clear visual reminder of their bubble choice.

2.4. Procedure

The study was completed in the parental home of the child with autism. Following a period of introductions and familiarisation between the children and researcher, both the target and control child received an explanation of what the task involved and their consent to taking part in the study obtained. The children completed a practice scenario before moving on to complete the two story scenarios. During this practice, the children were encouraged to make use of both thought and speech bubbles in order to familiarise themselves with their use. The researcher explained what each of the bubbles was for and when it was appropriate to use them to tell their story during this time. The completion of the practice scenario was important as it enabled the researcher to check the children’s understanding of the distinction between thought and speech bubbles before completion of the real scenarios.

The order of presentation of the scenarios was counterbalanced across the dyads, so half the dyads completed the fantasy and then reality based scenario, and the other half completed the reality then fantasy based scenario. At each turn of the ‘conversation’, the children had a free choice as to whether they entered text into the thought bubble, speech bubble, or into both for each conversational exchange for their character. Most children typed their own text into the bubbles, but at the request of the children, two of the children with autism and one control child dictated text to be entered by the first author. This request was upheld as it was inferred to relate to under-confidence with using the laptop and not because the children had any issues with writing or typing skills. Where this was the case, the adult sat next to one of the children and the two children sat together. In the majority of pairings, where no assistance with typing was given, the researcher sat close behind the children. In all cases data collection took place in a quiet, downstairs room. Parents remained close by but not in the room where the study was undertaken. At no point was the researcher left entirely alone with any child. No time limits were imposed on the children; all sessions finished when it became clear that the children had no more to contribute. This was judged in one of two ways: either one, or both, children stated explicitly that they had finished, or their behaviour was off-task for a sufficiently long enough period to prompt the researcher to ask if they had finished. Following the session a printed copy of the stories were created and given to each of the children.

2.5. Measures

Two types of performance measures were taken from the story transcripts; those which established whether the children were capable of completing the task (Task Competency), and those which established how much of the stories the children understood (Task Comprehension). The measures used here were, in the main, taken from previous work exploring similar issues to this study and are considered to be standard measures in story telling research.

2.5.1. Task competency

Three measures of task competency were recorded in this study. These were as follows:
2.5.1.1. Length of narrative. Narrative length is a frequently used measure in story telling research (Diehl et al., 2006). In this study, narrative length was calculated as the total number of words in each story. These were calculated from the typed story transcripts.

2.5.1.2. Bubble use. The way in which the children used the thought and speech bubbles to tell their stories was of particular interest here. A frequency count of the number of speech bubbles, thought bubbles and the total number of bubbles used by each half of the dyad was conducted for each story as a way to investigate the children’s natural understanding and proclivity towards using the two bubble types. Each child, therefore, received their own score representing the total numbers of bubbles they used, and the numbers of speech and thought bubbles they each used.

2.5.1.3. Inappropriate use of bubbles. An assessment of the inappropriate use of bubbles, termed “error” was made here. A frequency count was conducted of the number of occasions where the children made some reference to text entered into the thought bubbles by their counterparts. The number of thought bubbles that the other half of the dyad had used was summed and this was taken as a measure of the potential number of errors that a child could make. Thus, a percentage error rate was calculated for each child based on the potential number of errors that could have been made, and the actual number of errors that were made. By definition, errors could not be made in relation to speech bubble use in this sense. The only error that could be made in relation to the use of speech bubbles would be to use it as a thought bubble, although no evidence of this type of use was found throughout the study and so this type of error is not given further consideration here.

2.5.2. Task comprehension

Three measures of task completion were recorded in this study.

2.5.2.1. Narrative coherence. Narrative coherence refers to a global representation of story meaning and related links, including the temporal and causal structure of a story (Diehl et al., 2006; Karmiloff-Smith, 1985). By assessing coherence it is possible to determine the children’s ability to draw upon their imagination to aid understanding of the two story types (fantasy and reality) and ultimately their ability to link features of the pictures together to form a logical account/description of the action occurring. It also serves as an indicator of a propensity to focus on trivial rather than global parts of a picture as an index of central coherence (Beaumont and Newcombe, 2006).

Each child’s narrative was scored according to a four point linear scale (see Fig. 3) ranging from zero (no mention of appropriate action) to three (explains action in a coherent logical manner with the use of all salient features). The scales for narrative coherence and elaboration were closely based on those devised by Sternberg (2006).

2.5.2.2. Elaboration. The measure of elaboration is a measure of the child’s ability to develop the stories and characters from their original starting points. It serves as an indicator of the children’s ability to use their imagination to develop the story. The elaboration scale (see Fig. 4) was devised to take into consideration both the development of the characters (evidenced by the attributing of personality traits and names) and also the development of the story beyond its initial starting point. The scale devised for this measure was again based on a four point Likert scale with scores ranging from zero (no elaboration on either characters or story development) to three (coherent development of both story and character beyond original starting point).

2.5.2.3. Mental state terms. Using terms established by Baron-Cohen et al. (1985) such as ‘think’ and ‘know’, a frequency count of mental state terms children used in their narratives in relation to the characters was taken.

<table>
<thead>
<tr>
<th>Score</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - No Coherence</td>
<td>No mention of appropriate action.</td>
</tr>
<tr>
<td>1 - Weak</td>
<td>Mention of fragments of the action but with no logical order.</td>
</tr>
<tr>
<td>2 - Intermediate</td>
<td>Explains the action in a logical manner with features linked together, but fails to acknowledge all salient features.</td>
</tr>
<tr>
<td>3 - Good</td>
<td>Explains action in a coherent logical manner with the use of all salient features.</td>
</tr>
</tbody>
</table>

Fig. 3. Narrative coherence scale.
Each reference to a mental state term used was assigned a score of one, and there were no limits to the score a participant could obtain on this measure.

3. Results

A second rater also calculated all measures for two of the ten dyads (four children). Cohen’s kappa was used to determine the consistency of the coding and a high degree of inter-rater reliability was found between the ratings (all ratings were above the agreed criteria of 0.75 as the lowest cut off; Siegel and Castellan, 1988). Table 2 presents the descriptive statistics for each measure. Overall, performance between the two groups across the measures appears to be fairly similar. The descriptive statistics show that both groups were capable of constructing a narrative that was coherent and which drew together the salient features of the story. The children in both groups produced stories that were, on average, shorter for the fantasy based story than for the reality based story, although standard deviations were high within the groups, indicating large variations in story length within each group.

Analysis of overall bubble use by the two groups indicates that they used a similar number of bubbles to produce both the fantasy and reality based stories. Whilst it appears that there is little difference in speech bubble use, there does appear to be a slightly higher use of thought bubbles by the typically developing children in comparison to the children with autism for both story conditions.

Table 2 also shows that the children with autism made more errors in thought bubble use than the controls. Closer inspection of the scores revealed that both groups of children made more errors in the fantasy based condition than in the reality based condition. The high standard deviations presented in Table 2 reflect the fact that in each condition there were a number of children who either scored at ceiling (a 100% error rate) or at floor (a 0% error rate). The standard deviations also reflect a more varied error rate for the children with autism in comparison to the typically developing children. For the measures of story coherence, elaboration and mental state term use, a fairly even profile of performance between the two groups is evident.

The average score from both stories was computed and Mann Whitney U analyses conducted for each measure with group (autistic, typically developing) as the between subjects factor and scores on each measure combined as the dependent variable. There was no significant difference

<table>
<thead>
<tr>
<th>Score</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - No elaboration</td>
<td>On either characters or story development.</td>
</tr>
<tr>
<td>1 - Weak</td>
<td>Some evidence of the development of character description and/or story beyond action given, although no elaboration of such detail given.</td>
</tr>
<tr>
<td>2 - Intermediate</td>
<td>Elaboration of either story or character with elaboration in coherent format and not fragmented.</td>
</tr>
<tr>
<td>3 - Good</td>
<td>Coherent development of both story and character beyond original starting point.</td>
</tr>
</tbody>
</table>

Fig. 4. Elaboration scale.

| Table 2 Descriptive statistics for the measures of task competency and task comprehension. |
|-----------------------------------------------|-----------------------------------------------|
| N=20                                          | Total                                         |
|                                               | Autistic                                      | Control                                      | Between groups critical value* |
| Story length (number of words) mean (S.D)     | 64.41 (51.74)                                 | 60.27 (50.22)                                | 60.00                         |
| Total number bubbles used per child mean (S.D)| 5.32 (2.61)                                   | 5.41 (2.80)                                  | 58.50                         |
| Number of speech bubbles used per child mean (S.D)| 4.18 (2.48)                                 | 3.73 (2.28)                                  | 49.50                         |
| Number of thought bubbles used per child mean (S.D)| 1.14 (2.00)                                 | 1.64 (1.62)                                  | 45.50                         |
| Inappropriate use of bubbles (% error)        | 24.32 (40.85)                                 | 7.73 (22.62)                                 | 45.50                         |
| Story coherence (0–3) median (inter-quartile range) | 2 (2)                                        | 2 (1)                                        | 55.50                         |
| Elaboration (0–3) median (inter-quartile range) | 2 (1)                                        | 2 (1)                                        | 55.50                         |
| Number of mental state terms mean (S.D)       | 0.87 (1.35)                                   | 0.69 (0.96)                                  | 53.50                         |

*Critical values from the Mann Whitney U tests comparing scores between the two groups.
between the overall performances of the target and control children on any of these measures.

A second series of analyses investigated differences in the children’s collective response to the fantasy and reality based stories. The results of the Wilcoxon test found that as a whole, the children narrated more coherent fantasy based stories than reality based stories (Story coherence \( n=20 \) \( T=-2.00, p<0.05, \) one tailed), although they elaborated more frequently in the reality based stories (Elaboration \( n=20 \) \( T=-2.11, p<0.05, \) one tailed).

A further series of Mann Whitney U tests with group (autistic, typically developing) as the between subjects factor and each of the measures for the fantasy and reality based conditions as the dependent variables were also conducted and no group differences were found any of the measures.

Such findings suggest similar overall performance of both groups of children. Whilst there appears to be no differences between the groups, overall differences in the way the children collectively responded to the fantasy and reality based stories were apparent, with both groups narrating more coherent fantasy based stories than reality based stories but more elaborate reality based than fantasy based stories.

3.1. Explanation of the findings

It was anticipated that the use of Bubble Dialogue would provide further insights into the ways in which the children engage with fantasy and reality based story construction through not only the dialogue they type, but also how they choose to tell their stories through their characters’ thought and speech bubbles. Predicated on the theory of mind hypothesis, children with more developed theory of mind, namely the typically developing children, were expected to use speech, and particularly thought bubbles, more effectively than the less skilled children with autism (Wellman et al., 1996). A difficulty in understanding the public and private entities of the speech and thought bubbles was also a difficulty in understanding the public and private entities of the speech and thought bubbles was that comments made in thought bubbles are not a speech bubble which potentially highlights an interesting to note, however, that the child with autism thought bubbles should be kept as a private entity. It is interesting to note, however, that the child with autism (George) does act on this information, albeit in the form of another thought bubble, by stating that if they do go to the park later the skateboard ramp will be clear. This is not information that that is ‘spoken’ aloud, it should not be acted upon by the other child. However, the child with autism (George) does act on this information, albeit in the form of another thought bubble, by stating that if they do go to the park later the skateboard ramp will be clear. This is a clear violation of the fact that text entered into the thought bubbles should be kept as a private entity. It is interesting to note, however, that the child with autism uses a thought bubble to respond to this information, and not a speech bubble which potentially highlights an awareness of the rules surrounding thought bubble use.

In this extract, as part of the dialogue the typically developing child (Harry) enters text into a thought bubble outlining his desire to play on the skateboard ramp. As this is not information that that is ‘spoken’ aloud, it should not be acted upon by the other child. However, the child with autism (George) does act on this information, albeit in the form of another thought bubble, by stating that if they do go to the park later the skateboard ramp will be clear. This is a clear violation of the fact that text entered into the thought bubbles should be kept as a private entity. It is interesting to note, however, that the child with autism uses a thought bubble to respond to this information, and not a speech bubble which potentially highlights an awareness of the rules surrounding thought bubble use.

In comparison, extracts 2 and 3 demonstrate some level of awareness that comments made in thought bubbles should not be acted on:

Extract 2 from the fantasy based story:

Ping=Typically Developing Child (P3), Zing=Child with Autism (P4)
Ping says: What shall we play?
Zing says: We shall play rodent with zap guns.
Ping thinks: He will never catch me. I'm too fast.
Zing says: I can read minds—I just heard what you said.
Ping says: Oh well, I don’t care. You'll still never catch me.

**Extract 3 from a fantasy based story:**

Zing = Typically Developing Child (P5)
Ping = Child with Autism (P6)

Zing says: What shall we play.
Ping says: Alien tig.
Zing says: How about alien hide and seek?
Ping thinks: That’s a stupid game.
Zing says: I used my special alien powers to see what you are thinking and you said you didn’t want to play hide and seek.
Ping says: Well your powers are rubbish.

**Extract 4 from the reality based story**

George = Typically Developing Child (P7)
Harry = Child with Autism (P8)

George says: You’re not playing. I’m not coming round to your house because it stinks. You best not invite me round again.

George thinks: Oh, come here Harry. Why don’t we play a game?

Harry says: Well, if you’re going to act like that with me, well you’re not coming to mine and I’m not playing with you.

Harry thinks: Well, if George is thinking of that, what can I think of for him not to come round.

There was generally no aggression and little off-task behaviour or comments demonstrated by the all girl and mixed sex dyads. Whilst the all boy pairings did complete the tasks, the comparative increase in off-task comments for these groups suggests that managing the pairings is a crucial part of the story construction research process.

Previous research suggests children use more mental state language when they interact with friends or siblings than when interacting with their parents (Brown et al., 1996). This is confirmed by Dunn’s (2000) finding that different types of relationships and contexts affect children’s use of mental state references. It was anticipated that the children in this study would actively incorporate such terms into their narratives. However, this was not the case as, on average, each story elicited use of a mental state term on only one occasion from the children. This overall use of an impoverished language is one possible explanation of the lack of difference in the use of mental state terms between the groups. It may be that the use of the Bubble Dialogue software placed extra demands on the children, resulting in less of a focus on the characters in the stories given and more on the operation of the software.

One of the complexities created by the design of this study was the pairing of the children. The nature of the pairing of the children was crucial to outcomes on performance measures, an assumption that drew heavily on Rogoff’s (1990) work. In order to successfully complete this study, the children in each dyad necessarily had to engage in turn taking behaviour (a type of interaction that is mutually regulated, reciprocal and harmonious). Managing turn taking during an interaction is not something one person can do, or a state one person can be in alone. Rather, it is a state in which the actions of each partner are reflected back to the other. This type of interaction is thought to represent a crucial developmental achievement that is suggested may facilitate social, emotional and cognitive growth for the child. Thus, during the task the children were reliant upon one another’s responses in order to facilitate the development of the story and this necessarily impacted on individual performances. This reliance on working together followed by a separating out of the data is a potentially problematic issue. One might argue that it is the collective responses of each pair that should be entered into the analyses given the dependency on each child’s response by the other half of the dyad. However, this is not the stance taken here. Whilst there was a high
degree of dependency on the other half of the dyad required to complete the task, the children were also operating with some degree of autonomy; that is their responses were not fully contingent on the responses of the other half of the dyad. This autonomy in response is reflected, for example, in the measures of bubble use; that is the choice of which of the thought and speech bubbles the children entered text into. Whilst it was necessary for the children to take turns in entering text, the type of bubble that they chose to use for this task was very much their decision (thought or speech).

3.2. Concluding remarks

One of the aims of this study was to investigate the ability of children with high functioning autism to engage in a collaborative, imaginative story construction task using a computer based medium. Findings suggest that the children with autism were as able as the typically developing children to engage in the creation of stories given either a reality or fantasy based prologue as a starting point. There was no difference in the performance of the target and control groups on a range of simple, quantitative measures, including story length, elaboration and, more surprisingly, on use of emotional state terms. The latter finding is explained by the poverty of overall language use, rather than the children with autism using an unanticipated rich language.

In the same vein, although the anticipated poor performance of the target group on the fantasy compared to reality storylines study did occur, this was also true for the control group. Lack of coherence in the story telling of children with autism was a concern for Davis et al. (2009). In this study our target children were able to perform at the level of their typically developing peers for coherence, although performance on this measure suffered in the reality task. Both groups elaborated more in the reality based than fantasy based stories, suggesting greater ease in working with these stimuli. However, in terms of coherence, that is the logical sequencing of the story, both groups of children showed a more robust performance in the fantasy stories. While both groups were able to understand and respond to the fantasy story appropriately, we surmise that this might be because they lacked the real world experiences to underpin their imaginative abilities in the fantasy task.

Turning now to the use of speech and thought bubbles, children from both the target and control groups demonstrated violations in bubble use; that is commenting on information contained in the thought bubbles. However, there were qualitative differences in the way these errors were made. The control group made no references to any errors made. This might suggest a lack of awareness of the violation (i.e. information contained in the thought bubbles was acted upon with no suggestion that the children were aware that they should be not be acting upon this information), or an indifference to those violations.

In contrast, the children with autism showed awareness of rule violation whenever such a behaviour occurred. This was demonstrated by the innovative and imaginative methods of referring to information they should not have operated upon. Given there is a wealth of previous research suggesting that creative and imaginative thought can be difficult for children with autism, this is an interesting result that was not expected given previous research. This apparent need to justify their behaviour needs further research. It may be that these high functioning children with autism, although exhibiting impaired social interaction characteristic of their group, from past experience are sensitised to the need to explain their behaviours in social situations (see Frith, 1989). This may be less of a priority for typically developing children.

References


