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Autobiographical Memory and Social Problem-solving in Asperger Syndrome

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Barbara Dritschel · Trishna Patel

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Abstract Difficulties in social interaction are a central feature of Asperger syndrome. Effective social interaction involves the ability to solve interpersonal problems as and when they occur. Here we examined social problem-solving in a group of adults with Asperger syndrome and control group matched for age, gender and IQ. We also assessed autobiographical memory, on a cueing task and during social problem-solving, and examined the relationship between access to specific past experiences and social problem-solving ability. Results demonstrated a social problem-solving impairment in the Asperger group. Their solutions were less detailed, less effective and less extended in time. Autobiographical memory performance was also impaired with significantly longer latencies to retrieve specific memories and fewer specific memories retrieved in comparison to controls.

Keywords Autobiographical memory · Social problem-solving · Asperger syndrome

Introduction

Autobiographical memory is memory for information relating to the self and comprises biographical information and personally experienced events. It has many social functions, for example it facilitates social intimacy (Nelson, 1993) and provides a database for social problem-solving (Evans, Williams, O’Loughlin, & Howells, 1992; Goddard, Dritschel, & Burton, 1996). As such, it is an important predictor of healthy psychological functioning and autobiographical memory deficits have been associated with a range of clinical conditions, in particular depression and parasuicide (Williams, 1996).

Despite the importance of autobiographical memory in social functioning, there is little research examining it in Asperger syndrome, a condition primarily associated with abnormalities in the social domain. The theoretical basis would suggest that autobiographical memory deficits would be found here given both the high rates of depression (Ghaziuddin, Ghaziuddin, & Greden, 2002) and difficulties in social communication experienced by this group (Blacher, Kraemer, & Schalow, 2003). Research with children with autism has shown poor memory for recent events (Boucher & Lewis, 1989) and poor memory for events experienced personally compared to events that are witnessed as happening to another child (Millward, Powell, Messer, & Jordan, 2000). Involvement of the self usually facilitates memory processes (Rogers, Kuiper, & Kirker, 1977). The absence of this effect in autism has implications for autobiographical memory functioning since by definition it requires self-involvement. Comparable findings have been found with incidental memory tasks where words processed self-referentially

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(e.g., like me/not like me) are remembered no better than words processed semantically (Toichi et al., 2002).

Memory difficulties in autism may be due to the level of self-awareness at encoding. Bowler, Gardiner, and Grice (2000) found that while performance on a word recognition task was equivalent in Asperger syndrome and controls, the quality of remembering was different. Memory in Asperger syndrome was more likely to be associated with noetic awareness (i.e., the type of awareness associated with timeless facts, cf. Tulving, 1985). Thus, individuals could correctly identify whether a word have been presented previously but could not remember any contextual features associated with seeing the word. In contrast, recognition in the control group was more often accompanied by auto-noetic awareness, where contextual features associated with the word's presentation were recalled. These findings suggest that the specific autobiographical memory system in Asperger syndrome may be impaired because specific retrieval is, in essence, memory with self-awareness. This argument is consistent with findings of Klein, Chan, and Loftus (1999) who report the case of R.J., an individual with high functioning autism. RJ showed good access to his personal semantic memory as demonstrated by accurate knowledge of his personality traits, but poor episodic personal memory, as access to the personal experiences upon which his trait knowledge was based, was limited.

It has been suggested that the ability to access specific autobiographical memories (i.e., memories of individual events) is a critical ingredient in successful social problem-solving (Williams, 1996). This is because specific memories are richer and more detailed than general memories (i.e., summaries of events) and, therefore, contain more cues which could potentially aid the generation of an effective and detailed strategy. This theory was developed within a clinical framework where an overgeneral memory retrieval style, as commonly found in depression (cf. Williams, 1996) is predicted to perpetuate depressed mood through its effects on problem-solving. Research with a parasuicide sample provides some support for this hypothesis as the ability to retrieve specific memories on a word cueing task has been found to correlate positively with the effectiveness of solutions generated on a hypothetical problem-solving task (Evans et al., 1992). Moreover, in depressed groups, the types of memories retrieved *during* problem-solving have been shown to relate to the quality of solution produced; with general

memories resulting in less detailed and less effective solutions relative to when specific memories are retrieved (Goddard et al., 1996, Goddard, Dritschel, & Burton, 1997).

Social problem-solving difficulties have been demonstrated in children and adolescents with Asperger syndrome particularly with respect to the generation of socially appropriate solutions (Channon Charman, Heap, Crawford, & Rios, 2001). However, there is little research examining social problem-solving in adults. Although it seems likely that the impairments in this area will persist into adulthood, this is not inevitable, since maturation and an increase in life experiences may boost abilities to the extent that differences between adults with and without Asperger syndrome become less marked. However, if deficits do exist, then a clearer understanding of the processes involved in social problem-solving has important implications for intervention. Given previous research demonstrating a role for autobiographical memory in successful problem-solving it becomes pertinent to examine autobiographical memory within this context in an Asperger group.

Aim of the Study

The principal aims of the study were to investigate autobiographical memory and social problem-solving in adults with and without a diagnosis of Asperger syndrome. It was hypothesised that individuals with Asperger syndrome would show difficulties in retrieving specific autobiographical memories. This was assessed on a cueing task, where single word cues were used to elicit specific memories at speed, and in the context of social problem-solving where participants reported upon the memories that came to mind while generating solutions to hypothetical problems. It was also hypothesised that individuals with Asperger syndrome would show poorer social problem-solving and that problem-solving deficits would be related to difficulties in accessing specific autobiographical memories.

Few researchers have examined specific autobiographical memory deficits in the context of general memory ability, and yet it is important to establish whether autobiographical memory impairments are symptomatic of an underlying general memory problem. Therefore, we also examined whether autobiographical memory deficits were related to aspects of general memory functioning. No predictions were made in this respect.

Methods

Participants

The experimental group was recruited from various specialist social skills groups associated with the National Autistic Society and Educational Institutions specialised in teaching individuals with high functioning autism and Asperger syndrome. Criteria for inclusion included a formal diagnosis of Asperger/high functioning Autism from a Clinical Psychologist or Psychiatrist and a full scale IQ of 70 or above, i.e., within two standard deviations of the mean. An age criterion was also imposed so that only individuals between the ages 18 and 35 were accepted into the study. This was implemented for two reasons. Firstly, young adulthood represents a time when problem-solving ability may be especially important, because it is during this period that individuals begin to encounter a range of situations that are potentially problematic; secondly, in order to impose some control over differences in the extent of life experience. Of the 44 experimental participants recruited into the study, seven were eliminated as their IQs fell below the required range. Of the 37 remaining, seven were female and all but one had received a diagnosis of Asperger syndrome, the other having had a diagnosis of high functioning autism. The majority of individuals had been diagnosed in adulthood.

Control participants, fulfilling the age criterion, were drawn from a variety of Further Education¹/Higher Education colleges. They were group matched with the experimental group on verbal, performance, and full scale IQ. Of the 44 control participants recruited, five were eliminated due to low IQ scores. This left 39 participants, eight of whom were female. Although all participants fulfilled the age criteria, there was a statistically significant difference in age between the groups, with individuals with Asperger syndrome being slightly older (see Table 1).

Measures of Control and Independent Variables

The Wechsler Abbreviated scale of Intelligence (WASI; Wechsler, 1999) was used to assess verbal, performance, and full scale IQ. This is widely used in the United Kingdom in studies of both typical and atypical populations, where there is no reason for

Table 1 Demographic data for Asperger and control groups

	Asperger		Control	
	Mean	SD	Mean	SD
Age *	25.35	6.51	21.26	3.23
Verbal IQ	98.27	18.53	98.15	20.45
Performance IQ	98.32	18.81	100.49	14.17
Full Scale IQ	97.59	17.48	99.44	18.37
BPVS: language age*	15.67	3.59	13.67	4.02
Male:Female	30:7		31:8	

* Scores differ @: $p < .05$

exploring full cognitive profiles. Correlations with WAIS III have been shown to be high, e.g., 84 for performance IQ and 88 for verbal IQ (Wechsler, 1999). It was selected for the current study because of its speed of administration. Receptive language was assessed with the British Picture Vocabulary Scale II (BPVS; Dunn, Dunn, & Whetton and Burley, 1997). Certain subtests from the Wechsler Memory Scale (WMS-111; Wechsler, 1998) were administered: (a) the logical memory subtest which requires participants to recall a short prose passage; scores are comprised of three facets—the number of actual units recalled, the number of thematic units recalled, and a learning slope reflecting improvement in recall after a subsequent hearing, and (b) the visual reproduction subtest which assesses participants’ ability to draw a previously presented figure from memory. These scales constitute a measure of general memory functioning (B.A.Wilson, personal communication). Forward and backward digit span was also assessed.

Measures of Dependent Variables

Autobiographical Memory Cueing Task

This task requires participants to retrieve a specific autobiographical memory as quickly as possible, in response to each word cue presented. A specific memory was explained to the participants in terms of a past experience, which happened on a particular day in a particular place, and which in principle they would be able to date. Examples of appropriate specific memories and inappropriate general memories (e.g., to the cue word leisure—“playing squash last Friday night” versus “playing squash in the Summer”) were given to the participant and practice cues were administered to ensure that the requirement of the task was clearly understood. Fifteen word cues were presented, five positive emotion cues, five negative emotion cues, and five neutral cues. Words were presented orally with positive, negative, and neutral words alternating.

¹ Further education colleges in the UK provide training in practical/technical pursuits, although some academic courses are offered these are frequently attended by students who do not make it to University.

Participants were given a maximum of 60 s to retrieve a memory for each word. If a response was not given in that time a score of 60 s was recorded and the next word presented. When participants responded with a general memory they were prompted to recall one particular time. Latencies to the first word of each response were recorded using a stopwatch. Where a memory was inappropriately general and a prompt for a specific memory was given, latencies to subsequent responses were accumulated. Memories were categorised according to the following criteria.

Specific memories. A memory was deemed specific if the event recalled pertained to one particular day (e.g., last Christmas day).

General memories. As categoric general memories and extended general memories have been found to function independently (Williams & Dritschel, 1992) they were classified separately.

- (a) *Categoric:* A memory was graded categoric, if it referred to multiple occurrences of events (e.g., Christmas when I was a child).
- (b) *Extended:* A memory was deemed extended if it represented a single event occurring over a period of time (e.g., the last Christmas holiday).

Inter-rater reliability for memory categorisation was checked by two raters, one of whom was blind to participant's group membership, on 25% of the memories. This proved to be satisfactory (Cohen's $K = .90$)

Means-End Problem-Solving Test (MEPS) (Platt & Spivack, 1975)

This is a widely used test of social problem-solving ability. It consists of short stories, which describe a problem and then the resolution of the problem situation. An example is as follows: "John loved Mary very much but they had many arguments. One day she left him. John wanted things to be better. The story ends with everything fine between John and Mary. You begin the problem where Mary has just left John after an argument". Five problems were presented covering the following themes: (a) girlfriend/boyfriend troubles (b) falling out with friends (c) problems with the boss (d) moving into a new neighbourhood, and (e) initiating a new romantic relationship. The names of the characters in the stories were altered in accordance with the gender of each participant so that the main protagonists' gender matched their own. Participants were required to describe the ideal steps in order that the protagonist may solve the problem and reach the stated goal. The MEPS were read by the experimenter

to the participants who in turn followed them on index cards. Participants were told to take a few minutes to think about the actions that should be taken in order to solve the problem. They were further asked to attend to any thoughts and images that they experienced while they were thinking about the problem and how to solve it. A practice item was given to ensure that instructions were fully understood.

MEPS solutions can be marked along various dimensions of which the number of 'relevant means' generated within the solution and the effectiveness of the solution are most commonly used and, therefore, employed here. The relevant means dimension represents a quantitative measure of problem solving while effectiveness reflects more qualitative differences.

Relevant means and effectiveness. The former is assessed by counting up each discrete step, contained within the solution, which is effective in overcoming obstacles and facilitating progress towards the stated goal of the problem. The effectiveness dimension was scored according to the rating used originally by Marx, Williams, and Claridge, 1992. This marking system involves a Likert type scale ranging from 1 (not at all effective) to 7 (very effective). An effective problem-solving response is defined as a strategy that maximises positive and minimises negative short and long-term consequences. Inter-rater reliability was assessed on 50% of the scripts (half from each group), one rater was blind to participant's group membership. This proved to be acceptable for these measures, Pearson Product Moment Correlations were .86 & .81 for number of means and effectiveness, respectively.

In an attempt to capture other pertinent qualitative differences between the groups, some other measures were developed based upon theoretical models of Asperger syndrome, in particular "theory of mind" explanations of impaired social understanding. These measures are outlined below and detailed in the Appendix. Inter-rater reliability for these categorical measures was assessed on 50% of all scripts (half from each group), inter-rater agreement was acceptable for all measures with Kappa values ranging between .74 and .90.

Perspective taking. This measure aimed to capture the extent to which a problem-solving strategy took into account the standpoint of individuals other than the main protagonist. A three point scale was used for which inter-rater reliability was acceptable (Kappa = .82).

References to cognitions. This assessed the presence of any references to thinking about the problem. A 0 vs 1 categorical scale was used.

Time appreciation. This three point measure aimed to judge the extent to which there was recognition that problems and solutions evolve over time. The attempt here was to capture some element of the ability to adopt a diachronic approach (cf. Montangero, Pons, & Cattin, 2000) where actions are inserted within a time period rather than just considered in the here and now.

Script violation. Although social problems are typically open-ended, i.e., there is more than one way to solve them (cf. Williams, 1996), there is nonetheless an accepted general framework around which problems are understood and solved. For example in the case of arguments within a relationship, the general framework might include: understand why the argument happened, make contact, discuss issues on either side, compromise, try again etc. An attempt here was made to examine the extent to which solutions in the Asperger group deviated from this general framework using a categorical (0 vs. 1) scale.

References to emotion. Since Asperger syndrome is associated with impairments in emotional processing, references to an emotional response to problems were assessed. These were scored on a 0 vs. 1 categorical scale with a score of 1 given if the solution contained some reference to how the protagonist emotionally responded to the problem scenarios. This measure was not designed as an assessment of problem-solving ability (problem-solving models advocate an objective, rational response to problem-solving rather than an emotional response), the main aim was to capture qualitative differences. Inter-rater reliability was satisfactory ($Kappa = .77$).

After giving their ideal problem-solving strategy participants were asked, after each MEPS solution, to report on any thoughts and images during the problem-solving process. The majority of these images took the form of autobiographical memories and these were classified according to the same criteria as used on the Autobiographical memory cueing task. There were a few occasions where participants reported thoughts and images pertaining to information gained from books/films/TV. These instances were grouped together in the category “*General Knowledge*”.

Procedure

The order of the tasks was fixed. Participants first completed the WASI and BPVS followed by the MEPS and the cueing task. This was proceeded by the general memory tasks, and BDI. Total testing time was approximately 90–120 min although this was quite variable.

Results

As a relatively large number of statistical tests were conducted, a significance level of $p < .01$ was set in order to avoid Type 1 errors. However, exact significance levels are also reported for statistical tests yielding probabilities between .05 and .01. All comparisons and correlations were conducted using two-tailed tests.

Autobiographical Memory Performance

Autobiographical memory was assessed by examining speed and specificity of memory on the cueing task and by examining the propensity to retrieve memories while performing the MEPS task. With respect to the cueing task, the number of specific memories offered as a first response to positive, negative, and neutral cues was analysed using a 3 (Emotion Valence) by 2 (Group) mixed analysis of variance (ANOVA). This yielded a statistically significant main effect of Group: $F(1,74) = 24.89, p < .0005$ as the Asperger group generated fewer specific memories overall in comparison to the control group. There was no statistically significant main effect of Valence ($F(2, 74) = 4.18, p = .02$). However, there was a statistically significant Group \times Valence interaction: $F(2, 74) = 6.09, p = .003$. A simple effects test demonstrated a facilitation of emotional cues versus neutrals cue in the control group ($p < .01$) whereas the number of specific memories retrieved across cue type did not vary for the Asperger group ($p > .05$). Table 2 shows the mean total number of specific memories retrieved across different cue types.

The latencies to retrieve specific autobiographical memories were also examined using a 3 (Valence) by 2 (Group) ANOVA. Again there was a statistically significant main effect of Group ($F(1,74) = 29.32, p < .0005$) as the Asperger group were slower to retrieve specific memories to cues, (Asperger $M = 21.54$ s, $SD = 10.77$ vs. Control $M = 10.96$ s, $SD = 5.56$) but no significant valence main effect ($F(2,74) = 1.21, p > .05$)

Table 2 Autobiographical memory cueing task: number of specific memories retrieved to word cues

	Asperger ($n = 37$)		Control ($n = 39$)	
	Mean	SD	Mean	SD
Positive cues	3.27	(.19)	4.67	(.18)
Negative cues	3.62	(.17)	4.44	(.17)
Neutral cues	3.43	(.15)	3.90	(.15)

or significant Group \times Valence interaction ($F(2,74) = 1.89, p > .05$).

Memory on the MEPS

The data for these measures were not normally distributed and, therefore, non-parametric tests were used for statistical analysis. Before examining differences in the propensity towards retrieving qualitatively different types of memory, we first analysed group differences in the extent to which participants reported retrieving any experience (either personal or general) related to the problems. This was established by analysing the number of problems where participants reported no thoughts or images related to the problem. A Mann–Whitney test showed no significant differences between groups in the number of solutions generated in the absence of memory retrieval: $z = -.69, p > .05$, two-tailed (Asperger median = 1, range = 0–5; Control median = 1, range = 0–5). Thus both groups were equally able to access some experience cued by the problem vignettes. Since previous research suggests that specific autobiographical memories play a facilitating role in social problem-solving we first examined this variable. Here there was no statistically significant difference between groups: $z = -1.32, p > .05$ (Asperger median = 1, range = 0–3; Control median = 1, range = 0–3). As regards categoric memory retrieval during problem-solving, again there was no statistically significant difference although there was a tendency towards the Asperger group generating more categoric memories than the control group: $z = -2.32, p = .02$ (Asperger median = 2, range = 0–5, Control median = 1, range = 0–4).

General Memory Functioning

In order to investigate whether the relative impairment in the Asperger group with regard to specific memory retrieval was part of an overall general memory impairment, scores on the subtests of the Wechsler Memory scale were examined. The logical memory test (i.e., story recall) showed no significant differences between groups on (a) the number of actual units recalled ($t(74) = 1.4$), (b) the number of thematic units recalled ($t(74) = .17$) and, (c) the level of improvement in recall ($t(74) = .90$), (all p values $> .1$). There was also no statistically significant difference between groups in digit span ($t(74) = 2.25, p = .03$); Asperger group: $M = 9.22, SD = 3.04$ vs. Control $M = 10.77, SD = 2.91$). There was, however, a statistically significant difference in performance on the visual reproduction subtest ($t(74) = 4.27, p < .0005$) with the

Asperger group performing more poorly than the control group (means: 6.84, $SD = 4.76$ vs. 10.98, $SD = 3.63$). A Pearson product-moment correlation was used to examine whether specific autobiographical memory deficits were linked to visual memory. This revealed a small, but significant positive correlation ($r = .4, n = 76, p < .0005$). Within group correlations revealed this relationship to be carried by the Asperger group ($r = .34, p < .05$) as the correlation was close to zero in the control group ($r = .04, p > .1$).

MEPS Performance

Total scores on each of the MEPS performance measures were calculated by totalling each score across the five problem scenarios. Three of these measures (i.e., references to cognitions, references to emotions and script deviation) were not normally distributed and, therefore, Mann–Whitney U tests were used to detect significant group differences. For all other measures, t -tests were employed for group comparisons. The total mean scores are given for all variables for the purpose of comparison and statistical values relating to each MEPS measure are shown in Table 3. Three of the MEPS measures showed significant differences between groups at the .01 level, with the Asperger group generating solutions that were (a) less effective, (b) contained fewer relevant means and, (c) were less likely to evolve over time.

The Relationship between MEPS Performance and Memory Performance

Correlational analyses were then used to examine the existence of relationships between MEPS performance

Table 3 Total means for each of the MEPS measures

	Asperger ($n = 37$)		Control ($n = 39$)		Statistic	p
	Mean	SD	Mean	SD		
<i>MEPS MEASURES^a</i>						
Relevant means	12.32	4.63	15.54	5.03	$t = 2.9$.005*
Effectiveness	14.02	5.77	18.05	5.23	$t = 3.2$.002*
Perspective taking	4.68	2.43	5.41	2.44	$t = 1.3$	$> .1$
References to emotion	1.00	1.30	1.62	1.30	$u = 519$.03
References to cognition	1.00	1.18	1.41	1.46	$u = 613$	$> .1$
Time appreciation	3.78	2.75	5.51	2.64	$t = 2.8$.007*
Script violation	3.57	1.24	4.15	1.01	$u = 513$.02

^a For ease of comparison means and standard deviations are presented for all measures including those for non-parametric assessments.

* $p < .01$, two-tailed.

on the measures that had distinguished the groups and (a) memory on the cueing task and, (b) memory during the MEPS. With respect to the cueing task, within the Asperger group there was a small but statistically significant correlation between the ability to retrieve specific memories on the cueing task and the generation of solutions with a good appreciation of time, i.e., evolved over time. The other correlations within the Asperger group were positive but non-significant (see Table 4). No correlations were significant in the control group. As regards problem-solving during the MEPS, the relationship between the quality of MEPS solutions and the retrieval of past experience while problem-solving was examined and, in particular, whether specific retrieval was related to good problem-solving. Pearson product moment correlations again revealed a slightly different pattern between the groups (see Table 4). Here, while the failure to retrieve any memory during problem-solving (i.e., specific, categoric, extended, or general knowledge) was significant and negatively related to the quality of solutions in relation to time appreciation, in the control group, no such association was found in the Asperger group. This relationship was not dependent on the quality of memory retrieved; correlations were non-significant when only *specific* retrieval during problem-solving was examined ($ps > .01$). With respect to the means and effectiveness measures, the correlations were close to zero in the Asperger group, whereas the control group showed a stronger relationship between failing to retrieve experience and generating poor quality solutions.

Discussion

This study evaluated autobiographical memory functioning and social problem-solving in young adults with Asperger syndrome. To summarise, there was no

overall difference between groups in their tendency to retrieve memories in the context of problem-solving. However, a specificity deficit in the Asperger group was found when examining the ability to retrieve specific memories to word cues at speed. As regards social problem-solving ability, the Asperger group tended to produce solutions to hypothetical personal problems that were less effective, less detailed and less extended in time. These problem-solving impairments were linked to difficulties in retrieving specific memories on the cueing task. With respect to memory during problem-solving, however, while a relationship between memory retrieval and problem-solving ability was found in the control group, problem-solving performance in the Asperger group was independent of whether or not past experiences were retrieved during solution generation.

The specific autobiographical memory deficit observed in the Asperger group appeared largely independent of general memory functioning since groups did not differ in tests of logical memory or digit span. Interestingly they did, however, exhibit relatively more problems in visual memory, a finding consistent with previous research, (Minshew & Goldstein, 2001; Blair, Frith, Smith, Abell, & Cipolotti, 2002; Gunter, Ghaziuddin, & Ellis, 2002) and visual memory performance positively correlated with access to specific autobiographical memories. Visual processing is purported to play a critical role in autobiographical memory (cf. O'Connor, Butters, Miliotis, Eslinger, & Cermak, 1992, Ogden, 1993) and the findings here suggest that problems in visual processing may in part contribute to autobiographical memory problems in Asperger syndrome.

Specific autobiographical memory impairments have been found across a wide range of mood disorders e.g., borderline personality disorder (Kremers, Spinhoven, & Van der Does, 2004) and bipolar depression (Scott, Stanton, Garland, & Ferrier, 2000) where the underlying cause is purported to be the cognitive vulnerability associated with depression. The mechanisms involved in specific memory deficits in unipolar depression are a ruminative self-focus and a reduced central executive capacity which lead to the retrieval cycle being aborted at an early stage. A reduced access to the specific memory database is then compromised by a propensity towards retrieving categoric memories resulting in an overgeneral memory style (cf. Williams, 1996).

This raises the issue as to how memory deficits in Asperger syndrome are similar to and/or different from those found in depression. For the Asperger group here, a failure in specificity was not, on the whole,

Table 4 Relationship between MEPS performance and (a) specific retrieval on the cueing task and (b) failure to retrieve memories during the MEPS task

MEPS scores	Asperger group (n = 37)		Control group (n = 39)	
	Cueing task R	MEPS task r	Cueing task r	MEPS task r
Relevant means	.39	-.07	.18	-.34
Effectiveness	.38	-.04	.23	-.44
Time appreciation	.44*	-.22	.02	-.55*

* $p < .01$, two-tailed

compromised by a predisposition towards general, categorical memories. While there was some tendency towards retrieving more categorical memories during problem-solving, relative to controls, the numbers were small in comparison to those previously found in depression. Research suggests that the frontal and temporal lobes are critical to the networks involved in the storage and retrieval of episodic information (Kopelman, Stanhope, & Kingsley, 1997; Wheeler, Stuss, & Tulving, 1997) and, therefore, a likely common mechanism underlying specific memory deficits in both conditions is a reduced central executive capacity. However, the two conditions may diverge in terms of self-focus. This is excessive and ruminative in depression, causing events to be encoded and organised in over-inclusive self-referenced negative frameworks and retrieved in an over-general format. In Asperger syndrome, self and emotion may be less prominent markers in encoding events, preventing the likelihood of an over general ruminative retrieval style but also making life events more difficult to access. Indeed our findings showed that emotion cues failed to facilitate retrieval for the Aspergers group but did so for the control group.

In terms of social problem-solving ability, in line with findings from child and adolescent populations, evidence was found for a deficit in an adult sample with Asperger syndrome. This was evident with both traditional scoring procedures on the MEPS (i.e., relevant means and effectiveness) as well as new measures developed for the purpose of the study. Contrary to predictions, the Asperger group, were as likely to take others' perspectives into account in their solutions and there was no difference between groups in the extent to which the need for cognitive activity was endorsed within solutions (although the occurrence of this was small in both groups). There was also no difference in the extent to which solutions deviated from the average script. This is in some contrast to Channon et al. (2001) findings where adolescents with Asperger syndrome generated solutions to predicaments that were less socially appropriate relative to controls. Thus maturation may facilitate the recognition of pertinent solutions to problems. There was, however, a marked deficit in the extent to which the solutions of the Asperger group unfolded over a time course, with solutions tending to focus on the here and now. It has been suggested that difficulties in "time travel" are characteristic of autism (Suddendorf & Corballis, 1997), indeed Boucher (1999) suggests that this deficit may be, in part, a causal factor since an inability to represent temporal experience would impair a continuing sense and understanding of self and others. The findings here

support this proposition and are in line with Montanero et al. (2000) who have found this ability to be positively related to conflict resolution in children.

Channon et al. (2001) suggest that the problem-solving difficulties faced by individuals with Asperger syndrome may be a result of limited knowledge stores of prior problem solutions or due to problems in accessing prior knowledge. Contrary to this suggestion, our data suggest that adults with Asperger syndrome have a potential knowledge database available and accessible. However, unlike the control group, problem-solving does not seem to be directly related to the availability of past experience and as such experience may not be functioning as an effective database. This may be due to a failure in recognising and encoding the pertinent aspects of problems resulting in an impoverished knowledge database or due to problems with mapping the prominent features of current problems with the appropriate aspects of past problems. This corresponds with Bowler's (1992) conclusion that social deficits in Asperger syndrome are due to a more general inability to see the relevance of knowledge to particular problems rather than being a result of incompetence.

Evidence has been provided here for both a specific memory deficit and problem-solving deficit in Asperger syndrome, however, this study does have certain limitations. First, because of both time and financial limitations, it was not possible to clarify diagnostic status using standardised diagnostic assessments and parental interview. It is, therefore, important for future studies to confirm these findings with more stringent diagnostic criteria. Second, there were significant differences between the two groups in both age and BPVS scores. However, age differences were small and BPVS scores were in favour of the Asperger group and are, therefore, unlikely to represent a major threat to the validity of the findings. Nevertheless, the relatively low BPVS scores found in the control group does call into question the "normality" of this group. Third, latencies were recorded using stopwatches, which do not give such accurate readings as computerized measures. However, as the latency differences between groups was large (seconds, not milliseconds), this is unlikely to have significantly affected the findings. Finally, there was no measure of central executive functioning and yet this may be an important variable in explaining deficits. It would therefore be useful for future studies to ascertain the extent to which problems in specific autobiographical memory can be explained within a resource framework.

In summary, the study found that individuals with Asperger syndrome manifested difficulties in retrieving

specific autobiographical memories. This may be due to encoding/organisational difficulties, where the self fails to act as a sufficient memory tag. Problems with visual processing may also have a negative impact on encoding and/or retrieval strategies. Social problem-solving deficits in adults with Asperger syndrome were evident and characterised by deficits in generating detailed and effective solutions extending across a time-frame. While individuals with Asperger syndrome retrieve personal experiences in a response to problem-solving cues, they may not effectively use these experiences as a knowledge database. This has implications for interventions; encouragement towards encoding and retrieving events at a specific level and training in recognising and applying useful analogues from experience may improve social problem-solving processes.

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Appendix

Means-End Problem-Solving Task Additional Scoring Procedure

Perspective Taking

A 3 point scale was devised where 0 denoted no reference within the solution to another's perspective. A score of 1 was given where there was at least some implicit appreciation of another's view. For example, to apologise would infer some regard for another's viewpoint. A score of 2 was given where a more explicit understanding of another's position was given, for example where participants advocated the need to discuss issues and compromise or try to understand how another is feeling.

References to Cognitions

A score of 1 (as opposed to 0) was given where there was a reference to the need for cognition e.g., "try to work out what he'd done wrong".

Time Appreciation

A score of 0 was given if the solution offered implied an instant response with no time course, e.g., "He should give her some flowers and apologise". A score of 1 was given where the solution implied some

sequencing which extended over time., e.g., "John should approach his friend one-by-one to ask them why they are avoiding him". A score of 2 was given where there was explicit mention of time required for effective problem-solving, e.g., "He should wait for a while to check that he's not just being paranoid, then if they keep on ignoring him, approach them and ask what's wrong".

Script Violation

This measure was treated very conservatively with a script violation only having deemed to occur when the solution did not resemble any other solution generated by any other participant. An edited example of a script violation (in response to being avoided by friends) is given below:

First he was wearing black shoes and the next day white shoes with stars. Friends made excuses to ignore him 'sorry can't talk'...He went to classroom teacher..Was confused why, they said have you changed anything about yourself, he said "no just my shoes with stars on". Teacher said you think about what you have just changed and he says, yes it's probably the shoes with stars on...-changed his shoes and friends stopped avoiding him.

References to Emotions

These measures recorded the incidence of emotion e.g., "after he left, she sat down and cried"

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