

This research project was originally submitted as part of Joshua Muggleton's Honours degree at the University of St Andrews. Ethical approval for this research was sought and obtained from the University of St Andrews Teaching and Research Ethics Committee – Psychology division (Ethics Reference Number PS7973) Appendices available on request. Not to be copied, modified or reproduced in whole or in part without authorization from the author.

Available at www.mugsy.org/josh

Social Problem Solving Impairments in Sub-clinical Levels of Autistic Traits

PS4050: Psychology Project

Module coordinator: Dr Gerry Quinn

Supervisor: Dr Barbara Dritschel

Student ID: 080004555

Word Count: 5999



University of
St Andrews

Abstract

Social problem solving (SPS) skills are important in coping with interpersonal conflicts and have been shown to be lacking in some disorders, such as depression. Evidence suggests that autobiographical memory (ABM) specificity may help facilitate SPS. Both deficits in SPS and ABM specificity, and the relationship between them have been demonstrated in autistic spectrum disorders. This research investigated whether deficits in SPS and ABM specificity existed at low levels of autistic traits in the general population, when controlling for the effects of depressed mood. A questionnaire study yielded an opportunity sample of 21 participants, who demonstrated a significant relationship between the effectiveness of SPS solutions generated and the level of autistic traits. The number of solutions, and whether their solutions were qualitatively affected by the level of autistic traits was non-significant. No correlations between ABM specificity and SPS, autistic traits, or depression were found, despite strong evidence for the relationship in non-clinical populations from other research, questioning the reliability of our ABM measure in small samples. The implications of a relationship between SPS effectiveness and autistic traits are discussed with reference to the possibility of seeing autism as a trait, as well as a clinical diagnosis, and its implications for support.

Introduction

Social problem solving (SPS) refers to a set of cognitive processes used to find and derive solutions and adaptations to problems encountered in everyday life (D’Zurilla & Meydeu-Olivares, 1995). It can be subdivided into two processes; problem solving and solution implementation. Problem solving refers to the generation of possible solutions to a problem, and the recall of past solutions. Solution implementation is the ability to successfully apply the theoretical solution generated by problem solving to the real world (*ibid*).

Social problem solving is an important factor in successful coping behaviour. Adaptive coping strategies have been linked to positive problem orientation and rational SPS. Avoidant coping strategies, however, are associated with poor SPS (D’Zurilla and Chang, 1995). In addition to coping behaviour, SPS has also been linked to both psychological and behavioural adjustment (c.f D’Zurilla and Maydeu-Olivares, 1995). This can be seen in clinical populations, where deficits in SPS have been linked to hopelessness (Bonner and Rich, 1988), emotional disorders such as depression (Marx, Williams and Claridge, 1992), and suicidal behaviour (Sadowski and Kelly, 1993), as well as behavioural disorders, such as ADHD and Conduct Disorder (Matthys, Cuperus and Engeland, 1999).

Autobiographical Memory and Social Problem Solving

Based on research from individuals with depression, Williams (1996) theorised that autobiographical memory (ABM) for specific events might be important for successful

SPS. He suggested that specific autobiographical memories provide information about a single event, and therefore include contextual information. This allows for recall of similar situations, enabling the use of the experience to devise an effective strategy. Categorical and extended memories, however, are memories for repeated events or events extending over a large period of time, and therefore contain less contextual information with which to devise a solution.

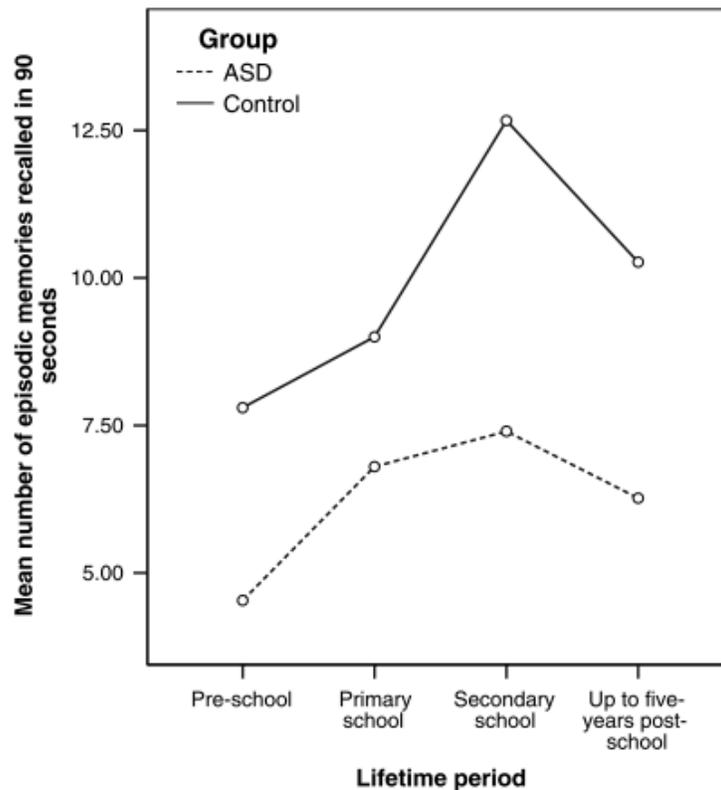
Supporting Williams (1996), Goddard, Dritschel and Burton (1997) studied responses to the Means-Ends Problem-Solving task (MEPS; Platt & Spivack, 1975) in a non-clinical sample. The MEPS task presents participants with ten vignettes, each starting with a social problem, and ending in a positive resolution. Participants are asked to describe the steps they would take in order to get from the problem described at the start, to the positive solution at the end. Goddard, Dritschel and Burton (1997) found that the number of specific memories recalled was significantly correlated with the number of means (steps to get to the positive end state) generated on the MEPS, but not to the effectiveness of the solutions. Categorical memories, however, were related to neither the number of means nor the effectiveness of solutions. This effect has been consistently shown in other non-clinical samples, regardless of age (Beaman *et al.*, 2007). In clinical samples, reduced SPS solution effectiveness, in addition to generating fewer means, has been found in parasuicidal patients (Evens *et al.*, 1992), patients with suicidal behaviour (Pollock and Williams, 2001), as well as suffering from depression (Goddard, Dritschel & Burton, 1996), and PTSD (Sutherland & Bryant, 2007).

Autism is a developmental disorder manifesting in deficits in social interaction, communication, and repetitive behaviour (ICD-10, 1994; DSM-IV-TR, 2000). Given the social-communicational deficit, it is unsurprising that problems in SPS have been found in people with autism. Channon *et al.* (2001) presented adolescents with Aspergers Syndrome (AS), a form of autism, with videos of social problems. While the AS group were able to generate as many solutions as the control group, the appropriateness and effectiveness of solutions they generated were significantly poorer. When asked to select a solution to implement, the AS group also chose to implement solutions that were less socially appropriate, although the effectiveness of the solutions they selected was equal to controls. This suggests that persons with autism may be impaired in the generation of SPS solutions, but less impaired in their ability to identify an optimal solution. Equally, Goddard *et al.* (2007) found (using the MEPS) that people with AS produced significantly fewer means and less effective solutions with which to resolve a problem, compared to controls.

Autobiographical Memory deficits in Autism.

In addition to the SPS deficits, people with autism also have problems in ABM. People with autism appear to lack a reminiscence bump and recency effect for autobiographical memories (figure 1) (Crane & Goddard, 2008), are more likely to omit pertinent facts (Bruck, *et al.*, 2007), and recall significantly fewer autobiographical memories, compared to controls (*ibid*, Crane & Goddard, 2008)

Figure 1: “Mean number of episodic memories recalled in the autobiographical memory fluency task”



From Crane and Goddard, 2008, p502

It has been suggested that people with autism may lack a sense of self-identity, which may contribute to ABM problems (Powell & Jordan, 1993; Millward, 2000). On a staged class trip, children with autism remembered more events where they observed peers actions than when they experienced events themselves. The opposite was true for controls (Millward, 2000). Equally, Bowler, Gardiner and Grice (2000) found that, on a word remembering versus knowing task, people with AS “rely more on noetic awareness (knowing), and less on auto-noetic awareness (remembering)”(p.301).

Goddard *et al.* (2007) argue that ABM for specific memories may be impaired in people with AS as they rely on auto-noetic self-awareness. Categorical memories,

however, are likely to rely more on noetic awareness. If, as suggested, people with ASDs have problems in self-awareness, this could create problems in recalling specific memories. Supporting this argument, Crane, Goddard and Pring (2009) found that while ABM for general events was in line with controls, memory for specific events was impaired in persons with autism.

There are clear deficits in both ABM specificity and SPS in autism. Equally, ABM and SPS have been shown to have a significant relationship in clinical and nonclinical samples. Goddard *et al.* (2007) investigated whether the same relationship between ABM and SPS is present in autism. They found that both the number of means and their effectiveness were linked to problems retrieving specific autobiographical memories in autism. This suggests that the relationship as seen in people with depression, suicidal behaviour, and PTSD may also be present in autism.

Qualitative SPS differences

In addition to assessing the effect of ABM on SPS, Goddard *et al.* (2007) considered the effect of other cognitive impairments found in autism on SPS. Problems in Theory of Mind (ToM)(c.f Baron-Cohen, 2001) and executive function (c.f. Hill, 2004) have been identified in autism, both of which could affect SPS. Theory of mind is the ability to attribute mental states to others, (Premack and Woodruff, 1978), such as knowledge, beliefs and desires. Accounting for these mental states in other people is likely to be important in creating a solution to a social problem. Equally, problems in executive function may lead to problems in both planning and selecting optimal solutions to social problems.

To account for the effects of other cognitive deficits in autism, such as executive function and ToM, Goddard *et al.* (2007) analysed MEPS responses according to five subjective measures designed to detect the effect of any additional cognitive deficits. Time appreciation (designed to detect the influence problems in diachronic thinking and executive function) was found to be significantly impaired. References to emotion (designed to detect effects of poor emotional processing) and script violation (whether a standard social script was used) were both approaching significance at the 1% level. References to cognition (not defined) and perspective taking (designed to detect the effect of ToM deficits) were both non-significant. The fact that one of these scales achieved significance when comparing AS subjects to controls, suggests that other aspects of cognitive ability in autism may be affecting SPS, and therefore need to be considered when interpreting results.

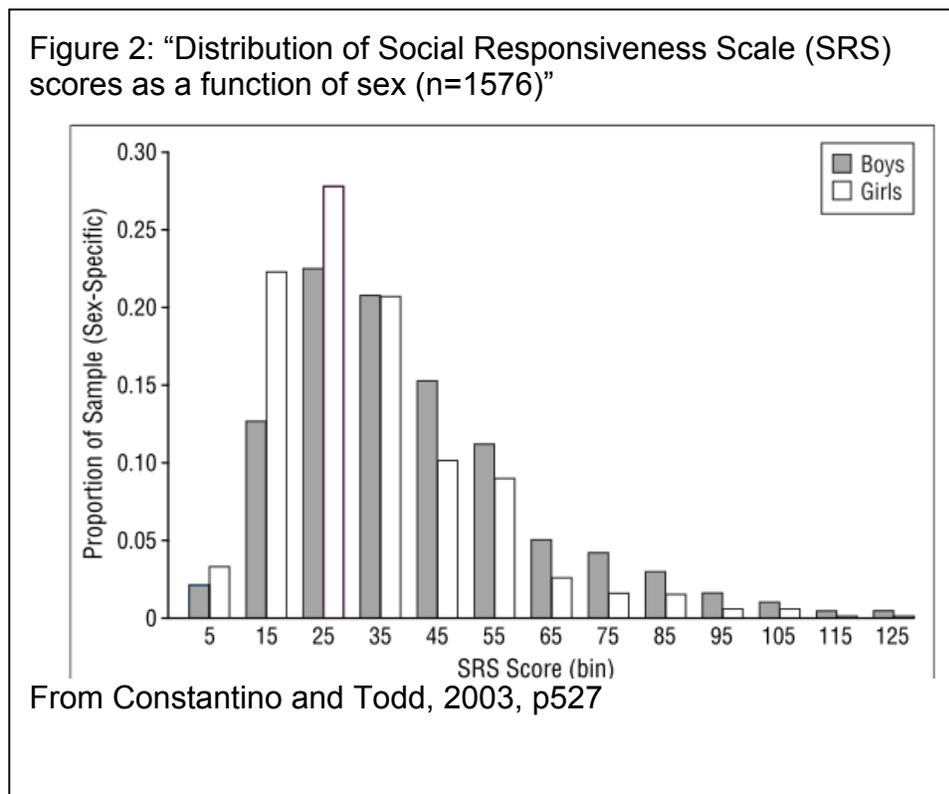
Depression, autism and social problem solving

As highlighted earlier, SPS deficits also occur in depression (Marx, Williams & Claridge, 1992). In addition, the same link between ABM specificity and SPS has been found in persons with depression. Goddard, Dritschel and Burton (1996) found that more effective solutions on the MEPS were associated with greater ABM specificity, and that poorer solutions were associated with retrieval of more categorical memories.

Depression is a recognised co-morbid condition in autism (Rutter, 1970), affecting 4.4% to 57.6% of those with autism (Lainhart, 1999). Part of the reason for this range of estimates may be due to difficulty in identifying depression in those on the autistic spectrum due to crossover symptoms, such as social withdrawal, diagnostic in both

depression and autism (Stewart *et al.*, 2006). Given the high co morbidity, the relationship between ABM specificity and SPS may be solely due to a high number of people with depression and autism. This may cause the appearance of this relationship in autism, when in fact; it is an artefact of a depressed sample.

Therefore, studies investigating autism and SPS must control for the possible effects of depression.



Autistic traits and the Broader Autistic Phenotype

There is a growing opinion that Autistic Spectrum Disorders (ASDs) such as Autism, AS, and Pervasive Developmental Disorder – Not otherwise specified (PDD-NOS), refer to the same constellation of symptoms, but at varying levels of intensity and impact. Due to this increasingly popular view, the DSM-V is removing all three terms, and replacing them with the term autistic disorder (APA, n.d, c.f Muggleton & Seed, 2011). Constantino and Todd (2003) provide evidence supporting this change. After

a large-scale twin study, they found a continuous distribution of autistic traits (measured by the Social Responsiveness Scale), suggesting that diagnostic cut-offs are largely arbitrary (figure 2)(*ibid*). In addition, statistical modelling suggested that in boys, 76% of the level of autistic traits were due to genetic influences (40% in girls), after factoring out environmental influences (such as upbringing).

Given the heterogeneity and genetic influences in autism, several authors have investigated a broader autistic phenotype (BAP), affecting relatives of autistic individuals. Bailey *et al.* (1998) found that problems in forming close friendships or relationships and social-emotional reciprocity were common in relatives of autistic individuals, but that repetitive behaviours only occurred in a minority of cases. Autistic-like personality traits, such as aloof and untactful, have also been found in relatives of autistic individuals (Piven *et al* 1994; Piven *et al* 1997) This suggests that while not all aspects of autistic behaviour (ie, the triad of impairments, Wing, 1981) carry on to sub-clinical levels, some socio-communicative difficulties do appear in the broad autistic phenotype, which could result in SPS deficits.

There is evidence of a continuous distribution of autistic traits in the general population, and that autistic-like deficits in social interaction occur in families of those with ASDs. This raises the question as to whether the same SPS deficits that are apparent in clinical levels of autism may be related to the level of autistic traits, when controlling for the effects of depression. If so, would subjective aspects of SPS, identified by Goddard *et al.* (2007) also be related to the level of autistic traits? Equally, would autistic traits predict the number of specific autobiographical memories recalled, and if so, would that predict the effectiveness of SPS solutions?

Understanding how deficits and impairments associated with autism change depending on the level of autistic traits will help understand the impairments of those with severe autism, who may lack the abilities needed to complete standard SPS and ABM tests. Equally, understanding whether low-level autistic traits cause low-level impairment, or whether a threshold for autistic traits needs to be reached for impairment to exist may help ensure accurate classification of ASDs.

Aims

This paper aims to establish the effect of low-level autistic traits in the general population on SPS, while controlling for the effects of depressed mood. In addition, we hope to establish whether low level autistic traits have a relationship with ABM specificity, and if so, whether that could account for any SPS deficits. This leads to the following hypotheses:

- 1) Higher levels of autistic traits will have a negative relationship to measures of SPS ability when controlling for depressed mood.
- 2) Reduced specificity of autobiographical memory retrieval will be associated with higher levels of autistic traits
- 3) Reduced autobiographical memory specificity will be associated with poorer SPS ability.
- 4) Greater levels of depressed mood will be associated with poorer autobiographical memory specificity

Methods

Participants

Participants were invited by opportunity sampling to take part in a study on “the effect of personality traits on autobiographical memory specificity”. There was no mention of autistic traits to avoid any priming effects. They were fully informed of the deception on completion of the questionnaire.

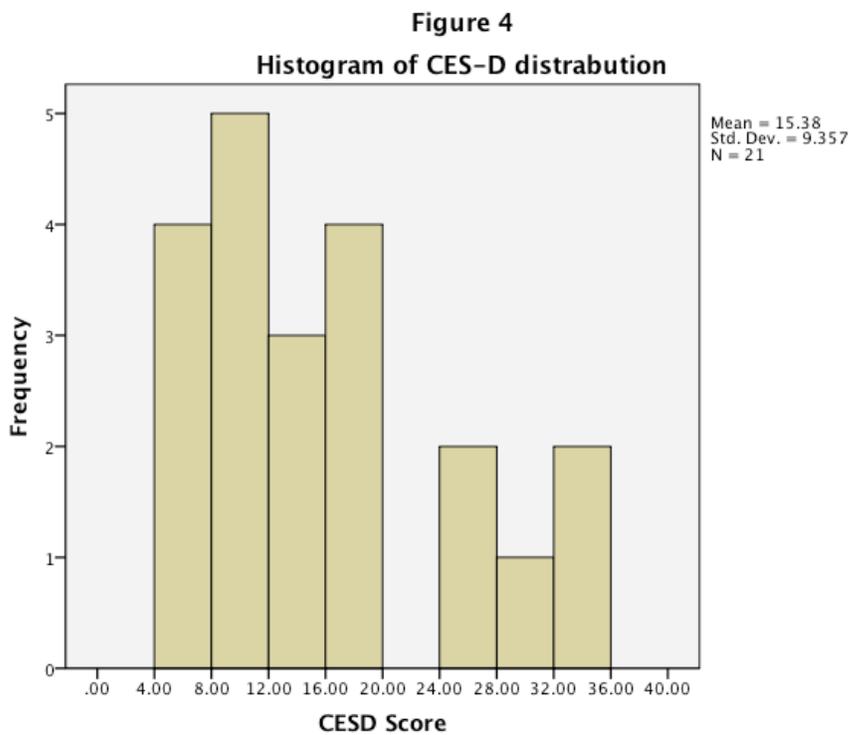
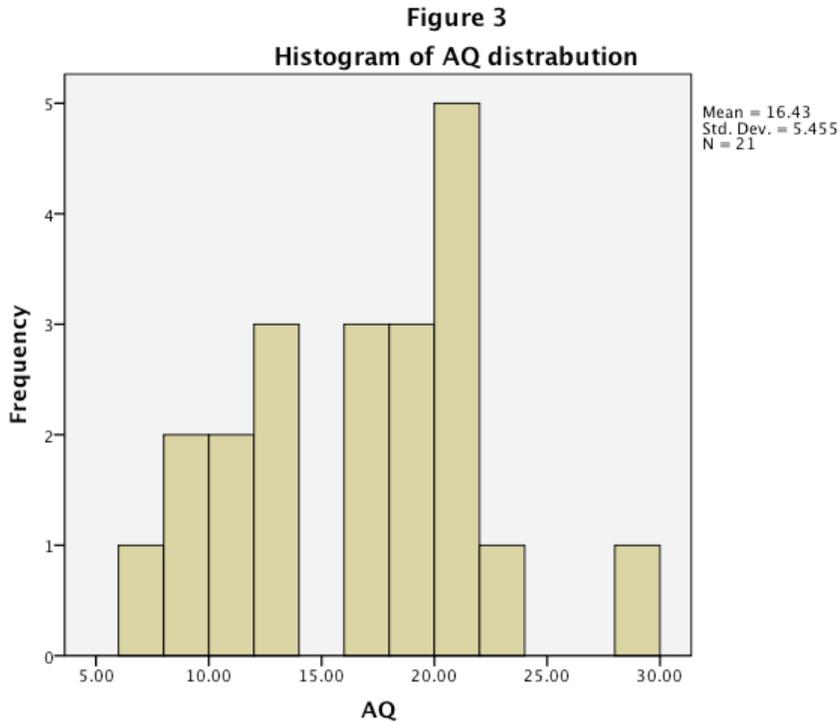
Fifty-three paper questionnaires were handed out to undergraduate students at the University of St Andrews. Twenty-two paper questionnaires were returned by the closing date (response rate, 41.5%). Participants were excluded if they scored above 32 (determined by Baron-Cohen *et al*, 2001, to be the cut off for distinguishing between high functioning autistic and control populations). One participant met this criterion. All participants were rewarded by the chance to win a £20 Amazon voucher.

Demographics

The final sample consisted of five men and 16 women, with a mean age of 19.95 years (19 years, 11 months), with a standard deviation of 1.5 (one year, six months). On the AQ, participants had a mean score of 16.43 (S.D 5.46), with no participant scoring higher than 28 (figure 3). Participants had a mean CES-D score of 15.38 (S.D = 9.36; figure 4). While there is no clinical cut off for depression on the CES-D, in field trials, Radloff (1977) found that no patients hospitalized for depression scored below 16, while 21% of the general population scored above 16. Demographic data displayed in table 1.

Table 1
Participant Demographic Information

	Mean	S.D	Min	Max
Age	19.95	1.5	18	23
AQ	16.43	5.46	7	28
CES-D	15.38	9.36	4	34



Materials

Autistic Traits

Autism-Spectrum Quotient (AQ; Baron-Cohen et al, 2001)(appendix A).

The AQ is a short self-administered questionnaire designed to assess autistic traits. Participants are asked to rate how well each of 50 statements describes them on a 4 point Likert scale, ranging “definitely agree” to “definitely disagree”. The questions are subdivided into 5 groups, assessing different diagnostic criteria for autism: social skills, attention switching, attention to detail, communication, and imagination (Baron-Cohen *et al.*, 2001). Scores are out of 50, with higher scores indicating higher levels of autistic traits (Baron-Cohen *et al.*, 2001, Bailey *et al.*, 1995), although this is not in itself diagnostic of an autistic spectrum disorder. Internal consistency for the subsections of communication, social skill, imagination, attention to detail, and attention switching were all moderate to high (Cronbach’s alpha of 0.65, 0.77, 0.65, 0.63 and 0.67 respectively) (Baron-Cohen *et al.*, 2001). Overall internal consistency was high (Cronbach’s alpha = 0.81)(Wakabayashi, Baron-Cohen & Wheelwright, 2006). No specific predictions regarding subscales were made, and therefore only the full-scale AQ was used, reducing family-wise error

Mood

Center of Epidemiologic Studies – Depression Questionnaire (CES-D; Radloff, 1977)
(appendix B)

The CES-D was developed to measure depressive symptoms in the general population. Participants are asked to rate twenty statements for how frequently they have experienced them over the past week. Higher scores indicate a greater number of depressive symptoms. Questions were taken from a selection of already validated

depression scales, and divided into 5 components; depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, and loss of appetite (Radloff, 1977). No specific predictions regarding subscales were made, and therefore only the full-scale CES-D score was used. The CES-D has been shown to have high internal consistency (Cronbach's alpha = 0.85 for general population, 0.9 for depressed patients) (Radloff, 1977), including across ethnicities (Cronbach's Alpha = 0.83-0.88) (Roberts, 1980).

Social Problem Solving

Means-Ends Problem-Solving Test (MEPS; Platt & Spivack, 1975)(appendix C)

The MEPS is a measure of a participant's ability to effectively apply their social problems solving skills to a hypothetical situation. The original assessment consists of 10 vignettes, each with a start point (describing a social problem) and an end point (describing a resolution state). The participant has to describe how to get from the initial problem state to the positive end state. The MEPS has been shown to have good internal consistency 0.8-0.84 (Marx *et al.*, 1992), and construct validity (D'Zurilla & Maydeu-Olivares, 1995).

This study used a condensed version of the MEPS, used in previous studies (Goddard *et al.*, 2007; Marx, Williams & Claridge, 1992) and been shown to be valid (Platt & Spivack, 1975). The four vignettes used involved unfair treatment by a teacher, teasing by friends for not socializing enough, moving to a new neighborhood without any friends, and a conflict with parents. In contrast to standard methodology, participants were asked to write, rather than dictate, answers.

Responses were scored on five dimensions; number of means, effectiveness, references to emotion, time appreciation, and considering another's perspective. Two raters scored participant's responses for each of the four vignettes, before being totaled to provide each participant with one score for each measure on the MEPS. Inter-rater reliability was poor to fair (Kappa = 0.24-0.63, see table 2)

The number of means produced is a widely used measure of MEPS responses, and is calculated by counting the number of steps offered within each solution.

Effectiveness was designed to measure how effective the solutions offered would be in reaching the outcome state. These were scored in a 7 point Likert scale, in accordance with the methodology used by Marx, Williams and Claridge (1992).

Goddard *et al.* (2007) created five additional scoring criteria for the MEPS, of which statistically significant differences between AS and control group scores were found for three: references to emotion, time appreciation and script violation. In this study, MEPS responses were scored for these three criteria; however, script violation was dropped due to insufficient variation.

References to the emotional responses of self or others were measured due to documented problems with emotional recognition in autism (Bacon *et al.*, 1998), and scored on a binary scale (Goddard *et al.*, 2007). Problems in diachronic thinking are apparent in autism, and have been shown to have an effect on SPS (Montangero, Pons & Cattin, 2000). Time appreciation was included to assess whether participants were able to consider the progression of a solution over time. Scoring was on a zero to two scale. An implication of the passage of time, (i.e. an order to do tasks) scored

one, an explicit reference to the passage of time scored two (Goddard *et al.*, 2007). For both measures, scoring was done for each vignette, leading to a maximum score of four and eight respectively.

On inspection of MEPS responses, it was felt that the ability to appreciate another's perspective may be influencing results, and was included. Scores were marked on a binary scale, scoring one point if there was an appreciation of another's perspective, for example, explicitly asking another's perspective or explaining, as opposed to telling their view to someone. This was done for each vignette, giving a maximum score of four.

Autobiographical Memory

Sentence Completion for Events from the Past Test (SCEPT; Raes, Hermans, Williams and Eelen, 2007) (See appendix D)

Raes *et al.* (2007) suggested that persons with sub-clinical levels of depression may, when asked to retrieve memories in the Autobiographical Memory Cueing task be able to force themselves to retrieve specific memories. The SCEPT was designed to overcome this by not instructing participants to retrieve specific or general memories, by using a sentence completion task designed to elicit *either* form of memory. The SCEPT has been widely used in both in conjunction with and instead of the AMT (Raes *et al.*, 2008; Anderson & Dewhurst, 2009; Raes, 2009). Eleven partial sentences are presented to participants to complete. Responses were coded by two raters as specific, categorical, extended or semantic associate. Fair to strong inter-rater agreement was found on all SCEPT subscales (Kappa = 0.37-0.89) (see table 2). The ratio of specific, categorical, extended, semantic associate memories, was

calculated. This was done by dividing the memory type by the total number of memories (not including omissions) recalled. In addition, the ratio of omissions to total possible responses was calculated by dividing the number of omissions by the number of possible responses (11).

Table 2:
Inter-rater Reliability on MEPS Measures and the SCEPT

	Kappa	Standard Error	p
MEPS Means	0.63	0.06	<0.001
MEPS Effectiveness	0.42	0.06	<0.001
MEPS Emotion	0.24	0.12	0.024
MEPS Time Appreciation	0.3	0.08	<0.001
MEPS Others Perspective	0.33	0.1	0.002
SCEPT Specific Memories	0.87	0.03	<0.001
SCEPT Extended Memories	0.39	0.07	<0.001
SCEPT Categoric Memories	0.51	0.06	<0.001
SCEPT Semantic Associate Memories	0.36	0.11	<0.001
SCEPT Omissions	0.89	0.06	<0.001

Procedure

Participants were administered the measures as a questionnaire, taking approximately 45 minutes to complete. Participants were allowed to take the questionnaire home and complete it at their leisure. However, they were asked to complete it all in one sitting in an area with few distractions.

The SCEPT was presented first, to avoid any priming by depression measures. The MEPS was then completed, followed by The CES-D. The AQ was administered last to avoid any possible effect of priming on depression, memory, or SPS measures.

Results

Distribution of data

The skewness and kurtosis of each measures distribution was calculated. All distributions presented with skewness less than +/- 1.5 (s.e=0.5), and kurtosis of less than +/- 1.82 (s.e=0.97), except for the ratio of semantic associate memories recalled. After transformation by Log_{10} , the distribution of semantic associate memory recall had skewness of 1.71, and kurtosis of 2.36. With the transformed semantic associate memory responses, data distribution was deemed to be normally distributed (Data on kurtosis and skewness in appendix E).

Descriptive Statistics

The mean ratio of memories recalled for specific, extended and categoric memories was 0.31 (S.D=0.18), 0.43 (S.D=0.21), and 0.25 (S.D=0.18) respectively. The mean number of means and the effectiveness scores, summed over the four vignettes in the MEPS was 14.76 (S.D=6.44) and 15.52 (S.D=4.36) respectively. Further descriptive statistics for scales and subscales are presented in Table 3

Table 3:
Descriptive Statistics for all Scales and Subscales

	Mean	Standard Deviation	Range
MEPS Means	14.76	6.44	24
MEPS Effectiveness	15.52	4.36	16
MEPS References to Emotion	1.14	0.79	3
MEPS Time Appreciation	3.38	1.53	5
MEPS Others Perspective	2.24	1.09	4
SCEPT Ratio of Specific Memories	0.31	0.18	0.63
SCEPT Ratio of Extended memories	0.43	0.21	0.91
SCEPT Ratio of Catagoric memoires	0.25	0.18	0.55
SCEPT Ratio of Semantic Associate memories (Transformed)	-0.88	0.29	0.7
SCEPT Ratio of Omissions	0.06	0.09	0.27

Hypothesis 1: Higher levels of autistic traits will have a negative relationship to measures of SPS ability when controlling for depressed mood

Relationship between autistic traits and depressed mood

To establish the extent of any pre-existing relationship between autistic traits and depressed mood, a one-tailed Pearson's R analysis were conducted (see table 4). A non-significant correlation was found between the AQ and CESD ($r(19) = -0.01$, $p=0.582$).

Table 4:
One-tailed Pearson's R Correlations Between MEPS Measures SCEPT Memories, CESD and AQ

	MEPS Means	MEPS Effectiveness	MEPS References to Emotion	MEPS Time Appreciation	MEPS Others perspective	CESD	AQ
SCEPT Specific	-0.16	0.03	-0.26	0.22	-0.12	-0.38*	-0.10
SCEPT Extended	0.07	0.14	-0.13	-0.17	-0.08	0.28	0.07
SCEPT Catagoric	0.05	-0.16	0.41*	-0.03	0.21	0.10	-0.04
SCEPT Semantic Associate (Transformed)	0.03	-0.31	-0.49	-0.12	-0.28	0.46	0.38
SCEPT Omissions	-0.30	-0.47*	0.07	-0.08	-0.30	0.29	0.15
CESD	-0.23	0.03	-0.02	-0.41*	0.20	-	-0.01
AQ	-0.23	-0.55**	-0.28	-0.01	-0.44*	-0.01	-

* $p < 0.05$, ** $p < 0.01$,

Relationship between autistic traits and social problem solving.

Five one-tailed Pearson's R correlation analyses tested for a relationship between autistic traits and SPS (see table 4). A Bonferroni correction to $p=0.01$ was applied. The AQ was significantly correlated to the effectiveness of solutions offered on the MEPS ($r(19)=-0.55$, $p=0.005$). The relationship between the AQ and the ability to consider another's perspective was approaching significance ($r(19)=-0.44$, $p=0.024$).

A series of hierarchical regression analyses were conducted to factor out the effect of depressed mood on SPS. The relationship between the AQ and the number of means, references to emotion awareness, and time appreciation were all non-significant when factoring out the effect of depressed mood. A significant relationship between the AQ and the effectiveness of solutions ($p=0.011$) was found, accounting for 31% of the variance (table 5a). While the relationship between the AQ and considering another's perspective was close to significance ($p=0.049$) it was not significant when correcting for family wise error (table 5b).

Table 5a
Hierarchical Linear Regression Between the AQ and Social Problem Solving Effectiveness Factoring out the CES-D.

	B	SE: B	β	R^2	Adjusted R^2	ΔR^2
Step 1:						
Constant	15.29	1.91				
CES-D	0.02	0.11	0.03	0.00	-0.05	
Step 2:						
Constant	22.58	3.06				
CES-D	0.01	0.09	0.03			
AQ	-0.44	0.16	-0.55*	0.31	0.22	0.31

* $p < 0.05$

Table 5b
Hierarchical Linear Regression Between the AQ and Others Perspective Factoring out the CES-D

	B	SE: B	β	R^2	Adjusted R^2	ΔR^2
Step 1:						
Constant	1.88	0.47				
CES-D	0.02	0.03	0.20	0.04	-0.01	
Step 2:						
Constant	3.32	0.81				
CES-D	0.02	0.02	0.20			
AQ	-0.09	0.04	-0.44*	0.23	0.15	0.19

* $p < 0.05$

Hypothesis 2: *Reduced specificity of autobiographical memory retrieval will be associated with higher levels of autistic traits*

Relationship between autistic traits and memory recall.

Five one-tailed Pearson's R analysis tested for a relationship between the AQ and the number of specific, categoric, extended, and semantic associate memories recalled, as well as the number of omissions (table 4). A Bonferroni correction to $p=0.01$ was applied. No significant results at the 0.05 or 0.01 level were found.

Hypothesis 3: *Reduced autobiographical memory specificity will be associated with poorer SPS ability*

Relationship between social problem solving and autobiographical memory

Twenty-five one-tailed Pearson's R correlation analyses tested for a significant relationship between the type of ABM recalled in the SCEPT and the scores on each of the MEPS measures (table 4). A Bonferroni correction to $p=0.002$ was applied.

Analysis revealed no relationship significant at the 0.002 level. However, a relationship at the 0.05 level was found between the ratio of categoric memories and references to emotion in solutions to the MEPS. ($r(19)=-0.42$, $p=0.028$).

Hypothesis 4: *Greater levels of depressed mood will be associated with poorer autobiographical memory specificity*

Relationship between depressed mood and memory recall

Four Pearson's R correlation analysis tested for a relationship between depressed mood and the ratio of specific, extended, categoric and semantic associate memories recalled. A Bonferroni correction to $p=0.0125$ was applied. The relationship between the ratio of specific memories recalled and depressed mood approached, but failed to reach the corrected significance level ($r(19)=-0.38$, $p=0.044$). No other significant relationship was found (table 4).

Discussion

This study considered how the relationship between SPS and ABM specificity varied as a function of the level of autistic traits in a sub-clinical sample. To summarise; there was a negative relationship between the level of autistic traits observed and the effectiveness of solutions generated, which was maintained when controlling for depressed mood. However, neither the level of autistic traits, nor SPS ability, was related to ABM specificity. Finally, while there were indications that ABM specificity may be linked to depressed mood, no relationship was significant at the required level.

Hypothesis 1

The relationship between the level of autistic traits and the effectiveness of SPS solutions is in line with past research in clinical populations. Goddard *et al.* (2007) found reduced effectiveness of solutions to the MEPS in a sample of people with AS, compared with controls. Equally, Channon *et al.* (2001) noted that the effectiveness of solutions generated using a different SPS measure was significantly poorer in people with AS. Combined with previous evidence, our findings suggest that the

level of autistic traits significantly influence the effectiveness of SPS solutions, even when the level of autistic traits is at subclinical levels.

The number of means generated on the MEPS was not significantly related to the level of autistic traits. Contrary to this, Goddard *et al.* (2007) found that persons with AS produced significantly fewer means than control participants. One explanation for this discrepancy is the difference in sample sizes ($n=21$, compared to Goddard *et al.* 2007 sample of 76). Such an explanation would not necessarily negate the relationship found between the effectiveness of solutions and autistic traits; the difference between controls and people with AS had a greater significance level for the effectiveness of solutions ($p=0.002$) than the number of means produced ($p=0.005$). Therefore, with the smaller sample size in this study, weaker results are less likely to reach significance.

An alternative explanation is that the number of means produced may not have a linear relationship with the level of autistic traits. It could be that clinical levels of autistic traits are required to cause problems in generating means. Goddard, Dritschel and Burton (1997) found a significant correlation between the number of means generated on the MEPS and autobiographical memory specificity. If clinical levels of autistic traits are required to influence noetic awareness, and in turn affect autobiographical memory specificity, then SPS (Goddard *et al.*, 2007), the compound effect of multiple dependant relationships may produce a nonlinear relationship between autistic traits and the number of means produced.

The results from the subjective measures on the MEPS responses differ from the results of Goddard *et al.* (2007). Goddard *et al.* (2007) only found a significant difference between the control and AS groups for time appreciation. However, no correlation between time appreciation and autistic traits was found in our sample. References to emotion, which was approaching significance in the Goddard *et al.* (2007) sample, also bore no relation to autistic traits. Considering another's perspective ($p > 0.1$ in Goddard *et al.* 2007) while non-significant, did approach significance after controlling for depressed mood, although was non-significant after adjusting for family-wise error.

Given that the same marking criteria were used for references to emotion, and time appreciation, the subjective analysis of the data (perhaps resulting in greater noise), and a small sample size may have prevented these measures from reaching significance. However, correlation between time appreciation and the AQ was -0.01 . Even with a larger sample, this seems unlikely to reach significance. Equally, this explanation cannot explain why considering another's perspective was almost significant in this sample ($p = 0.049$), but not in Goddard *et al.* (2007).

A more likely explanation for the discrepancy in results is that the responses were incorrectly marked. Poor inter-rater reliability was found on all three measures ($\kappa < 0.331$), whereas good reliability was found in Goddard *et al.* (2007) ($\kappa > 0.74$). Given that the marking criteria used in Goddard *et al.* (2007) were used in two of the three measures, it may be that these measures, as well as our own derivation of perspective taking, lack reliability. Given this discrepancy, and that none of these measures have been independently tested, assessing the reliability (and validity) of

these measures is needed before their results can be fully interpreted. Once completed, further research with a larger sample is needed to establish whether any of these effects are present in ASDs, and if so, whether they are dependent on the level of autistic traits.

Hypotheses 2-4

The lack of any relationship between memory specificity and autistic traits, SPS and depression is contradictory to past research. Autobiographical Memory specificity has demonstrated a relationship with autism (Crane & Goddard, 2008; Bruck *et al.*, 2007; Crane, Goddard & Pring, 2009, Goddard *et al.*, 2007), SPS ability (Evans *et al.*, 1992; Goddard, Dritschel & Burton, 1996), and depression (Goddard, Dritschel & Burton, 1996). Indeed, findings that indicate a relationship between SPS ability and ABM specificity are present even in nonclinical samples (Goddard, Dritschel & Burton, 1997; Beaman *et al.*, 2007). This finding, in particular, suggests that results gained from this sample using the SCEPT may not be reliable.

One explanation is that ambiguous data (demonstrated by poor inter-rater reliability: kappa = 0.36-0.89), increased the noise in the data, which could not be sufficiently reduced with this sample size. The SCEPT is arguably less structured than tasks such as the Autobiographical Memory Cueing task, in which not only is the participant aware the test is a test of ABM, but is also aware of the different types of memory specificity. Therefore, they may be more likely to search for a memory that accurately fits this description. The SCEPT, however, gives no indication that it is an ABM task. Therefore, results given may be less directed towards autobiographical memory recall, and thus harder to classify. Supporting this, both experimenters

reported difficulty classifying some retrieved memories. While the SCEPT may be better designed to detect low-level differences in autobiographical memory recall, it may also require a larger sample size to compensate for noise. Because a small sample was used in this study, further research using either a larger sample, or a more controlled measure is required to determine if the relationships between ABM specificity and SPS, depressed mood, and autism exist at low levels in the general population.

Implications and further research

While low levels of autistic traits have been detected in the general population before (Baron-Cohen *et al*, 2001), this evidence suggests that autistic traits in the general population have a tangible effect on the social functioning of individuals, without requiring clinical levels of autistic traits. However, while this relationship exists, questions over the reliability of the SCEPT mean that further investigation is required to establish whether autistic traits affect SPS directly, or through deficits in ABM specificity. In addition further research should investigate what, if any, other clinical characteristics (such as communication impairment and repetitive behaviour) correlate with the level of autistic traits at low levels.

If the level of autistic traits mediates multiple clinical characteristics of autism in the general population, this could change our definition of the autistic spectrum. Rather than an autistic spectrum consisting of AS, autism and PDD-NOS, it may be much broader, encompassing the whole population. Under this definition, either the number of autistic traits or the level of impairment caused would define an individual's location on the spectrum.

This research suggests that support, particularly relating to social skills and conflict resolution, should be extended to those with higher levels of autistic traits within the general population, and not be limited by a diagnosis. Support, at present, is often accessed via a diagnosis of autistic spectrum disorder (Volkmar *et al.*, 2009), with early interventions often having long-term benefits for people with autism (Rogers, 1996). However, such support and early intervention is likely to be unavailable to those with higher levels of autistic traits, but no diagnosis. A review of current access pathways to support, and the restrictions therein should be considered, particularly if other impairments are shown to be mediated by autistic traits. In addition, research on improving social skills in people with autism (i.e Ozonoff & Miller, 1995) should consider expanding its sample base, to investigate treatment effectiveness across the autistic spectrum.

As already highlighted, the small sample size, low levels of impairment, and (in the case of the MEPS), untested measures may account for some null results in this study that contradict past research. Therefore, further testing is required to assess whether ABM specificity impairments also exist at low levels of autistic traits. In addition further research on the validity and reliability of the subjective measures in MEPS derived both in this study, and by Goddard *et al.* (2007) is required before results can be confidently drawn from them. However, if this can be achieved, then it may be possible to identify what other cognitive factors influence SPS, based on the level of autistic traits.

Criticisms

People with autism find social interaction difficult, and often stressful (c.f Frith, 1989; Attwood, 1995). Despite this, studies investigating social problem solving and autobiographical memory in ASDs are often done in person (for example, Channon *et al.*, 2001, Goddard *et al.*, 2007, Crane & Goddard 2008, Bruck *et al.*, 2007).

Having to interact with an unknown individual this way may increase anxiety, and impair performance in people with autism, but not affect the performance of controls. Unlike previous research on this topic, we were able to control for the effect of social interaction by allowing participants to complete the study in an environment in which they felt at ease.

The use of a questionnaire design for the MEPS task has not, to our knowledge, been done before. Writing responses is arguably more effortful than dictating, which may have lead to participants reporting fewer means, and offering less detailed solutions. However, comparison to Goddard (2007) suggests this is not the case; control participants (who have most MEPS solutions) gave an average of 15.54 means (s.d 5.03) to 5 vignettes (average 3.1 per vignette), compared to 14.762 means (s.d 6.441) over 4 vignettes (average 3.7 per vignette) in this study. While the data for a statistical analysis was not available, this suggests that there was only a minimal effect on the number of means, resulting in greater variance. In addition, the questionnaire design did mean that where ambiguous or irrelevant responses were given on the MEPS or SCEPT, we were unable to ask for clarification. This is likely to have resulted in greater noise in the data, and may have clouded the scores.

In conclusion, this study provides evidence that autistic traits, even at low levels, are linked to SPS ability. It was, however, not possible to prove or disprove any

relationship between autobiographical memory, and either SPS, autistic traits, or depressed mood. Regardless, this research provides the evidence that autism may be regarded as a trait, in addition to a clinical diagnosis.

References

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.).
- American Psychiatric Association (n.d). Proposed revision: 299.00 Autistic Disorder. Accessed on 14/11/10 from www.dsm5.org/
- Anderson, R. J., & Dewhurst, S. A. (2009). Remembering the past and imagining the future: differences in event specificity of spontaneously generated thought. *Memory*, 17(4), 367-73. doi:10.1080/09658210902751669
- Attwood, T. (1997) *Asperger's Syndrome: A Guide for Parents and Professionals*. London: Jessica Kingsley Publishers
- Bacon, A L., Fein, D., Morris, R., Waterhouse, L., & Allen, D. (1998). The responses of autistic children to the distress of others. *Journal of autism and developmental disorders*, 28(2), 129-42. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9586775>
- Bailey, a, Le Couteur, a, Gottesman, I., Bolton, P., Simonoff, E., Yuzda, E., & Rutter, M. (1995). Autism as a strongly genetic disorder: evidence from a British twin study. *Psychological medicine*, 25(1), 63-77. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/7792363>
- Bailey, a, Palferman, S., Heavey, L., & Le Couteur, a. (1998). Autism: the phenotype in relatives. *Journal of autism and developmental disorders*, 28(5), 369-92. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9813774>
- Baron-Cohen, S. (2001). Theory of mind and autism : a review. *Special Issue of the International Review of Mental Retardation*, 23(169).

- Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of autism and developmental disorders*, 31(1), 5-17. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11439754>
- Beaman, A., Pushkar, D., Etezadi, S., Bye, D., & Conway, M. (2007). Autobiographical memory specificity predicts social problem-solving ability in old and young adults. *Quarterly journal of experimental psychology* (2006), 60(9), 1275-88. doi:10.1080/17470210600943450
- Bonner, R.L., & Rich, A. (1988) Negative life stress, Social problem-solving self-appraisal and life stress: Implications for suicide research. *Cognitive Therapy and Research*, 12 549-556
- Bowler, D. M., Gardiner, J. M., & Grice, S. J. (2000). Episodic memory and remembering in adults with Asperger syndrome. *Journal of autism and developmental disorders*, 30(4), 295-304. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11039856>
- Bruck, M., London, K., Landa, R., & Goodman, J. (2007). Autobiographical memory and suggestibility in children with autism spectrum disorder. *Development and Psychopathology*, 19(01), 73-95. doi:10.1017/S0954579407070058
- Channon, S., Charman, T., Heap, J., Crawford, S., & Rios, P. (2001). Real-Life-Type Problem-Solving in Asperger's Syndrome. *Autism*, 31(5).
- Constantino, J. N., & Todd, R. D. (2003). Autistic Traits in the General Population: A Twin Study. *Archives of General Psychiatry*, 60, 524-530.

- Crane, L., & Goddard, L. (2008). Episodic and Semantic Autobiographical Memory in Adults with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, 38(3), 498-506. doi:10.1007/s10803-007-0420-2
- Crane, L., Goddard, L., & Pring, L. (2009). Specific and general autobiographical knowledge in adults with autism spectrum disorders: the role of personal goals. *Memory*, 17(5), 557-76. doi:10.1080/09658210902960211
- D’Zurilla, T. J., & Chang, E. C. (1995). The relations between social problem solving and coping. *Cognitive Therapy and Research*, 19(5), 547–562. Springer.
Retrieved from <http://www.springerlink.com/index/31200u01076r7vk8.pdf>
- D’Zurilla, T. J., & Maydeu-olivares, A. (1995). Conceptual and methodological issues in social problem-solving assessment. *Behavior Therapy*, 26(3), 409-432.
doi:10.1016/S0005-7894(05)80091-7
- Evans, J., Williams, J. M., O’Loughlin, S., & Howells, K. (1992). Autobiographical memory and problem-solving strategies of parasuicide patients. *Psychological medicine*, 22(2), 399-405. Retrieved from
<http://www.ncbi.nlm.nih.gov/pubmed/1615107>
- Frith, U. (2003) *Autism: Explaining the Enigma* (2nd Ed). Sussex: Wiley.
- Goddard, L., Dritschel, B., & Burton, A. (1996). Role of autobiographical memory in social problem solving and depression. *Journal of abnormal psychology*, 105(4), 609-16. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/8952194>
- Goddard, L., Dritschel, B., & Burton, A. (1997). Social problem solving and autobiographical memory in non-clinical depression. *The British Journal of Clinical Psychology*. 36 (3), 449-51. Retrieved from
<http://www.ncbi.nlm.nih.gov/pubmed/9309360>

- Goddard, L., Howlin, P., Dritschel, B., & Patel, T. (2007). Autobiographical memory and social problem-solving in Asperger syndrome. *Journal of autism and developmental disorders*, 37(2), 291-300. doi:10.1007/s10803-006-0168-0
- Hill, E. L. (2004). Executive dysfunction in autism. *Trends in Cognitive Sciences*, 8(1), 26-32. doi:10.1016/j.tics.2003.11.003
- Lainhart, J. E. (1999). Psychiatric problems in individuals with autism, their parents and siblings. *Health*, 278-299.
- Marx, E. M., Williams, J. M., & Claridge, G. C. (1992). Depression and social problem solving. *Journal of abnormal psychology*, 101(1), 78-86. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/1537977>
- Matthys, W., Cuperus, J. M., & Engeland, H. V. (1999). Deficient Social Problem-Solving in Boys With ODD/CD, With ADHD, and With Both Disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, 38(3), 311-321. doi:10.1097/00004583-199903000-00019
- Millward, C., Powell, S., Messer, D., & Jordan, R. (2000). Recall for Self and Other in Autism : Children ' s Memory for Events Experienced by Themselves and Their Peers. *Autism*, 30(1).
- Montangero, J., Pons, F., & Cattin, J.-P. (2000). The diachronic approach and solutions to interpersonal conflicts. *British Journal of Developmental Psychology*, 18(3), 415-429. doi:10.1348/026151000165779
- Muggleton, J., Seed, A. (2011) Classifying the autistic spectrum: can it be done? Effectiveness of current, future and alternative methods of classifying the autistic spectrum. *Good Autism Practice* 12 (2) 7-18
- Ozonoff, S., & Miller, J. N. (1995). Teaching Theory of Mind: A New Approach to Social Skills Training for Individuals with Autism. *Journal of Autism and*

- developmental Disorders*, 25(4), 415–433. Springer. Retrieved from <http://www.springerlink.com/index/B65312302831053L.pdf>
- Piven, J., Wzorek, M., Landa, R., Lainhart, J., Bolton, P., Chase, G. a, & Folstein, S. (1994). Personality characteristics of the parents of autistic individuals. *Psychological medicine*, 24(3), 783-95. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/7991760>
- Piven, J., Palmer, P., Landa, R., Santangelo, S., Jacobi, D., & Childress, D. (1997). Personality and language characteristics in parents from multiple-incidence autism families. *American journal of medical genetics*, 74(4), 398-411. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9259376>
- Platt, J. J., & Spivack, G. (1975) *Manual for the Means-Ends Problem-Solving Test (MEPS): A measure of interpersonal problem-solving skill*. Philadelphia, Hahnemann Medical College and Hospital.
- Pollock, L. R., & Williams, J. M. (2001). Effective problem solving in suicide attempters depends on specific autobiographical recall. *Suicide & life-threatening behavior*, 31(4), 386-96. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11775714>
- Powell, S. D., & Jordan, R. R. (1993). Being subjective about autistic thinking and learning to learn. *Educational Psychology* 13. 359-370
- Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind. *Behavioral and brain sciences*. Retrieved from <http://www.phillipscentral.net/uploads/Does the Chimpanzee Have a Theory of Mind.pdf>

- Radloff, L. S. (1977). The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. *Applied Psychological Measurement*, 1(3), 385-401. doi:10.1177/014662167700100306
- Raes, F., Hermans, D., Williams, J. M. G., & Eelen, P. (2007). A sentence completion procedure as an alternative to the Autobiographical Memory Test for assessing overgeneral memory in non-clinical populations. *Memory (Hove, England)*, 15(5), 495-507. doi:10.1080/09658210701390982
- Raes, F., Watkins, E. R., Williams, J. M. G., & Hermans, D. (2008). Non-ruminative processing reduces overgeneral autobiographical memory retrieval in students. *Behaviour research and therapy*, 46(6), 748-56. doi:10.1016/j.brat.2008.03.003
- Raes, F., Williams, J. M. G., & Hermans, D. (2009). Reducing cognitive vulnerability to depression: a preliminary investigation of MEmory Specificity Training (MEST) in inpatients with depressive symptomatology. *Journal of behavior therapy and experimental psychiatry*, 40(1), 24-38. doi:10.1016/j.jbtep.2008.03.001
- Rutter, M. (1970) Autistic children: infancy to adulthood. *Seminars in Psychiatry*, 2, 435-450. As cited in Lainhart, J. E. (1999). Psychiatric problems in individuals with autism, their parents and siblings. *Health*, 278-299.
- Roberts, R. E. (1980). Reliability of the CES-D Scale in Different Ethnic Contexts. *Psychiatry Research*, 2(2), 125–134. Elsevier. Retrieved from <http://www.sciencedirect.com/science/article/pii/0165178180900694>
- Rogers, S. J., (1996). Brief Report: Early Intervention in Autism. *Journal of Autism and Developmental Disorders* (26) 2. 243-246

Sadowski, C., & Kelley, M. L. (1993). Social problem solving in suicidal adolescents.

Journal of consulting and clinical psychology, 61(1), 121-7. Retrieved from

<http://www.ncbi.nlm.nih.gov/pubmed/8450097>

Stewart, M. E., Barnard, L., Pearson, J., Hasan, R., & O'Brien, G. (2006).

Presentation of depression in autism and Asperger syndrome: a review. *Autism : the international journal of research and practice*, 10(1), 103-16.

doi:10.1177/1362361306062013

Sutherland, K., & Bryant, R. a. (2007). Autobiographical memory in posttraumatic

stress disorder before and after treatment. *Behaviour research and therapy*,

45(12), 2915-23. doi:10.1016/j.brat.2007.08.009

Volkmar, F. R., State, M., Klin, A., (2009). Autism and autism spectrum disorders:

diagnostic issues for the coming decade. *Journal of Child Psychology and*

Psychiatry (50) 108-115.

Wakabayashi, A., Baron-cohen, S., & Wheelwright, S. (2006). Are autistic traits an

independent personality dimension? A study of the Autism-Spectrum Quotient

(AQ) and the NEO-PI-R. *Personality and Individual Differences*, 41(5), 873-883.

doi:10.1016/j.paid.2006.04.003

Williams, J.M.G. (1996). Depression and the specificity of autobiographical memory.

In D.Rubin (Ed.), *Remembering our past: studies in autobiographical memory*

(pp 244-267). Cambridge, England: Cambridge University Press. As cited in

Goddard, L., Dritschel, B., & Burton, A. (1996). Role of autobiographical memory

in social problem solving and depression. *Journal of abnormal psychology*,

105(4), 609-16. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/8952194>

Wing, L. (1981). Asperger' s syndrome : a clinical account. *Psychological medicine*,

11, 115-129.

World Health Organization (1992) International Classification of Diseases (10th ed)

Geneva: World Health Organization