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**AN INVESTIGATION OF THE DEVELOPMENTAL LINK  
BETWEEN THEORY OF MIND AND EXECUTIVE  
FUNCTION IN AUTISM**

**& RESEARCH PORTFOLIO**

**VOLUME ONE**

**Katharine A Russell**

**(MA Hons)**

Submitted in partial fulfilment of the degree of Doctorate in Clinical Psychology,  
Department of Psychological Medicine, Faculty of Medicine, University of Glasgow,  
July 2002

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## **Acknowledgements**

There are a number of people I have to thank for assisting me in completing this Thesis. I would firstly like to thank Dr. Fiona Knott for all her input, advice and support at all stages. It is truly one of those experiences that has its highs and lows and Fiona has experienced all of those with me. I must also thank Dr. Andrew Gumley for his advice at the analyses stage of this paper. This advice has proved invaluable. In addition, Chwee and Helen have always been on hand to guide me through the administrative side of the thesis and have, therefore, also been invaluable. On a more personal note, I would like to thank Heather for all her support during this process as we have stood side-by-side throughout. Also, to all my family and friends who have been very supportive during the last year.

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# **SMALL-SCALE SERVICE EVALUATION PROJECT**

**An Analysis of Hospital Anxiety and  
Depression (HAD) Scales completed by  
attendees of a Sexual Abuse Clinic**

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**Department of Psychological Medicine  
University of Glasgow**

Submitted in partial fulfilment of the degree of Doctorate in Clinical  
Psychology, Department of Psychological Medicine, Faculty of Medicine,  
University of Glasgow, July 2002

**This Presentation was given on August 25<sup>th</sup> 2000 at the Clinical Psychology Department in Stobhill Hospital to both members of the Clinical Psychology Department and the Psychotherapy Department.**



# PRESENTATION TRANSCRIPT

## **Slide 1 - Title**

My name is Katharine Russell and I am a first-year trainee in Clinical Psychology. My presentation today concerns a Small-Scale Service Evaluation Project I carried out as part of my Doctoral course. I've been carrying out my first year placement in Stobhill Clinical Psychology Department where there is a weekly Sexual Abuse Clinic that covers the whole of the North of Glasgow. Those who attend the clinic are victims of Child Sexual Abuse (CSA) or Sexual Assault (SA). This project was designed to look at attendees' scores on the Hospital Anxiety and Depression Scale (HADS), the relationship between patient characteristics and HADS scores, and the relationship between HADS scores and the outcome of assessment.

## **Slide 2 - Background**

Victims of Child Sexual Abuse have been studied widely as a population. Baker & Duncan (1985) in a UK study estimated that 10% of the general population has been sexually abused at least once in their lives. A number of articles have found a relationship between childhood sexual abuse and psychiatric morbidity as an adult. Stein et al. (1996) found that a history of childhood sexual abuse was more common among women with anxiety disorders (45.1%) than among comparison subjects (15.4%) in a community sample.

Bryer et al. (1987) found a high rate of childhood sexual and physical abuse in a sample of 600 female psychiatric inpatients (21% experienced sexual abuse only, 18% experienced physical abuse only, 33% experienced both sexual and physical abuse). These childhood abuse experiences were correlated with severity of adult psychiatric symptoms. A multiple regression analysis was conducted with the SCL-90-R global severity index as the dependent variable and the background and traumatic factors as independent variables. The only

significant variables and their percentages of the global severity index variance were early sexual abuse (21.4%); father's alcohol abuse (10.2%) and early physical abuse (7.3%).

Johnsen et al. (1999) have also found that people in the community who have experienced childhood sexual abuse or neglect are considerably more likely than those who were not abused or neglected to have a Personality Disorder and elevated Personality Disorder symptoms levels during early adulthood. On the basis of this information, it is clear that victims of Childhood Sexual Abuse are at risk of a range of mental health problems in adulthood.

Research has shown that around 30% of female patients attending psychiatric outpatient clinics report having been sexually abused as a child (Cahill et al., 1991). However, as the Greater Glasgow Health Board report, "Mental Health & Illness in Greater Glasgow" (March 1999), highlights, it is hard to demonstrate the causal connection between Child Sexual Abuse (CSA) and the development of mental illness, "given the possible contribution of other factors in the survivors' background such as disturbed family relationships (p.48). It is true that despite there being clear evidence of a relationship, there is little understanding of the precise theoretical link explaining why those with a sexual abuse history should become anxious or depressed.

Previous clinical psychology trainees have carried out audits on The Sexual Abuse Clinic in North Glasgow. Clive Hillary (1997) used file information to look at a variety of variables and coded patient information using ICD-10 Diagnostic criteria and file information. He found PTSD, depression and problems relating to sexual abuse were the most common diagnoses in his sample. Janice McKenzie (to be published) carried out another audit looking more specifically at factors affecting opt-in and attendance at a Sexual Abuse and Assault Clinic. She found significant findings for substance abuse, anxiety problems, marital status

and source of referral. In particular, those that were married or cohabiting were more likely to attend after opt-in. Patients with substance abuse problems were less likely to opt-in for assessment, less likely to attend if they had opted-in and less likely to be offered treatment. GP referrals were more likely to be offered treatment straight away, whereas CMHT referrals were put on a waiting list. Those who were suffering from anxiety were more likely to opt-in for assessment but a significant proportion did not attend. In this study, diagnostic categories were taken from the referral letters.

Neither of these audits has looked at a psychological measure as one of their variables; they have relied on medical opinion or self-made ICD-10 diagnoses taken from file information. The HADS is now given routinely to all patients on their assessment interview at the Clinic and it is stored in patient files. It was felt that it would be interesting to investigate if the HADS data added anything to the knowledge already held about the Clinic patients.

The HADS is a 14-item self-report measure of anxiety and depression. Lisspers et al. (1997) administered the HADS and other measures to a Swedish normal population sample. They found the average HAD-A score to be 4.55 and the average HAD-D score to be 3.98.

Spinhoven et al. (1997) carried out a validation study with different groups of Dutch subjects. They used psychiatric outpatients, a GP sample, a general medical sample with unexplained somatic symptoms, adults and older adults. Of interest, the mean Anxiety score for the GP sample with unexplained somatic symptoms was 6.5 and the mean Depression score was 5.3. The mean psychiatric outpatient Anxiety score was 11.1 and the mean Depression score was 9.3.

Previous audits of this Sexual Abuse Clinic have been carried out but they have relied on information from the referral letter. This will be the first audit looking both at self-report measures of anxiety and depression on first attendance at the Clinic and the information gathered from the assessment interview (taken from the Psychologist's letter to the referrer). As noted above there is a high prevalence of CSA that results in a significant rate of psychiatric morbidity. A variety of agencies offer services to CSA survivors including voluntary agencies, social work and the NHS. The GGHB Trust Implementation Plan is currently looking at the need for a service within Mental Health Services for Sexual Abuse victims. This evaluation aims to find evidence that CSA survivors and victims of Sexual Assault in North Glasgow have a level of mental health problems that is significant enough to warrant a separate service.

### **Slide 3 - Aims of Project**

The first aim was to discover if people with a history of Child Sexual Abuse attending a North Glasgow Sexual Abuse Clinic were suffering from levels of Anxiety and Depression on the HADS that reach "caseness". I will explain what this means in a moment. The second aim was to investigate, by looking at a range of variables, i.e. characteristics of the population, if any of them affect the level of severity on the HADS, that is:

- Age & Gender – Do people within a certain age category or does one gender group have a higher mean score on the HADS?
- Relationship Status – Finkelhor et al. (1990) stated that a secure relationship is often a prompt for seeking help. Do those who are married or cohabiting have a higher mean score on the HADS?
- Geographical Location, i.e. locality of North Glasgow – Maryhill, Springburn/Possil... Strathkelvin. These localities incorporate quite distinct different socio-economic groups.

Do patients from one particular locality have a higher mean HADS score than another locality?

- Substance Misuse – Coded ‘yes’ if mentioned as a problem, ‘no’ if not mentioned. – Do patients who are misusing illicit drugs have a higher mean score on the HADS?
- Who referred them – GP or Psychiatrist – Do Psychiatric referrals have a higher mean score on the HADS?
- Type of Abuse – Sexual Assault (victim is an adult) or CSA (victim is a child) – Do those that have experienced CSA have a higher mean score on the HADS than those who experienced Sexual Assault?
- Type of Perpetrator – Nuclear Family (Stepfather and Mother’s boyfriend coded as Nuclear Family) or Nuclear Family – Finkelhor et al. (1986) stated that one of the factors associated with long term problems was abuse by a parent or parental figure. Does a particular kind of perpetrator result in a higher mean score on the HADS?
- Number of Abuse Incidents – Finkelhor et al. (1986) stated that another factor associated with greater long-term problems was abuse involving multiple abusers. Does a greater number of abusers result in a higher mean HADS score?

The third aim was to discover if the self-report rating of Anxiety and Depression reaching ‘caseness’ affected opt-in for treatment.

#### **Slide 4 - Design and Measures Slide**

Every patient that attends the Clinic fills out a Hospital Anxiety and Depression Scale (HADS). The HADS is a self assessment scale that has "been found to be a reliable instrument for detecting depression and anxiety" in a clinical outpatient setting (Zigmond & Snaith, 1983). The Hospital Anxiety and Depression Scale consists of two sub-scales: anxiety and depression. It is a 14-item scale with 7 items in each sub-scale, each item having

four possible answers with scores ranging from 0-3. The maximum total on a sub-scale is therefore 21 and the minimum score 0. The HAD is a “reliable instrument for screening for clinically significant anxiety and depression cases.....(and) a valid measure of the severity of these disorders”(Zigmond & Snaith, 1983, p. 364). The HAD scale can be used to get an indication of “caseness”. For each sub-scale a score of 10 or 11 is taken to indicate caseness “where the research requires the inclusion of only those patients who have a high probability of suffering from the mood disorder” (Zigmond & Snaith, 1983, p. 365).

Patients who attend for assessment are seen by a member of the Clinic team. The team consists of Psychologists, Psychotherapists and a Forensic Psychiatrist. Allocation of patients to team members is essentially random. However, the Forensic Psychiatrist will generally pick up the cases where psychiatric input or forensic knowledge is required. The assessment will last approximately 50 minutes. Once this is finished, the patient is asked to fill out a HADS while their case is discussed with the whole team. A decision is made as to what intervention should take place. Every six weeks, a joint substance abuse and sexual abuse clinic is held. The options are to be put on a Waiting List for Therapy, immediate Therapy, a referral to another agency or no intervention. The most common type of therapy to be offered would be a 5-session brief intervention followed by a review.

This project used information from 50 patients who were seen for an assessment appointment between January and September 1999. Information was taken from the letter that the Psychologist sent to the referrer after the assessment had taken place. The data were analysed using Descriptive Statistics on SPSS 8.0. Due to the small numbers in this study, I am unable to use Inferential Statistics. As a result, I cannot make a statement about significant differences.

## **RESULTS AND DISCUSSION**

### **Slide 5 - Results – Aim 1**

For Aim 1, when I looked at the average score on each sub-scale of the HADS, I found that the mean Anxiety score of 14.44 reached caseness while the mean Depression score of 9.578 did not. These graphs illustrate the proportion of patients reaching caseness on each sub-scale. 84% of patients met caseness for anxiety.

#### **Graph 1 – Anxiety Caseness**

Only 44% met caseness for depression.

#### **Graph 2 – Depression Caseness**

### **Results – Aim 2 Slide**

To investigate Aim 2, many variables were looked at and I am only going to discuss the variables that produced interesting results. To quickly summarise:

- Only 12% of attendees were men so it was felt that an analysis of the difference in mean scores between men and women would be meaningless.
- No relationship was found between age and HADS score
- Only 20% of attendees reported substance misuse at assessment and there was very little difference in mean scores between them and those who did not report substance misuse.
- 50% of patients came from the Springburn/Possil area, 28% from Maryhill and 22% from Strathkelvin. However, there was little difference between mean scores again.
- 80% of attendees were referred by their GP, 14% from Psychiatrists and 6% by CPNs. A further analysis of difference in means would again be meaningless here due to the small numbers.
- 78% of attendees had reported CSA alone, 10% had reported SA alone and 12% had reported both so a fair comparison could not be made. Interestingly, research has noted

that victims of sexual abuse are more likely to experience further sexual assaults. Russell (1996) hypothesised that this is due to victims being less aware of safety issues.

The variables of greatest interest were Relationship status, First Perpetrator and Number of abuse incidents.

### **Graph 3 – Anxiety and Relationship Status**

Firstly, patients were divided into two groups. They were classified as single or cohabiting. 54% were cohabiting and 46% were single. As you can see from this graph, there was little variation between mean Anxiety scores for these two groups. The mean Anxiety scores were:

Single = 13.96

Cohabiting = 14.85

There is approximately a one-point difference between the two means. All these scores are well above the caseness cut-off of 11.

### **Graph 4 – Depression and Relationship Status**

The mean Depression scores were:

Single = 9.13

Cohabiting = 9.96

As you can see there is little difference between the two means again. Both scores fall below the caseness cut-off of 11.

These results contradict Finkelhor's finding. Whereas Finkelhor et al. (1990) stated that a secure relationship might be a prompt for seeking help, almost equal numbers of single and cohabiting people sought help. There was also little difference in severity of perceived symptoms. Therefore relationship status is not a differential in this sample.

### **Graph 5 – Anxiety and First Perpetrator**

Secondly, I looked at the effect that the type of perpetrator had on the HADS score. 78% of the sample had been abused by only one person so these results are based on the details of the



first abuse experience. 44% had been abused by a member of their nuclear family and 54% had been abused by someone outside of their nuclear family. One patient was not willing to reveal who the perpetrator was. Essentially, the mean scores of the two groups were very similar. The mean Anxiety Score was 14.23 for the Nuclear Family group and 14.67 for the Non-Nuclear Family Group. Both these scores reach caseness.

#### **Graph 6 -Depression and First Perpetrator**

The mean Depression score was 10.18 for the Nuclear Family group and 9.04 for the non-Nuclear Family group. Again there is only a one-point difference and both scores are below caseness.

#### **Table 1 – Depression and First Perpetrator Chi-square**

However, a Pearson Chi-square shows that there is a general trend emerging between being abused by a member of your nuclear family and reaching caseness on the Depression scale. This Chi-square shows that those who are abused by a member of their Nuclear family are more likely to reach caseness on the Depression sub-scale and those who are abused by someone outside of their nuclear family are more likely not to reach caseness on the Depression sub-scale. This is significant at 0.06. This provides support for Finkelhor's (1986) finding that abuse by a parent or parental figure is associated with longer-term problems. Nevertheless, no such trend was found with Anxiety Caseness

#### **Graph 7 – Number of Abuse Incidents**

Thirdly, there is a general trend for both mean scores of Anxiety and Depression to increase with the number of abuse or assault incidents that a person experienced. The most number of incidents any patients had experienced was four. As you can see the mean scores were lower than the scores for those who experienced 3 incidents but only one patient had experienced 4 incidents. 78% had experienced 1 incident, 14% had experienced 2 incidents, 6 people had experienced 3 incidents and 2% (1 person) had experienced 4 incidents. Again the small

numbers in this study make it hard to draw firm conclusion but there may be a general trend here.

#### **Slide 7**

##### **Table 2 – Anxiety Caseness and Outcome**

For Aim 3, a Pearson Chi-Square looking at the relationship between caseness and outcome shows that those reaching caseness on anxiety were more likely to get offered treatment and attend. Therefore caseness differentiated significantly between being offered and not offered treatment on the Anxiety sub-scale.

##### **Table 3 – Depression Caseness and Outcome**

However, this was not the case on the Depression sub-scale. Nearly equal numbers of those who both did and did not reach caseness were offered and accepted for treatment. That reaching caseness on the Anxiety sub-scale is associated with attendance for treatment is of practical interest to the Clinic. On the basis of this, the team could consider the likelihood of patients returning for treatment if they do not reach caseness for anxiety. In turn they could take steps, i.e. adapting their assessment session to provide information for the patient if they require help in the future. This finding is in contrast to Janice McKenzie's finding that a significant proportion of those with anxiety did not attend for treatment. This difference could be attributed to a difference in the samples as both projects are based on small numbers, especially this one.

#### **CONCLUSIONS**

##### **Slide 8 - Conclusions**

The pattern emerging from the above results indicate that survivors of Child Sexual Abuse typically present with anxiety-related problems that are severe enough to reach caseness. In response, the Sexual Abuse Clinic offers treatment which is, in general, accepted. The mean Depression scores did not reach caseness but were sufficient to classify as a mild depression.

Overall, this provides evidence that victims of CSA and Assault have mental health problems that are of a severity that requires the input of NHS professionals. However, the theoretical relation between CSA and developing anxiety or depression requires further exploration.

Finding variables that differentiated those who did and did not reach caseness was difficult as a result of the similarity of each patient's HADS scores. Any differences that were found were generally between one and one and a half points and therefore firm conclusions were difficult to make.

Finally, the small number of patients reaching caseness on Depression is somewhat surprising. Bifulco (1991) found that 64% of women and 26% of men with a history of CSA developed Adult onset Depression. McKenzie found 57.5% reported Depression whereas only 32.5% reported Anxiety. It may be that although, Depression is present, it is Anxiety that provokes people to present for help and it may be an event that has triggered anxiety. This would be worthwhile investigating in a larger study.

# Small Scale Service Evaluation Project

An Analysis of HADS Scores completed  
by Attendees of a Child Sexual Abuse  
Clinic

# Background

- CSA and Psychiatric Morbidity
  - Anxiety
  - Personality Disorder
- Previous Audits of the Clinic
- HADS studies with CSA population
- Rationale of Project

# Aims of Project

- What is the severity of Anxiety and Depression in those attending the clinic?
- Do any characteristics of the population affect severity of Anxiety and Depression?
- Does 'caseness' affect opt-in for Treatment?

Slide 3

# Design and Measures

 HADS

 Assessment Procedure

 50 patients

 File information

 Descriptive Statistics

Slide 4

# Results - Aim 1

☞ Mean Anxiety Score = 14.48 (S.D. = 3.51)

☞ Reaches Caseness

☞ Mean Depression Score = 9.58  
(S.D. = 4.03)

☞ Does not reach Caseness

Slide 5



# Results - Aim 2

- ▣ Demographics
- ▣ Summary of general results
- ▣ Relationship Status
- ▣ First Perpetrator
- ▣ Number of abuse incidents

# Results - Aim 3

☞ Reaching caseness on Anxiety sub-scale was associated with accepting treatment and attending for treatment.

- Anxiety Caseness = Accept
- Below caseness = DNA

# Conclusion

## General Findings

- Patients experience moderate to high levels of anxiety and mild depression.
- Patient characteristics have little influence on this in this sample. Larger sample required.
- Further work could focus on the reasons behind the surprisingly low levels of depression found in this sample

Slide 8

## **Graphs and Tables**

Graph 1 Anxiety Caseness Graph

Graph 2 Depression Caseness Graph

Graph 3 Anxiety and Relationship Status Graph

Graph 4 Depression and Relationship Status Graph

Graph 5 Anxiety and First Perpetrator Graph

Graph 6 Depression and First Perpetrator Graph

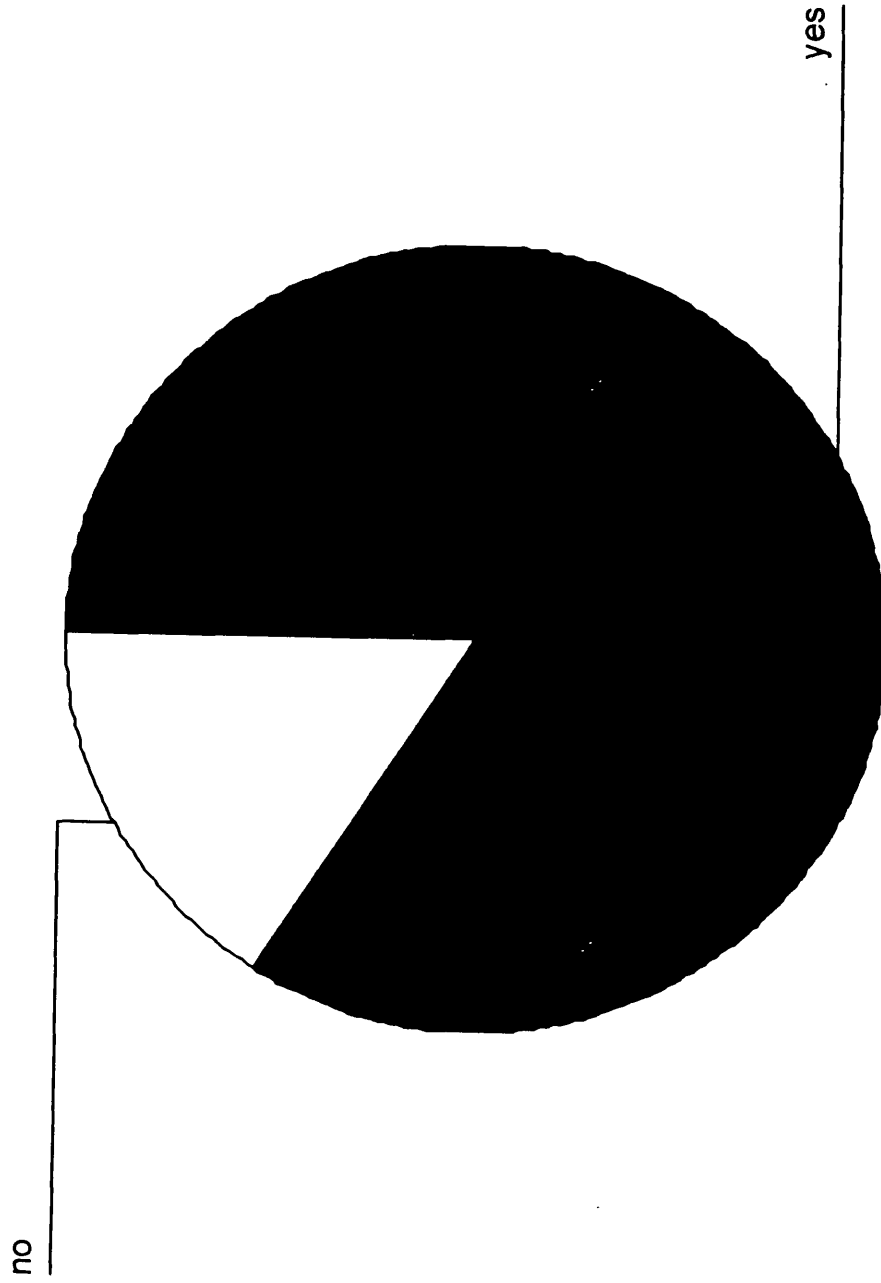
Graph 7 Number of Abuse Incidents Graphs

Table 1 Depression and First Perpetrator Table

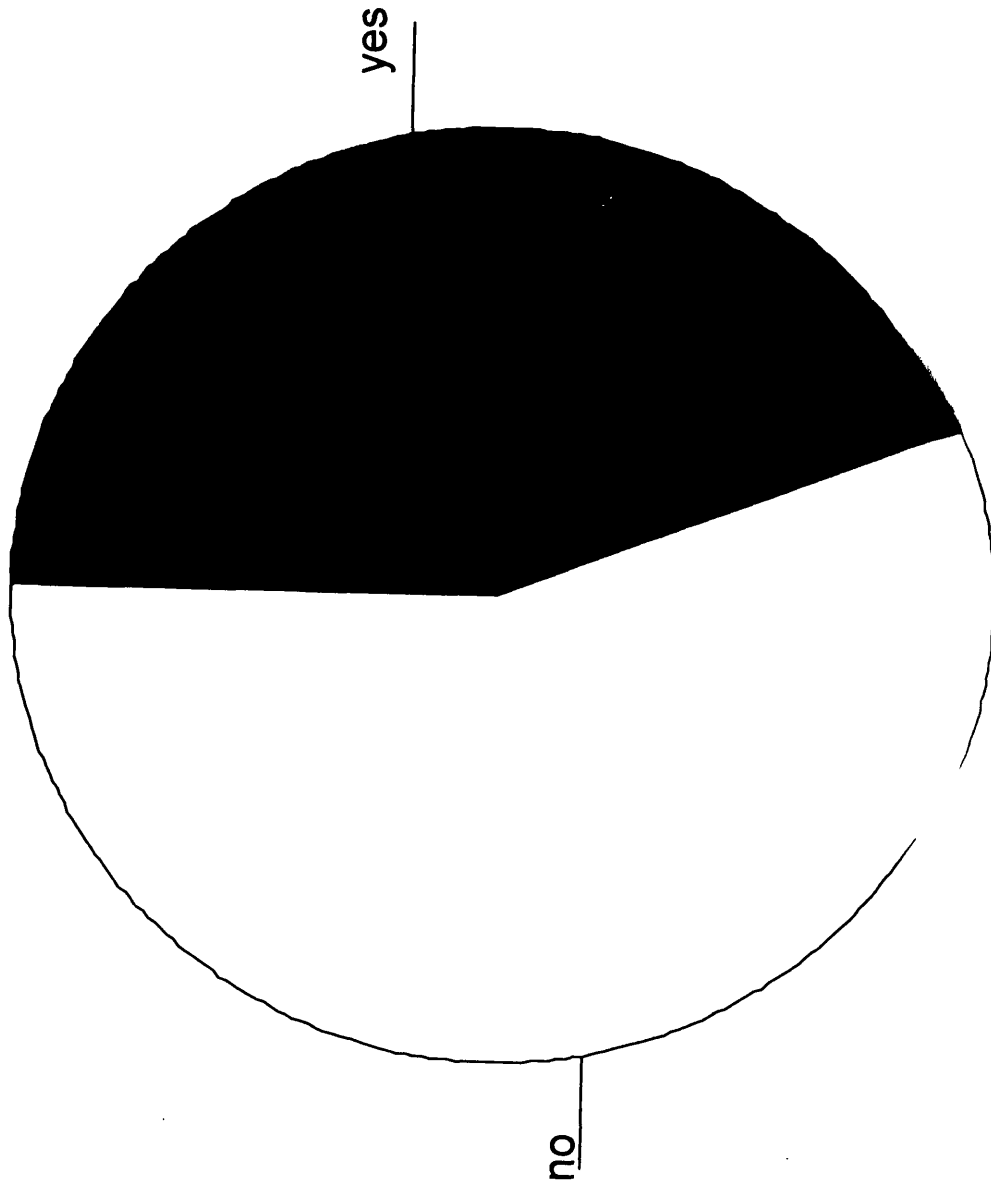
Table 2 Anxiety Caseness and Outcome Table

Table 3 Depression Caseness and Outcome Table

# Anxiety Caseness

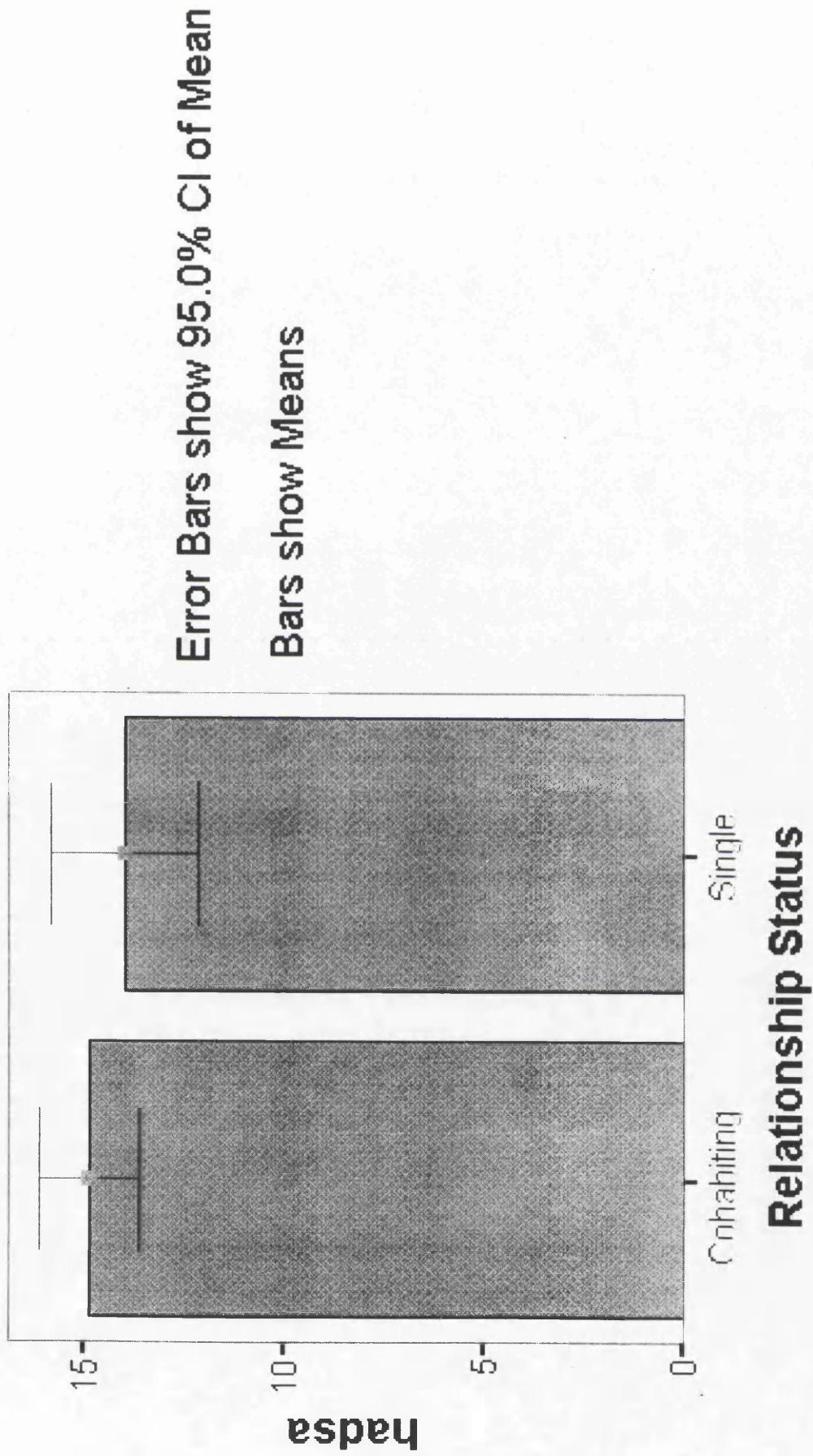


# Depression Caseness



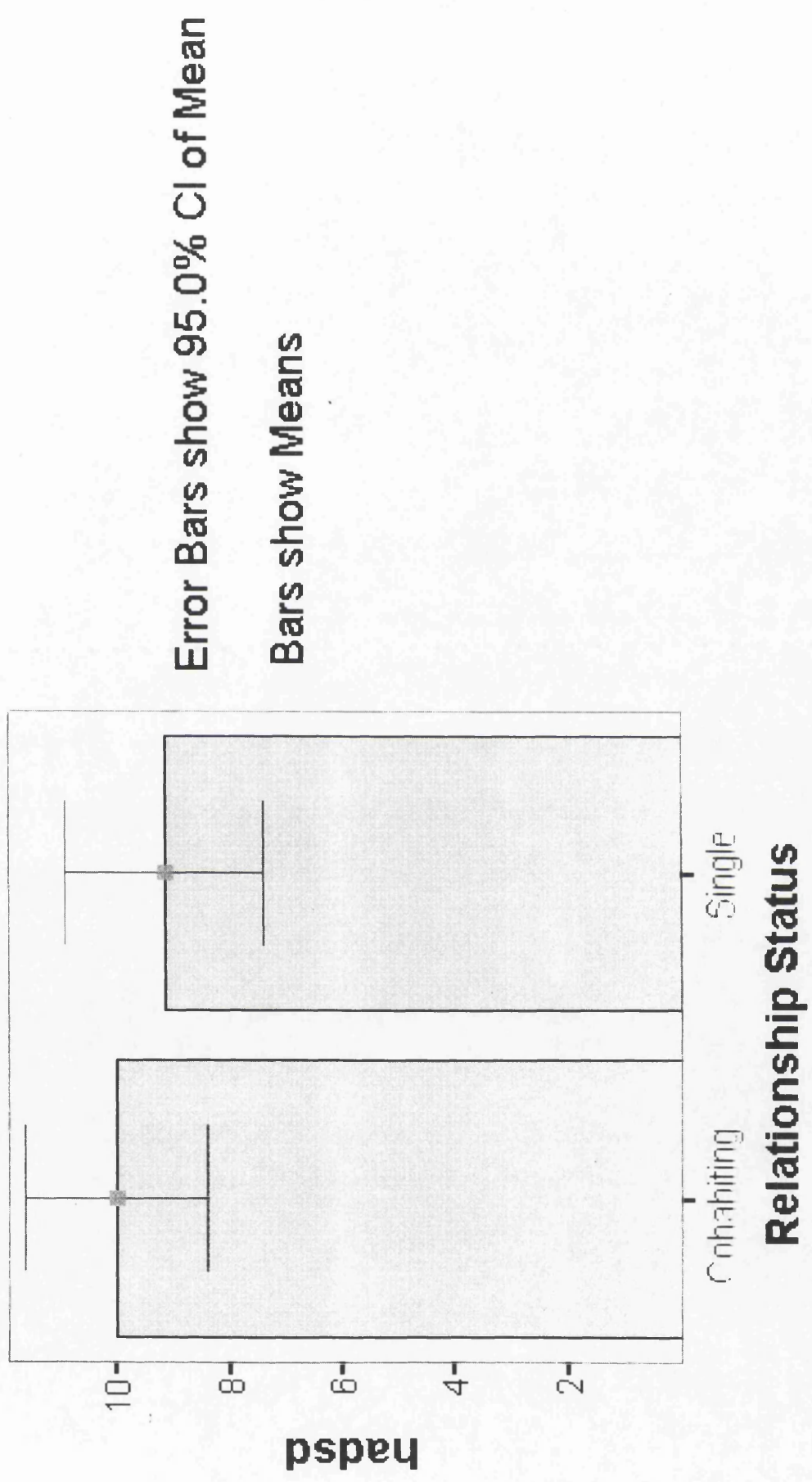
Graph 3

# Anxiety and Relationship Status



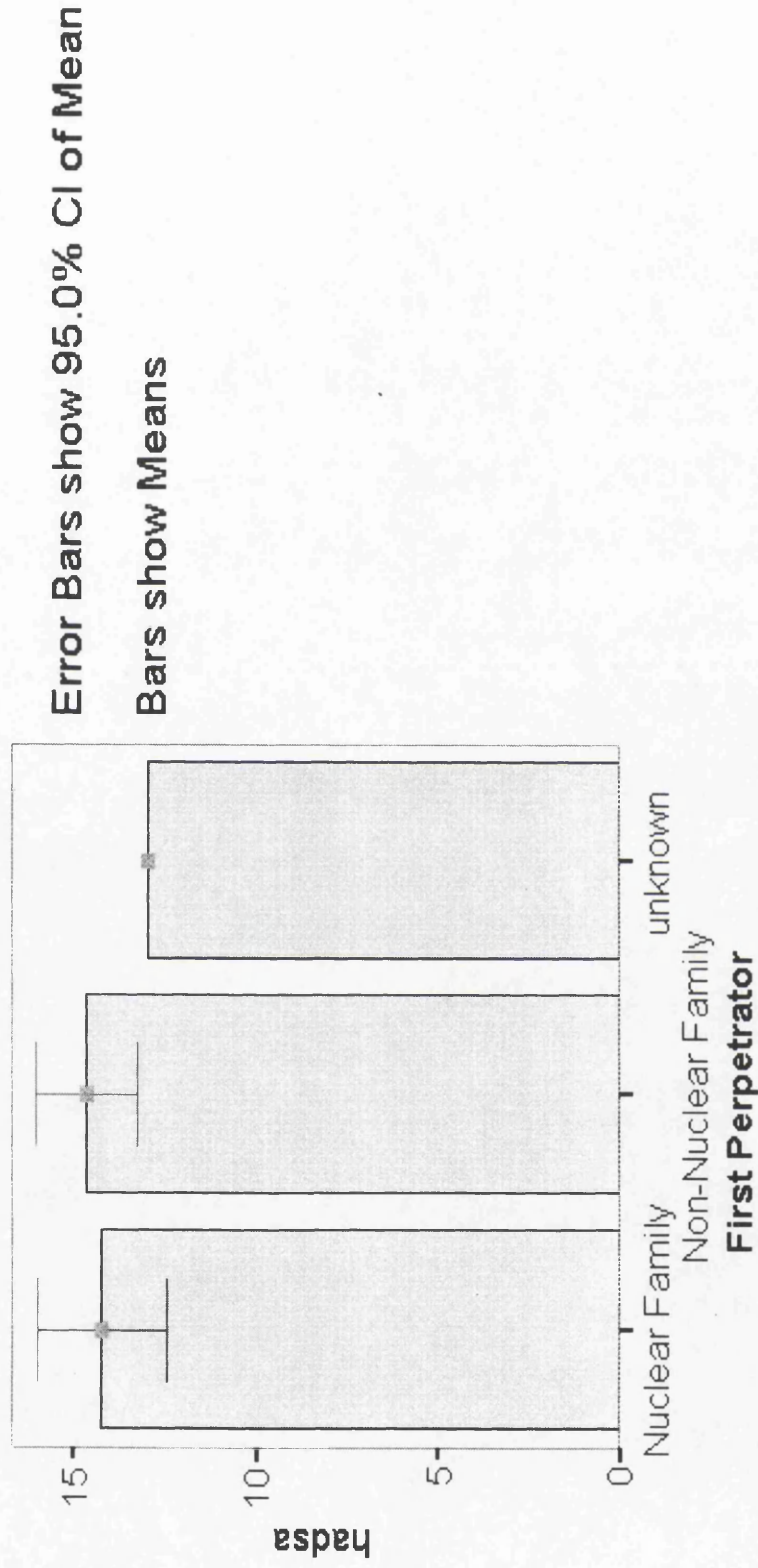
Graph 4

# Depression and Relationship Status



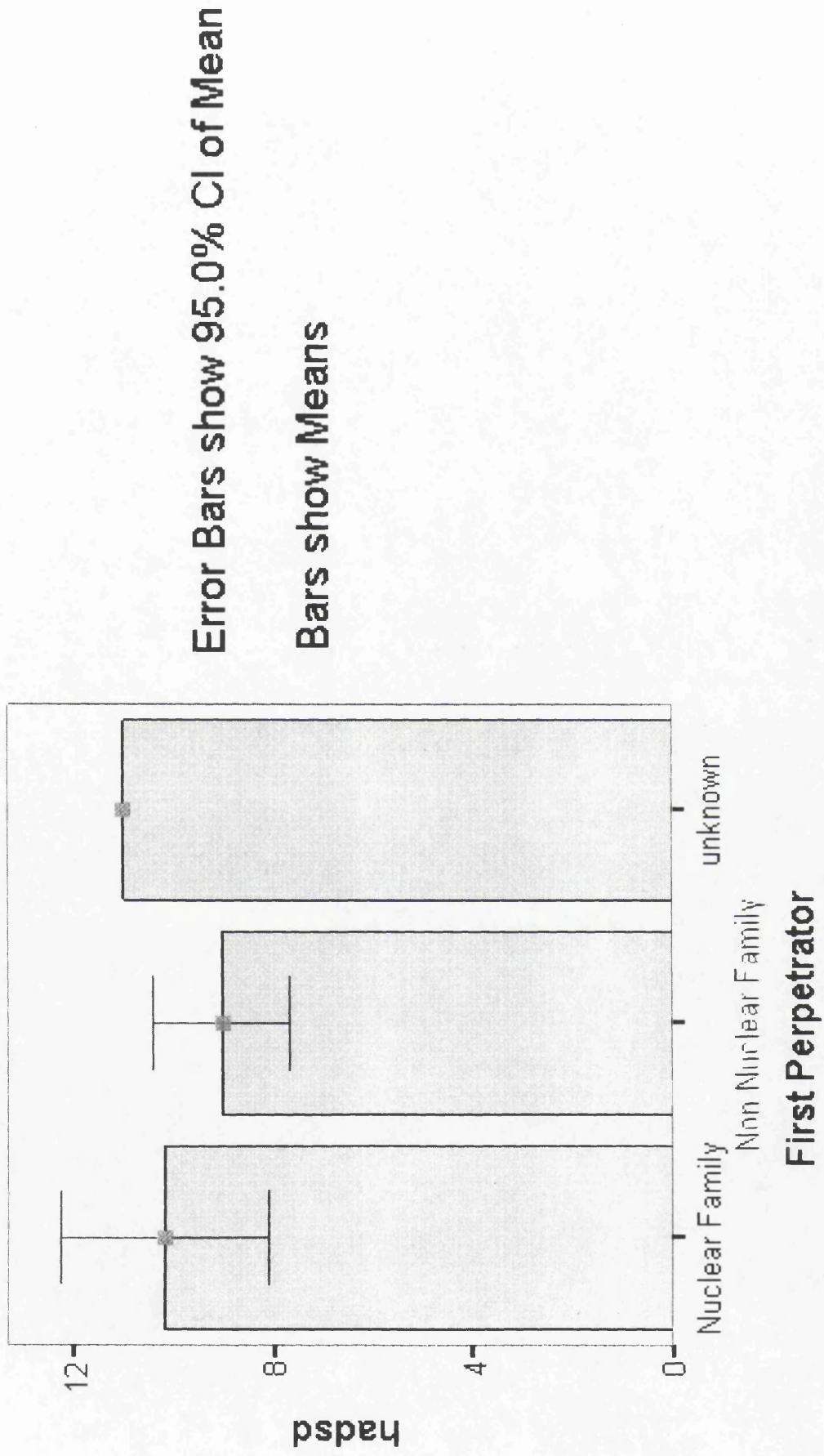


# Anxiety and First Perpetrator



Graph 6

# Depression and First Perpetrator



# Number of Abuse Incidents

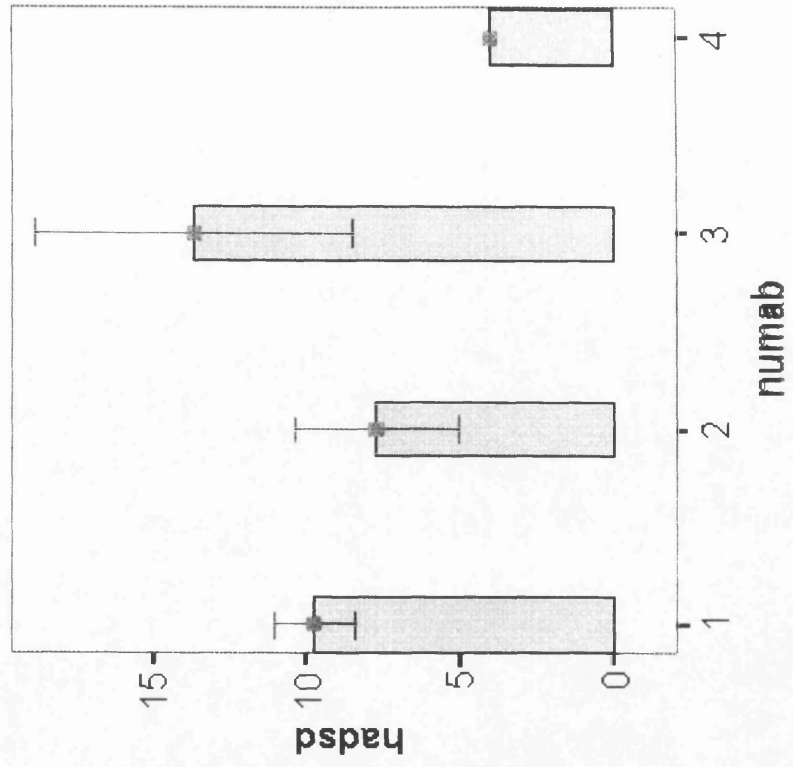
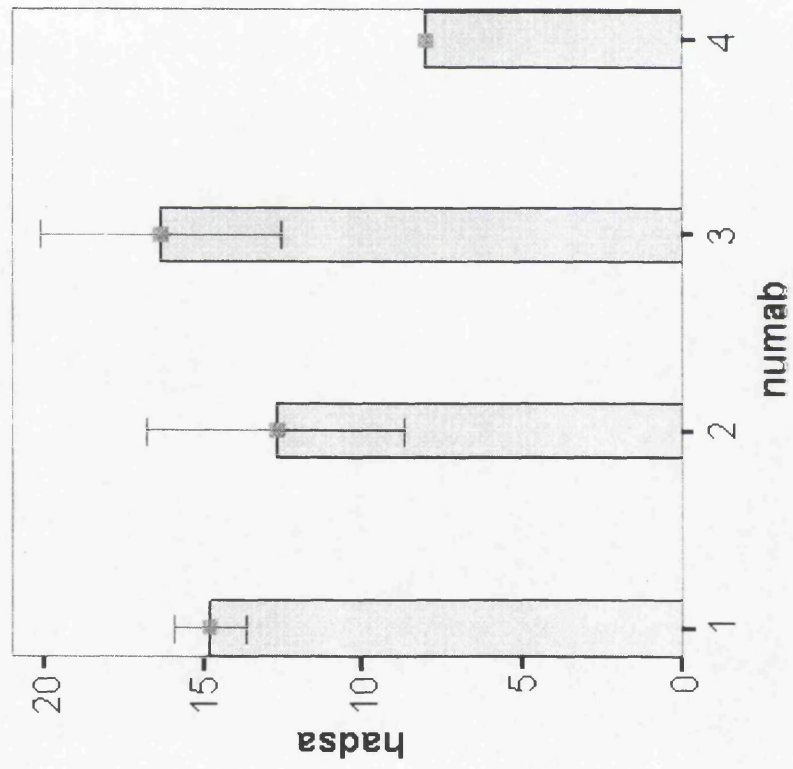


Table 1

# Depression and First Perpetrator

		First Perpetrator		
		Nuclear Family	Non-Nuclear Family	Unknown
Depression Caseness	Yes	13	8	1
	No	9	19	
Total		22	27	1

Pearson Chi-square = 5.569 (df=2, p = 0.062)

Table 2

## Anxiety Caseness and Outcome

		Outcome		
		Never offered Treatment	Offered Treatment but DNA	Offered and Accepted
Anxiety Caseness	Yes	1	9	32
	No	3	1	4
Total		4	10	36

Pearson Chi-square = 11.268 (df = 2, p = 0.04)

Table 3

## Depression Caseness and Outcome

		Outcome		
		Never offered Treatment	Offered Treatment but DNA	Offered and Accepted
Depression Caseness	Yes	1	5	16
	No	3	5	20
Total		4	10	36

Pearson Chi-square = 0.735 (df = 2, p = .692)

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# **SYSTEMATIC REVIEW**

**An Investigation of the Developmental  
Relationship between Theory of Mind  
and Executive Function in Children with  
Autism**

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Prepared in accordance with the guidelines for submission to *Journal of Child  
Psychology and Psychiatry and Allied Disciplines*  
See Appendix A1 for notes to contributors



# **AN INVESTIGATION OF THE DEVELOPMENTAL RELATIONSHIP BETWEEN EXECUTIVE FUNCTION AND THEORY OF MIND IN CHILDREN WITH AUTISM**

## **Objectives**

The objective of this review is to identify, examine and analyse the current literature on the developmental relationship between Executive Function and Theory of Mind in children with autism. These two components are postulated to explain certain deficits in the functioning of children with autism. It will first be necessary to establish if there is evidence that the two are related and then to establish what that relationship may be.

## **Search Strategy**

I conducted electronic searching of MEDLINE, EMBASE, PSYCHINFO, BIOMEDICAL COLLECTION, CINAHL. Three journals were hand searched: Journal of Autism and Developmental Disorders, Journal of Child Psychology and Psychiatry, and Journal of Child and Adolescent Psychiatry. A hand trawl of the references of the articles chosen through these search engines was also completed.

## **Selection Criteria**

The inclusion criteria for all studies were that they looked at both Theory of Mind AND Executive Function and the relationship between the two. The paper should be an experimental paper and not a Literature Review or Expert Opinion. The studies should discuss children with autism and/or typically-developing children.

### **Data collection and analysis**

Eight trials met criteria for inclusion. Methodological Quality was either moderate or high. Data could not be synthesised.

### **Main Results**

No overall conclusion could be made as there were so few studies that had differing outcomes. Different outcome measures were used as well as different control groups.

### **Reviewers Conclusions**

More research is required in this area. Larger samples and agreement on which outcome measures should be used will be an important area to focus on.

## INTRODUCTION

Autism is a Pervasive Developmental Disorder that normally appears in the first 3 years of life. It is recognised both in DSM-IV (APA, 1994) and ICD-10 (WHO, 1993) and is characterised by impairments in social interaction, communication and imagination. Autism presents with varying degrees of severity so the term Autistic Spectrum Disorders (ASDs) is often used to reflect this.

### The Triad of Impairments

The triad of impairments; social interaction, social communication and imagination, as stated above, can present in a variety of forms depending on the severity of the impairment. The triad has been further defined:

<i>Social</i>	Impaired, deviant and extremely delayed social development – especially interpersonal development. The variation may be from ‘autistic aloofness’ to ‘active but odd’ characteristics.
<i>Language and Communication</i>	Impaired and deviant language and communication – verbal and non-verbal. Deviant semantic and pragmatic aspects of language.
<i>Thought and Behaviour</i>	Rigidity of thought and behaviour and impoverished social imagination. Ritualistic behaviour, reliance on routines, extreme delay or absence of ‘pretend’ play

*(Wing & Gould (1979) cited in Jordan, 1999, p. 13)*

Children with autism also have a range of intellectual abilities, some children having a Learning Disability, others not. Recent prevalence estimates of all ASDs have shown an increase to approximately 60 per 10000 (Baird et al, 2000; Center for Disease Control, 2000; Chakrabarti & Fombonne, 2001). The ratio of ASD in males and females is generally accepted as 4:1 but this varies across the spectrum with the ratio being higher in those without learning disabilities (PHIS Needs Assessment Report, 2001).

There are competing theories striving to explain the cause of autism, e.g., the limbic system hypothesis (Brothers, 1990); temporal lobe theory, (Bauman & Kemper (1985) and the genetic theory (Bailey, Le Couteur, Gottesman & Bolton, 1995). However, given the rise in the prevalence of autism, there are still a surprising number of questions remaining unanswered regarding that causal mechanisms of autism. Psychological theories have been most helpful in understanding autism at the behavioural level as they provide theoretical constructs that help to “make sense of observable behaviours, while fitting the constraints imposed by the little we know of the biological basis of that behaviour” (Jordan, 1999, p.59).

In the last fifteen years, a large amount of research has considered the range of deficits in autism which emphasise cognitive functions and processes. This work has been done on the premise that cognitive deficits underlie the social deficits in autism. The three main cognitive deficits identified are:

- Theory of Mind (Baron-Cohen, Leslie & Frith, 1985)
- Executive Function (Ozonoff, Pennington & Rogers, 1991a)
- Central Coherence (Frith, 1989)

Within psychology, there is an ongoing debate as to the relative importance of these cognitive components in explaining autistic behaviour. However one particularly large and significant debate centres around two of these deficits: Theory of Mind (ToM) and Executive Function (EF), and how the two are related. This review will concentrate on this debate.

*Theory of Mind (ToM)* concerns “The ability of children with autism to appreciate their own and other people’s mental states – such as their beliefs, desires, intentions, knowledge, pretence, and perception” and “to understand the links between mental states and action” (Baron-Cohen & Swettenham, 2000, p. 880). Theory of Mind abilities manifest themselves in different ways, e.g. deception, pretence, recognising emotion (Baron-Cohen, 2000). However, the most frequent mode of experimental testing for ToM has been with the false-belief task. Different levels of understanding false-belief tasks have been identified: First-order ToM (ability to infer someone else’s mental state) and Second order ToM (understanding what one character thinks another character is thinking”) (Baron-Cohen, 2000). Baron-Cohen et al (1985) initially established that the majority (80%) of children with autism were developmentally delayed on a First-order false-belief task compared to typically developing children and children with Downs Syndrome. Baron-Cohen (1989) further demonstrated that those who passed the First-order false-belief task subsequently failed a Second-order false-belief task.

*Executive function (EF)* is the postulated mechanism that enables a person to shift attention flexibly, inhibit pre-potent responses, generate goal-directed behaviour, and solve problems in a planful, strategic way (Baddeley, 1991). As such it is an umbrella term for a range of abilities (e.g. inhibitory control, set-shifting, intention-editing) and it is now perceived that EF in itself may be too broad a level of analysis. Ozonoff et al (1991a) compared those with

Asperger's Syndrome to those with high-functioning autism (both subsets of autism) to investigate their distinctiveness. They found that those with high-functioning autism were impaired on ToM and verbal memory tasks but that both groups were impaired on tasks tapping EF. As a result they proposed that EF was the primary deficit in autism and ToM was secondary to this.

However, EF deficits are found in a wide range of disorders, e.g. Schizophrenia (Elliot & Sahakian, 1995), treated PKU (Diamond, 1994), OCD (Head, Bolton & Hymas, 1989), Tourette's Syndrome (Baron-Cohen & Robertson, 1995), ADHD (Grodzinsky & Diamond, 1992), Parkinson's (Downes et al, 1989), Frontal Lobe Syndrome (Owen et al, 1991) and in people with a learning disability (Borys, Spitz & Dorans, 1982). If it is not unique to autism, can it be causal? It is now perceived that EF in itself may be too broad a level of analysis. As a result, a more fine-grained analysis has been attempted, breaking EF down into components such as generativity, inhibition, attention-shifting and disengaging. Using this model, it is possible that findings may show that people with autism have specific deficits within EF with other parts remaining intact (Baron-Cohen & Swettenham, 2000).

Difficulties in separating ToM deficits from EF measures have arisen from claims that ToM tests require some Executive Functioning and some EF tests have a ToM component (Russell, Mauthner, Sharpe & Tidswell, 1991). In an important experiment with children with autism and typically-developing children, Russell et al (1991) found that performance on a false-belief task and strategic task were related. They argued that this had less to do with knowing how mental states relate to the world and more to do with inhibiting reference to a salient object. Children with autism continued to perseverate with a wrong response even though they lost rewards because physical knowledge was more salient to them than the knowledge

of mental reality. Further work by Hughes & Russell (1993) supported this and concluded that failure on false-belief tasks should be seen as evidence of a deficit in EF, or more importantly inhibitory control.

The research described above has forced people to question what the cause of the exhibited deficits in autism may be. Some hypothesise that they are due to ToM deficits (e.g. Baron-Cohen), others hypothesise that they are due to EF deficits (e.g. Hughes, Ozonoff). Some argue that the two deficits cannot be separated. Baron-Cohen's original hypothesis behind ToM was that there was a specific developmental delay, i.e. as children with autism get older they display more ability at ToM tasks. One question that has been asked is: if the two are related, does this improvement in ToM result from an improvement in EF deficits?

Perner & Lang (2000) reviewed the current literature when they posed the question: "Theory of mind and Executive Function: is there a developmental relationship?" They advanced five possible theories to explain the link between the development of EF and ToM capabilities in young children. Three of these were discarded relatively easily: common brain regions, executive component in ToM tests and conditional reasoning as a common functional component. The main task was to separate the remaining two:

- Theory of Mind development improves self-control (i.e. Executive Function)
- Action monitoring is necessary for developing a Theory of Mind

They concluded that the theory that had the most supporting evidence, from the data reviewed, was that 'Theory of Mind development improves self-control', particularly around 3-5 years old. (Perner et al, 1998; Ozonoff et al 1991). The relationship between executive control and ToM did not appear to be mediated to any great degree by conditional reasoning

ability (i.e. the third theory above) or by the methodological features of ToM tests. However, they acknowledged the difficulty in separating theory one and two, i.e. EF requires ToM vs ToM depends on EF. Unless one were to accept that we have a ready-made ToM (as in Leslie's model, 1987) then it seems obvious that a developing ToM requires the need to know one's intentions. Therefore an EF deficit in editing one's intentions would develop into a ToM deficit as much as a ToM deficit theory should result in executive dysfunction.

Perner & Lang's (2000) review suffers from the fact that it is only a literature review and as such is subject to bias, e.g. the author chooses what evidence is reported in the paper. It also relied on evidence from papers where only ToM or EF were looked at in isolation. It is, therefore, possible that evidence contradictory to these theories was not reported. A systematic review rules out this type of bias as the author must report the search strategy and explain why studies are included or excluded in the review. Studies are also rated on quality so that the reader knows how much faith they can put in the study's results. As such, Perner & Lang (2000) lacked the validity and reliability of a systematic review.

This systematic review aims to explore the experimental research investigating the relationship between ToM and EF. The answer to this debate appears to have spawned many articles based on literature reviews and expert opinion. However, there appears to be very little in terms of good quality experimental research. The clinical implications for this research are providing a focus for clinicians to work on to improve a child's abilities if one is found to be primary. For example, training a child in Executive Function tasks would not only improve their functioning in that area but also in Theory of Mind. It would also provide the clinician with markers by which to monitor a child's development.



## **OBJECTIVE**

- To assess the evidence for a developmental relationship between Executive Function and ToM using studies that have compared children with autism and typically developing children or studied typically developing children alone.

## **CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW**

### **Types Of Participants**

Participants included in this review were children or adolescents. They could be of either sex. Matched controls (Children with Downs Syndrome and typically developing children) were also included.

### **Types of Assessment Measures**

The measures used should be recognisable as ToM and EF Tests.

### **Types Of Studies**

Although there is a wide range of literature on ToM and EF deficits in autism, there is less literature on the two together and even less considering the developmental relationship. In addition much of this work consists of Literature Reviews and Expert Opinion. Only the book chapters and journal papers that investigate the developmental relationship within an experimental paradigm have been included.

## **SEARCH STRATEGY**

A number of different resources were used to search for appropriate studies. These were:

- **Electronic Bibliographic Databases**

- a) **Medline** (1996 – July 2002) was searched using the following strategy for WinSPIRS:

- I. Asperger Syndrome/ or Autistic Disorder/

- II. Frontal Lobe/or Executive Function.mp. or Cognition/ or Cognition Disorders/ or Mental Processes
- III. Cognition Disorders/ or executive dysfunction.mp. or Memory Disorders/ or Frontal Lobe
- IV. 2 or 3
- V. Theory of Mind mp.
- VI. Child development/ or child development disorders, pervasive/ or human development.
- VII. 1 and 4 and 5 and 6
- VIII. 1 and 5

- b) **Embase** (19890 – July 2002) was searched using the above strategy for MEDLINE
- c) **PsycINFO** (1887-July 2002) was searched using the above strategy for MEDLINE
- d) **Cinahl** (1982 – July 2002) was searched using the above strategy for MEDLINE
- e) **CORE BIOMEDICAL COLLECTION**
- f) **CORE BIOMEDICAL COLLECTION II**

To search for the studies investigating only typically developing children's development, the word children was inserted instead of Asperger Syndrome/ or Autistic Disorder in the first line.

- **REFERENCES**

Reference lists of potentially relevant papers obtained by the above methods were searched for further relevant references

- **HAND SEARCH OF JOURNALS**

Journal of Autism and Developmental Disorders

Journal of Child and Adolescent Psychiatry

Journal of Child Psychology and Psychiatry

**REASONS FOR EXCLUDING STUDIES**

Given that the search strategy revealed relatively few papers in this area, inclusion and exclusion criteria were based on whether the paper investigated the *developmental* relationship between ToM and EF (as opposed to discussing their developmental route separately) and the Level of Evidence that each paper provided. Levels of Evidence were classified by numbers ranging from 1-6 and are outlined below. It was decided that papers that only provided a Level of Evidence of 5 or 6 would be excluded from the study and their data not presented. Expert Opinion and Literature Reviews are at risk of introducing too much bias as authors in this area tend to have allegiance to ToM or EF

**Levels of Evidence**

- 1a. Systematic review and meta-analysis of case-control studies with a low risk of bias
- 1b. Systematic review and meta-analysis of case control studies with a high risk of bias
- 2a. Longitudinal studies with low risk of confounding, bias, or chance. Prospective
- 2b. Longitudinal studies with high risk of confounding, bias, or chance. Retrospective
- 3a. Well-conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal
- 3b. Poorly-conducted case control or cohort studies with a high risk of confounding, bias, or chance and a low probability that the relationship is causal

- 4 Non-analytic studies, e.g. case reports, case series
- 5 Expert opinion
- 6 Literature Review

## **METHODS OF THE REVIEW**

### **Study Selection**

The reviewer decided whether each potential study fulfilled inclusion criteria. The reviewer was not blind to the name of the author, institutions, journal of publication, and results, when the inclusion criteria were applied. A decision about inclusion would begin with an examination of the abstract. If the content appeared relevant, the full publication was examined. Studies were matched against inclusion criteria and methodological quality, not the results.

### **ASSESSMENT OF METHODOLOGICAL QUALITY**

Studies that met the inclusion criteria were then assessed according to Quality criteria (See below). These criteria are adapted from guidelines published by Scottish Intercollegiate National Guidelines (SIGN) for reviewing case-control studies and cohort studies. On the basis of how well the studies fit the criteria they are given a Quality Rating:

- A** High Quality All or most of the criteria have been filled
- B** Moderate Quality The majority of the criteria have been fulfilled
- C** Low Quality Some criteria have been filled

## **Criteria**

Does the study address an appropriate and clearly focussed question?

### **Subject Selection**

Are source populations comparable? (cohort)/Are the cases and controls taken from comparable populations?(case study)

What percentage of subjects recruited into the study are included in the analysis?

Is there any comparison made between full participants and those lost to follow-up?

Are all subjects diagnosed/classified in the same way?

Do all subjects in a 'group' have the same diagnosis/classification?

### **Analysis**

Are outcomes clearly defined?

Are reliable and valid outcome measures used?

Have both groups been assessed in the same conditions with the same tests?

Is the study powered enough to detect group differences?

Are the same data-processing methods used for cases and controls?

### **Control Group**

If there is a control group:

Are the same inclusion and exclusion criteria used for cases and controls?

Has the control group been screened for pervasive developmental disorders, associated medical conditions and psychiatric illness?

Are the same data processing methods used for each group?

Are cases clearly defined and differentiated from controls?

### **Confounding and Overall Assessment**

How well has the study minimised risk of bias or confounding?

Is the conclusion made a just one, i.e. is there a possible alternative explanation?

### **DATA EXTRACTION**

The above data was used to construct a standardised data sheet against which each paper was analysed. Information was abstracted from the paper on the recruitment and characteristics of subjects, assessment procedures, attention to bias and conclusions drawn. Once this was done a Quality Rating was given according to the categories above.

### **DESCRIPTION OF STUDIES**

See Table of Included Studies (Tables 1 & 2) and Excluded Studies (Table 3)

#### **Excluded Studies**

Studies were excluded because they were based on Expert Opinion as opposed to an experimental paradigm (Bishop, 1993; Rapin, 1997; Baron-Cohen & Swettenham, 2000; Happé, 1994; Perner & Lang, 2000, Happé, 2000, Happé, 2001; Hughes, 2001)

#### **Included Studies**

Eight studies have been included in the review. These have been split into two sub-groups. The first group (Group A) includes those studies that compare typically developing children with children with autism. The second group (Group B) includes the studies that look at typically developing children alone. No studies have been found in this search that look at ToM and EF in children with autism alone.

**Group A** – Four studies comparing children with autism to control group – See Table 1

### ***Description of Study Design***

All studies were case control apart from Baron-Cohen & Robertson (1995) which was a single case series.

### ***Participant Selection***

Children with autism were selected from a treatment programme (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994) and special schools for children with autism (Baron-Cohen & Robertson, 1995; Shimmon & Lewis, 2001). Clinical control groups were taken from Special Education Departments of Public Schools (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994), special schools (Shimmon & Lewis, 2001) and mainstream schools (Baron-Cohen & Robertson, 1995). Shimmon & Lewis (2001) took their non-clinical controls from preschool centres.

### ***Participant Characteristics***

Studies either used a mix of children meeting diagnostic criteria in DSM-III-R for autistic disorder or pervasive developmental disorder not otherwise specified (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994; Baron-Cohen & Robertson, 1995)) or they used children with high-functioning autism and Asperger's Syndrome (Shimmon & Lewis, 2001).

Participants varied in age from 12 to 15 years old with the exception of Shimmon & Lewis (2001) who did not specify the age of their children.

Control groups used fell into two categories: Learning disability controls (Ozonoff et al. 1991; Ozonoff & McEvoy, 1994) and a combination of learning disability and typically-developing controls (Shimmon & Lewis, 2001). As a case series, Baron-Cohen & Robertson (1995) did not have controls.

### ***Cultural Setting***

Two studies were carried out in Denver, Colorado in the USA (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994). One study was carried out in Lancashire and Staffordshire in England in the UK (Shimmon & Lewis (2001) and one study was carried out in study was carried out in London and Birmingham, UK. (Baron-Cohen & Robertson, 1995)

### ***Sample Size***

The groups in each trial had similar numbers of people in each group varying from 18 to 24 apart from Baron-Cohen & Robertson (1995) who examined three single cases. Shimmon & Lewis (2001) study had three groups (a clinical and non-clinical control group) whilst the two other studies had just two groups (one clinical control group), thereby employing more participants overall. A clinical control group is a group with a psychiatric diagnosis or a learning disability. None of the studies commented on the sample size or the power of the study.

### ***Time interval***

Ozonoff & McEvoy (1994) was a longitudinal study with a time interval of three years. Testing on both occasions was carried out in one session. The Shimmon & Lewis (2001) study took place over two to three sessions in two days. All three children in the Baron-Cohen & Robertson (1995) study were administered all the tests in one session. Ozonoff et al



(1991) administered all tests in one session except the Wechsler test. The entire control group had been administered it within the previous two years and were therefore not re-tested. The autistic sample were administered the Wechsler in a separate session to the experimental session.

### *Outcome Measures*

Within the field of EF there are a wide range of measures. In particular, on the one hand, there are those such as the Wisconsin Card Sorting Test and Tower of Hanoi which have been used with adults and are accepted as a global assessment of EF. On the other hand, there are tasks such as the Luria Hand Game which looks at inhibition, which is a component of EF. Two of the studies used global, omnibus measures of EF (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994). Baron-Cohen & Robertson (1995) used tasks that target specific abilities within EF. Shimmom & Lewis (2001) used a combination of the two.

There are fewer ToM measure to choose from and, therefore, more consistency between studies. All four studies used the M&M's or Smarties task. Two studies used variations of the Sally-Ann task as a False belief test (Baron-Cohen & Robertson, 1995; Shimmom & Lewis, 2001). In addition, the Penny Hiding game (Baron-Cohen & Robertson, 1995), the Brain Function Task (Ozonoff et al, 1991), the Mental/Physical Distinction Task (Ozonoff et al, 1991) and the Second order attribution Task (Ozonoff & McEvoy, 1994) were used.

**Group B** – Four studies using typically-developing children alone - see Table 2

### ***Description of Study Design***

Three studies (Hughes, 1998a; Hughes 1998b; Lang & Perner, 2002) were cohort studies while one (Hughes, Dunn & White, 1998) was a case control design.

### ***Participant Selection***

All participants were selected from nursery schools and primary schools. One study used a screening questionnaire sent to families of all children attending 15 primary and nursery schools in two London Burghs (Hughes et al, 1998). Children were excluded if the wrong age, if below the 90<sup>th</sup> Percentile, if parental consent not given or if there was a known language delay or English was not their first language. Hughes (1998 a & b) took children from four inner-city nurseries who had English as their first language and were within the required age range. As they were recruited for a longitudinal study of friendship, the group consisted of 25 pairs of friends. These are the only selection criteria mentioned. One study took children from a nursery but excluded certain participants because the knee-jerk reflex could not be elicited. This was crucial to the experiment. All studies have, therefore, used different criteria to separate participants from non-participants in their target population.

### ***Participant Characteristics***

As these studies were on typically developing children no recognised diagnostic criteria (i.e. DSM-IV, ICD-10) were applied. However, Hughes et al (1998) were looking for children who were “Hard to manage” so they chose children who achieved the 90<sup>th</sup> Percentile on a Hyperactivity Scale (80% of whom coincidentally scores over the 90<sup>th</sup> Percentile on the Conduct Disorder Scale) on the Strengths and Difficulties Questionnaire. Parental and

teacher ratings were also taken. The control group was matched for gender, age and school and had to score below the 50<sup>th</sup> Percentile on the Hyperactivity and conduct disorder scales. The age range of children in the four studies varied from 3;1 years to 5 years old.

### ***Cultural Setting***

All studies were carried out in London, UK except Lang & Perner (2002) which recruited children from Salzburg and Linz in Austria.

### ***Sample Size***

Lang & Perner (2002), Hughes (1998a) and Hughes (1998b) were cohort samples and had a sample size varying from 50 to 69. Hughes, Dunn & White (1998) was a case control that had 40 children in both the experimental and control group. None of the authors comment on the sample size or power of the study.

### ***Time Interval***

In all the studies, there was only one testing session except for Hughes (1998b) which is a longitudinal study over 13 months.

### ***Outcome Measures***

As above, the authors have a wide range of EF tests to choose from and a decision to make about the types of test. Given that there are no children with autism, who are known to have EF deficits, there is maybe less need to avoid complex omnibus measures. However, having said this, three of these studies are written by the same author therefore there is a large overlap in the studies used in these tests. All four studies use the Luria Hand task. In addition the detour reaching box (Hughes et al, 1998; Hughes 1998 a & b), the visual

searching task (Hughes, 1998a), the Tower of London task (Hughes et al, 1998b, Hughes et al, 1998), the Auditory sequencing task (Hughes, 1998a), set-shifting task (Hughes, 1998 a & b), pattern-making task (Hughes, 1998a), noisy book working memory task (Hughes 1998b: Hughes et al, 1998), attention flexibility task (Hughes et al, 1998), marbles pattern-reproduction task (Hughes et al, 1998), and the card-sorting task (Lang & Perner, 2002).

These studies contained a greater variation of ToM tasks, possibly attributable to the fact that typically developing children are hypothesised as having well-developed ToM abilities by the age of four. The Smarties task (Hughes, 1998a), variations on the Sally-Ann task (Hughes, 1998a, Lang & Perner, 2002), a false-belief explanation task (Hughes, 1998 a & b), a deception task (Hughes, 1998a), the Penny-Hiding game (Hughes, 1998a; Hughes et al. 1998), a false-belief prediction task (Hughes, 1998b), a book task (Hughes et al. 1998), a story task (Hughes et al, 1998), a puppet deception game (Hughes et al, 1998) and the knee-jerk reflex task (Lang & Perner, 2002) were all used. All studies appear to contain a false-belief task but aside from this there is great variation.

## **METHODOLOGICAL QUALITIES OF INCLUDED STUDIES**

**GROUP A** - Four studies comparing children with autism to control group (See Table 1)

### ***Overall Methodological Quality***

Three studies (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994; Baron-Cohen & Robertson, 1995) were rated as having 'high' methodological quality. One study (Shimmon & Lewis, 2001) was rated as having a 'moderate' methodological quality.

### ***Selection Criteria for Participants with Autism***

Three studies (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994 & Baron-Cohen & Robertson, 1995) used DMS-III-R criteria. One study (Shimmon & Lewis, 2001) used DSM-IV criteria. Three studies (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994; Shimmon & Lewis, 2001) extended this from autism to include Pervasive Developmental Disorder not otherwise Specified (PDDNOS). One study (Ozonoff et al, 1991) used the Childhood Autism Rating Scale (Schopler, Reichler & Renner, 1986) in addition to DSM-III-R. Ozonoff & McEvoy (1994) is the follow-up to this and therefore also used this test.

### ***Screening for Associated medical and neurological disorders in Participants with Autism***

None of the studies mentioned this in their methodology section.

### ***Screening for PDD in control group***

One study (Ozonoff et al, 1991), which had used the CARS as an additional diagnostic aide, used this to screen for PDD in the control group. As a result, so did Ozonoff & McEvoy although this was not re-administered at the time of the follow-up. One study (Shimmon & Lewis, 2001) did not mention this at all. The other study (Baron-Cohen & Robertson, 1995) implied they had as part of their case series.

### ***Control Group***

All studies had a control group except one (Baron-Cohen & Robertson, 1995), which was a case series thereby ruling out the need for a control group. Two studies (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994) used a clinical control group consisting of children with dyslexia, other learning disabilities, ADHD and mild mental retardation. They were matched for chronological age, sex, verbal IQ. One study used a clinical and a non-clinical control group.

The clinical group had moderate learning disabilities and the non-clinical group were preschoolers. All subjects were matched for verbal comprehension and forward digit span from the Wechsler's Intelligence Scale for Children (WISC) and Wechsler's Preschool and Primary Scale of Intelligence (WPPSI). All three cases in the case series (Baron-Cohen & Roberson, 1995) were matched for chronological age, sex and verbal age.

### ***Outcome Measures***

A range of measures was used in these tests making them difficult to compare. All measures were clearly described and were widely used in this area of research. EF measures are better known than the ToM tests as they are used extensively with a range of clinical groups. All the tests of intelligence used are reliable and valid.

### ***Statistical Analysis***

All these studies have a small sample size leading to greater probability of a Type II error.

**GROUP B** – Four studies investigating typically-developing children alone (See Table 2)

### ***Overall Methodological Quality***

All studies (Hughes, 1998a; Hughes, 1998b; Hughes et al, 1998; Lang & Perner, 2002) were rated as having 'high' methodological quality.

### ***Selection Criteria for Participants***

All studies used preschoolers (3, 4 and 5 year-olds). One study (Hughes, et al, 1998) specifically used children who were classified as 'Hard to Manage', i.e. having a behavioural disorder such as conduct disorder or ADHD. This study used the Strengths and Difficulties

Questionnaire to select appropriate participants. Two studies (Hughes, 1998 a & b) used children where English was the first language. The last study (Lang & Perner, 2002) excluded children on whom the knee-jerk reflex could not be elicited, as this was crucial to one of their tests. These were the only selection criteria specified.

### ***Screening for PDD, Learning Disabilities, Head Injury in Participants***

No mention was made in any of the studies about screening for any developmental disorders or learning difficulties.

### ***Control Group***

Only one study (Hughes et al, 1998) had a control group. They were matched on gender, age and school. They were also rated on the Strengths & Difficulties Questionnaires to screen out any behavioural difficulties.

### ***Outcome Measures***

All tests were well described. Again, the EF tests are more extensively used in a range of clinical groups and therefore have more validity and reliability. The Intelligence tests are known standardised tests.

### ***Statistical Analysis***

Again, sample sizes are small leading to greater likelihood of Type II difficulties.

## **RESULTS**

Given that the studies varied in their use of outcome measures, the studies will be analysed separately rather than by meta-analyses.

With regards to the objectives of this review, i.e. to investigate the nature of the developmental relationship between ToM and EF, the findings are as follows:

### ***Overall, what evidence is there for a developmental relationship between Executive Function and Theory of Mind in children with autism?***

None of the four studies (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994; Shimmon & Lewis, 2001; Baron-Cohen & Robertson, 1995) found conclusive support for a developmental relationship between EF and ToM. One study (Ozonoff et al, 1991) found that EF deficits were universal in all children with autism with only second-order Theory of Mind being universal thereby suggesting that EF is the primary deficit. However, they conclude that four different hypotheses could be used to explain their findings. They claim that the most favourable hypothesis is that there is an underlying prefrontal deficit, which is the primary deficit in autism, and EF and ToM are secondary to that and thereby related. However, they suggest more work is needed on this. Another study (Ozonoff & McEvoy, 1994) suggests that ToM and EF are related and interdependent as they have similar developmental trajectories. In addition, they also claim that these abilities are deviant in autism rather than delayed. The third study (Shimmon & Lewis, 2001) did not find support for the existence of a developmental relationship between ToM and EF, instead finding some support for the idea that ToM tests have EF components. The last study (Baron-Cohen & Robertson, 1995) also did not find support for the existence of a developmental relationship as their patient with Tourette's Syndrome had an intact ToM but impaired EF.



One of the studies (Shimmon & Lewis, 2001) that did not find any evidence for a relationship was only rated as being on 'moderate' methodological quality. Baron-Cohen & Robertson (1995) was a high quality case series which demonstrated that the development of EF was independent of the development of ToM. Ozonoff et al (1991) and Ozonoff & McEvoy (1994) found that there was a relationship, although they made tentative conclusions as to the exact nature of the relationship, and they were rated as being of 'high' methodological quality.

***Overall, what evidence is there for a developmental relationship between Executive Function and Theory of Mind in typically-developing children.***

These four studies found more support for a developmental relationship than the above. One study (Hughes, 1998b) had the most specific finding, in that early EF performance predicted ToM performance a year later but early ToM performance did not predict EF performance a year later. Another study (Hughes, 1998a) found that deceptive abilities were related to inhibitory control and that improvement of Theory of Mind reflected growing strategic rather than metarepresentational abilities. They concluded that EF and ToM were multi-faceted constructs with specific rather than general relationships between them. A third study (Hughes et al, 1998) made more vague conclusions: Hard-to-manage preschoolers had an uneven or delayed ToM; EF and Theory of Mind were associated in the Hard-to-manage preschoolers alone and direct and indirect links were found between EF and disruptive behaviour. The last study (Lang & Perner, 2002) found a strong correlation between false belief, inhibitory control and understanding the knee-jerk reflex and claim that this is because they rely on a common ability, i.e. to understand metarepresentations. They claim that this finding is compatible with the idea that having a ToM brings about better self-control.

However, they also concluded that it was compatible with the theory that self-monitoring is a prerequisite for development of ToM as well as the conditional-reasoning theory.

All of these studies have found a relationship, general or specific, between EF and ToM. On the basis of these findings, as all of these studies were rated as 'high' quality, one can be more confident that ToM and EF are related in some respects. However, the exact nature of the relationship is still unclear as the results that these studies have generated appear to be open to different interpretations and therefore no firm conclusions are drawn. All studies recommend more work in the area.

### **REVIEWERS' CONCLUSIONS AND DISCUSSION**

This review aimed to draw conclusions based on only sound evidence and to highlight the gaps and questions that still remain unanswered in this field.

This review looked at the research that has been carried out in this area with children with autism and typically developing children. Eight studies met criteria for this review. Four of these studies investigated children with autism with reference to typically developing children and four studies investigated typically developing children alone. All papers were rated as either being of 'high' or 'moderate' quality. Given the range of the search that was carried out, very few papers have actually met criteria for this review. One reason for this is that the majority of papers in this area either look only at ToM *or* EF or they are Literature Reviews or Expert Opinion reviewing other people's experimental work and drawing conclusions. A possible other reason is that it is difficult to recruit participants for the study. A substantial amount of literature is generated in this field attempting to answer the question as to the nature of the hypothesised relationship. It is, therefore, worrying that it is based on

so few studies and that studies that only investigate one deficit or the other are making claims about the relationship without having thoroughly investigated it

In children with autism, two studies of high quality found some degree of relationship between ToM and EF. These two studies were related in that they were part of the same longitudinal study. One suggested that, although there were several different explanations for their findings, EF and ToM were possibly secondary to an underlying primary deficit. The other suggested that as the two deficits had similar developmental trajectories they were likely to be related and interdependent. These two findings are not mutually exclusive but they are vague and serve to highlight the need for further work rather than making clear conclusions.

In typically developing children, all the studies found a relationship between ToM and EF but again varied in the claims that they made. The most conclusive finding was the EF ability predicted future ToM ability. However, none of the other studies agreed with this, one concluding the opposite, and the last two did not state the nature of the relationship. Again all these studies point to the need for further work.

There are obvious difficulties in this review in drawing firm conclusions from the above studies. These will be discussed below.

The use of the outcome measures in these studies varied, making it impossible for them to be quantitatively integrated. There appears to be no agreement on which tests are the best to use, with some authors developing their own measures. The Sally-Ann Task is a well-known first-order Theory of Mind task. However, researchers often adapt it to make it easier for the

children to grasp the concept. There is an inherent difficulty in using a story with puppets to test children who have a known deficit in imagination skills. To make it easier, they may use the same format but change the characters and the situation the characters are in, e.g. Shimmon & Lewis (2001) used a car instead of a marble. Most of the measures have no norms and their reliability and validity have not been assessed. It is true that within the field of ToM and EF, particularly, there is a wide range of measures to choose from and there is no consensus about which are the best to use thereby making it hard to compare studies

The studies investigating children with autism have used different control groups. Again this makes it difficult to draw comparisons. The case series used a child with Tourette's Syndrome and a child with Autism and Tourette's. Two studies used the same control group, as they were papers commenting on different points in a Longitudinal study, but these children were not homogenous with a variety of different diagnoses and abilities present within the group. Children with moderate learning disabilities will vary in their strengths and weaknesses as a learning disability is not a psychiatric diagnosis as such. The last study used two control groups: a clinical and non-clinical group. Hobson (1991) states that it is best to include a normal and non-autistic clinical control group as the contrast between the two control groups reveals the effects of generalised cognitive impairment on task performance which may also affect children with autism's performance on tasks.

The sample size of all of these studies is relatively small. Important generalisations are being made on the basis of one unreplicated finding on a small sample, i.e. Ozonoff et al's (1991) conclusion that Executive Function is likely to be the primary deficit given that it was universal amongst their whole sample. This sample consisted of only 23 children with High-Functioning Autism and Asperger's Syndrome. Some of the studies have used not only those

children diagnosed with autism but also those diagnosed with Pervasive Developmental Disorder Not Otherwise Specified. This is most likely done to increase the sample size but introduces greater variability into the sample.

The studies have often failed to highlight their exclusion and inclusion criteria for control subjects, or in the case of the cohort studies, the typically-developing participants, i.e. these include screening for Autism, head injury, learning disabilities, childhood illness and psychiatric diagnoses.

### **IMPLICATIONS FOR CLINICAL WORK**

Given the conclusions that are drawn, there is actually little that can be said about the implications this research can have on clinical work. Instead, it is possible to comment on the potential effect that this work could have on clinical practice. If one of these deficits was found to be primary, it would provide a focus for clinicians to work on to improve a child's abilities in both areas. For example, training a child in Executive Function tasks would not only improve their functioning in that area but also in ToM. It would also provide the clinician with markers by which to monitor a child's development. For instance if we knew that a level of Theory of Mind should be achieved by the time a child had achieved a certain Executive function and this was not apparent on assessment, it could be highlighted as a difficulty or problem area and pinpointed for input.

### **IMPLICATIONS FOR FUTURE RESEARCH**

The most important conclusion to be drawn from this Review is that this area requires much more investigation. More specifically, it requires good quality experimental research where the question of the nature of the developmental research is directly tested. In order to do this

more homogenous experimental and control groups, larger sample sizes and standardised measures that are reliable and valid need to be used. There should be more, or better, collaboration between interested researchers and service providers in order to maximise resources. A single researcher in one area of the country will have a limited population to draw on. If this collaboration took place a standard approach to the selection of research instruments would be easier to devise. More importantly, research work needs to be replicated in order that firm conclusions can be drawn. The conclusions of this review are that there are currently too few studies to make a firm statement about the nature of the relationship between ToM and EF although it is likely from the evidence presented that there *is* a relationship between ToM and EF.

# Tables

Table 1	Guideline Topic for Group A
Table 2	Guideline Topic for Group B
Table 3	Table of Excluded Studies

## Guideline topic: Children with autism

### Evidence table covering:

Author	Year	Study Type	Evidence & Quality Rating	Population	Theory of mind measure used	Executive Function measure used	Measure of intellectual ability used
Ozonoff, Pennington & Rogers	1991	Case Control	3a A	23 high-functioning autistic and 20 non-autistic children aged 8-20 with dyslexia, other learning difficulties, ADHD and mental retardation	<ul style="list-style-type: none"> <li>M &amp; M's task,</li> <li>Van Task</li> <li>Brain Function task</li> <li>Mental-physical distinction</li> </ul>	<ul style="list-style-type: none"> <li>Tower of Hanoi</li> <li>Wisconsin Card Sorting Task</li> </ul>	<ul style="list-style-type: none"> <li>WISC-R or WAIS-R</li> </ul>

### Conclusions

Hypothesised that Theory of Mind was primary to autism while executive function was a correlated deficit.

The study found the autistic sample had selective deficits in executive function, theory of mind, emotion perception and verbal memory. It failed to replicate earlier findings by Baron-Cohen et al (1986) that autistic children perform poorly on the intentional condition of a picture sequencing measure than controls.

Second-order theory of mind deficits and executive function were significantly more widespread among participants with autism but first-order deficits only found in a subset. Executive function deficits were the only deficits found in both participants with high-functioning autism and Asperger's syndrome. This universality suggests that Executive function may be the primary deficit

Suggest four possible ways in which Theory of Mind and Executive Function may be related. First one is primary and causes the other. Second, one is primary, but does not cause the other, which is a correlated deficit caused by brain damage to a neuroanatomically proximal system. Third, some other deficit is primary and causes both theory of mind and executive function. Four, both are independent primary deficits in autism.

They suggest that considering a prefrontal hypothesis or autism may be useful. An underlying deficit in prefrontal function may be primary. However, this would need further investigation.

TABLE 1



## Guideline topic: Children with Autism

### Evidence table covering:

Author	Year	Study Type	Evidence & Quality Rating	Population	Theory of mind measure used	Executive Function measure used	Measure of intellectual ability used
Ozonoff & McEvoy	1994	Longitudinal Study -3 years	2b A	23 Non-retarded adolescents with autism (mean age = 12.1), 20 LD controls (mean age = 12.4)	<ul style="list-style-type: none"> <li><b>Time 1:</b> M&amp;M's task, Second-order belief attribution task.</li> <li><b>Time 2:</b> M &amp; Ms task, Second order belief attribution Task, Overcoat Story, Prisoner Story</li> </ul>	<ul style="list-style-type: none"> <li><b>Time 1:</b> Wisconsin Card Sorting Test (WCST) and Tower of Hanoi (ToH)</li> <li><b>Time 2:</b> WCST and ToH</li> </ul>	$\frac{VIQ \times CA}{100}$ $\frac{PIQ \times CA}{100}$

### Conclusions

This study addressed the questions: Do theory of mind and executive function abilities improve with development (e.g. increasing MA) in autistic individuals; and is there a ceiling or upper limit on theory of mind or executive function development among autistic individuals?

Study 1 presented both the WCST and ToH at Time 1 and three years later at Time 2. If executive function deficits are central to autism then there should be little change over time whereas there should be improvement in the control group. There should also be little relationship with chronological or mental age. IQ and severity of autism may affect performance. If there is a ceiling on executive function development then few subjects should perform within normal limits at Time 2. Results showed little evidence of development over time. The group with autism performed less well than the controls at both time periods. Autistic Group performance tended to worsen over time while the control group performance tended to improve with time. In Study 2, Theory of mind measures were given at Time 1 and Time 2. Controls were at ceiling at Time 1 and therefore tasks were not re-administered to them at Time 2. The same predictions that were made in Study 1 with executive function were made here. There was little evidence that theory of mind abilities improved over the three-year follow-up period. Therefore there appears to be a ceiling. There were also significant correlations between performance and MA.

Results indicate that both executive function and theory of mind abilities are seriously deficient in people with autism, improve little with development and may never reach normal functioning, instead hitting a developmental ceiling. The similar developmental trajectories of Executive Function and Theory of Mind suggest the skills may be related and interdependent, rather than independent modules of cognitive function. The pattern of results also suggests that Executive Function and Theory of Mind are deviant in autism rather than delayed.

TABLE 1

## Guideline topic: Children with Autism

### Evidence table covering:

Author	Year	Study Type	Quality Rating	Population	Theory of mind measure used	Executive Function measure used	Measure of intellectual ability used
Shimmon & Lewis	2001	Case Control	3a B	24 children with Autism, 18 children with moderate LD, 21 preschoolers	<ul style="list-style-type: none"> <li>Smarties Task</li> <li>Sally-Ann Task</li> </ul>	<ul style="list-style-type: none"> <li>Tower of London</li> <li>Tower of Hanoi,</li> <li>Luria Hand Game</li> </ul>	<ul style="list-style-type: none"> <li>Verbal comprehension and forward digit span subtests from the WPSI and the WISC</li> </ul>

### Conclusions

All children were trained on the Tower of London task. The pre-schoolers and children with autism showed training gains. These gains also generalised to a related task, the Tower of Hanoi but not a less clearly related task, the Dimensional Change Card Sort, or a false belief task.

This therefore conflicts with Perner & Lang's (2000) account that Executive Function is a prerequisite for mental-state understanding. Perner & Lang's second position, Theory of Mind is a prerequisite for Executive Function also does not receive much support. However, performance on the Sally-Ann test predicted outcome on the Tower of London move-away trials but not the move towards trials. The authors speculate that it is the inhibitory demands required of the move away trials that matches those imposed by the unexpected transfer task which would provide support for Hughes & Russell's claim that Theory of mind tests have executive components and their disengaging from salient object hypothesis.

**TABLE 1**

## Guideline topic: Children with Autism

### Evidence table covering:

Author	Year	Study Type	Evidence & Quality Rating	Population	Theory of mind measure used	Executive Function measure used	Measure of intellectual ability used
Baron-Cohen & Robertson	1995	Single case study	4 A	1 child with autism, one child with Tourettes, a child with a co-morbid case of autism and Tourettes.	<ul style="list-style-type: none"> <li>• Smarties Task</li> <li>• Sally-Ann Task</li> <li>• Penny Hiding Game</li> </ul>	<ul style="list-style-type: none"> <li>• Yes/No game</li> <li>• Hand Alternation Task</li> <li>• Children's Stroop Test</li> <li>• FAS Test</li> </ul>	<ul style="list-style-type: none"> <li>• BPVS</li> </ul>

### Conclusions

Found patient with autism was significantly impaired on theory of mind tasks but not intention editing tasks, the patient with Tourette's showed the opposite pattern and the co-morbid patient was impaired in both domains. The three children were equally impaired on the Executive Function tasks.

Results consistent with notion that theory of mind and intention editing are independent processes. Also indicates that there is an associated (frontal) cognitive process that is impaired in both disorders (i.e. executive function). Throws doubt on idea that theory of mind is dependent on executive function as in the patient with Tourette's, theory of mind is intact while executive function is impaired.

Of note, single case studies should be treated with caution. Also a case with intact executive function and impaired theory of mind has never been found.

TABLE 1

## Guideline topic: Typically-developing children

### Evidence table covering:

Author	Year	Study Type	Evidence & Quality Rating	Population	Theory of mind measure used	Executive Function measure used	Measure of intellectual ability used
Hughes	1998a	Cohort Study	3a A	50 preschoolers: 25 boys and 25 girls, aged 3.5 to 4.5 years old.	<ul style="list-style-type: none"> <li>Smarties Task,</li> <li>Sally-Ann task,</li> <li>False-belief explanation task</li> <li>A deception task,</li> <li>Penny-hiding game</li> </ul>	<ul style="list-style-type: none"> <li>Visual searching task,</li> <li>Auditory sequencing task,</li> <li>Detour reaching box</li> <li>Luria hand task</li> <li>Set-shifting task</li> <li>Pattern making task.</li> </ul>	<ul style="list-style-type: none"> <li>Peabody</li> <li>Vocabulary scales,</li> <li>BPVS-II,</li> <li>Bus Story,</li> <li>McCarthy</li> <li>Intelligence Scales</li> </ul>

### Conclusions

The aim of this task was to develop a set of simple EF tasks appropriate for young children and developmentally sensitive to early changes in Executive Function and to examine the nature of the hypothesised association between Executive function performance and developing awareness of mental states in preschoolers.

Specific links were found between Executive Function and Theory of Mind even when age and verbal/non-verbal ability accounted for. In particular deceptive abilities are related to inhibitory control. When age, verbal and non-verbal ability were partialled out, both inhibitory control and attentional flexibility were significantly correlated with scores for deceit. Support was found for the view that improvements in Theory of mind skills reflect growing strategic rather than representational abilities. No support found for theory that age-related improvements on standard false-belief tasks are mediated by co-varying increases in Executive Function.

Final conclusion is that both executive function and theory of mind are multi-faceted constructs with specific rather than general relationships between the two domains.

TABLE 2

## Guideline topic: Typically-developing children

### Evidence table covering:

Author	Year	Study Type	Evidence & Quality Rating	Population	Theory of mind measure used	Executive Function measure used	Measure of intellectual ability used
Hughes	1988b	Longitudinal Study – 13 months	2a A	50 preschoolers; 25 boys and 25 girls, aged 3.5 to 5 years old.	<ul style="list-style-type: none"> <li>False-belief prediction task</li> <li>False belief explanation task</li> </ul>	<ul style="list-style-type: none"> <li>Detour reaching box,</li> <li>Luria hand game,</li> <li>set-shifting task,</li> <li>noisy book working memory task</li> <li>Tower of London task</li> </ul>	<ul style="list-style-type: none"> <li>BPVS</li> </ul>

### Conclusions

Four hypotheses: Executive function and Theory of mind are independent; both improve with age as a result of a maturation of an underlying domain-general developmental process; development of metarepresentation leads to later differences in executive function; early individual differences on simple executive function tasks can be used to predict later false-belief understanding.

Found that early Executive Function performance predicts performance on Theory of Mind tasks one year later. These findings were not symmetrical: early Theory of Mind did not predict Executive Function performance later.

**TABLE 2**

## Guideline topic: Typically-developing children

### Evidence table covering:

Author	Year	Study Type	Evidence & Quality Rating	Population	Theory of mind measure used	Executive Function measure used	Measure of intellectual ability used
Hughes, Dunn & White	1998	Case control	3a A	40 children with behaviour problems aged 3.5-4.5 & 40 matched controls without behaviour problems	<ul style="list-style-type: none"> <li>• Book task,</li> <li>• Story task,</li> <li>• Puppet deception game</li> <li>• Penny hiding game.</li> </ul>	<ul style="list-style-type: none"> <li>• Noisy book task</li> <li>• Tower of London task,</li> <li>• Detour reaching box</li> <li>• Luria Hand game,</li> <li>• Attention flexibility task</li> <li>• Marbles pattern-reproduction task.</li> </ul>	<ul style="list-style-type: none"> <li>• BPVS</li> <li>• Busy Story task</li> <li>• Bead memory subtest from Stanford Binet Intelligence scales.</li> </ul>

### Conclusions

This study had four aims: to examine whether disruptive children develop either a delayed or uneven theory of mind, examine whether these children's understanding of emotions is also delayed; explore the extent to which these posited deficits were restricted to situations or tasks involving conflicting, ambiguous, or complex social information; examine the role of executive functions in these impairments.

Modest support for first hypothesis. No support for third hypothesis. Early executive function deficits were found but disappeared once verbal ability and social background taken into account so further research required in this area.

Hard to manage pre-schoolers showed poor understanding of emotion and executive control, poor prediction or recall of a false belief, and better understanding of the belief-dependency of emotion in the context of a trick than a treat. Executive function was associated with performance on theory of mind tasks for the Hard-to-manage group alone suggesting direct and indirect links between executive dysfunction and disruptive behaviour.

TABLE 2

## Guideline topic: Typically-developing children

### Evidence table covering:

Author	Year	Study Type	Evidence & Quality Rating	Population	Theory of mind measure used	Executive Function measure used	Measure of intellectual ability used
Perner & Lang	2002	Cohort Study	3a A	69 typically-developing 3,4 and 5 year-olds	<ul style="list-style-type: none"> <li>First-order false-belief task</li> <li>Knee-jerk reflex task</li> </ul>	<ul style="list-style-type: none"> <li>Version of Luria Hand task</li> <li>Card-sorting task</li> </ul>	<ul style="list-style-type: none"> <li>K-ABC</li> </ul>

### Conclusions

Testing the prediction that understanding false-belief, understanding the involuntary nature of the knee-jerk reflex and the ability to inhibit interfering action tendencies depend on a common ability, i.e. understanding mental representations (e.g. beliefs, action plans and intentions) are causally responsible for our actions. The hypothesised that three types of task (False belief, Executive function and knee-jerk reflex task) would be mastered at the same age and be strongly correlated even after age and verbal intelligence partialled out.

A strong correlation was found between understanding false belief, understanding knee-jerk reflex and ability to inhibit interfering action tendencies after age and verbal intelligence partialled out. Correlations support theoretical position: children's understanding of mental states as representations that are causally responsible for action (Perner, 1991) allow children to understand false beliefs as determining action (go to empty cupboard) in a way that is not conducive to satisfying one's goals (find chocolate).

This finding is therefore compatible with the position that understanding how the mind governs other people's and ones' own actions brings about better self control. However, it is also compatible with other postulated theories, e.g. the conditional reasoning theory, Russell's theory that self-monitoring as part of executive control is a prerequisite for developing a theory of mind.

Again more research is recommended.

**TABLE 2**

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# **MAJOR RESEARCH PROPOSAL**

**An Investigation of the developmental link  
between Theory of Mind and Executive  
Function in Autism**

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# **An Investigation of the developmental relationship between Theory of Mind and Executive Function in Autism**

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## **SUMMARY**

Autism is a pervasive developmental disorder that affects social and communication skills. In children, this is often observed as repetitive behaviours, lack of imaginative play, marked resistance to change and delayed language acquisition.

There is currently a great deal of research focusing on the relative importance of three cognitive deficits in autism (i.e. Theory of Mind, Executive Function and Central Coherence), to what extent they are independent and they can account for specific observed behaviours in those with autism (Baron-Cohen & Swettenham, 2000). The aim of this research project is to look at the development of Executive Function and Theory of Mind capabilities in both normal children and children with autism.

Hughes (1996), in an investigation of executive control in children, identified a possible link between the development of mental state awareness and self-control among children with autism. This correlation was not found in normally developing children. They also found that four-year-olds performed well on a simple test of executive control that demanded the participant to override externally driven behaviour in order to produce self-directed acts. This appears contrary to Baron-Cohen, Cross, Crowson & Robertson (1994) finding that children could not learn to edit their intentions until around 5-6 years. They therefore concluded that the "executive capacity" for inhibiting externally driven responses appears to be developmentally prior to executive editing of intentions in normally developing children.

Hughes (1996) also found that in children with autism there was a significant and positive correlation between meta-cognitive awareness and Executive Function although not in normal children. Perner & Lang (2000) in a review of recent literature, however, concluded that in all children aged 3-5 years old there is a developmental link between Theory of Mind and Executive Function in that having a Theory of Mind improves our self-control (exhibited in our ability to complete executive tasks)

The aim of this project is to test out this development of executive control and also investigate the link between the development of mental-state awareness and self-control in both normally developing children and children with autism. Children will be taken from both the Glasgow and Renfrew areas of the West of Scotland subject to ethics approval.

## **INTRODUCTION**

### **Autism**

Autism is a pervasive developmental disorder that normally appears in the first 3 years of life.

Symptoms include:

- Deficits in the pragmatic aspects of language (Baron-Cohen, 1988)
- An absence of symbolic play (Baron-Cohen, 1987a)
- The presence of ritualistic behaviour (DSM-IV)
- A severe impairment in their ability to relate socially (Kanner, 1943; Rutter, 1983)

This social impairment is now seen as the primary symptom of the disorder and several theories have been proposed. In the last fifteen years, a large amount of research has been carried out into looking at the range of cognitive deficits in autism. This has led to the hypothesis that cognitive deficits may underlie the social deficits. The three main cognitive deficits identified are:

- Theory of Mind (Baron-Cohen, Leslie & Frith 1985)
- Executive Function (Ozonoff, Pennington & Rogers, 1991)
- Central Coherence (Frith, 1989)

For the purposes of this piece of research I am interested in only two of these; Theory of Mind and Executive Function.

### **Theory of Mind in Autism**

**Theory of Mind (ToM)** “concerns the (a) ability of children with autism to appreciate their own and other people’s mental states – such as their beliefs, desires, intentions, knowledge, pretence, and (b) perception and to understand the links between mental states and action” (Baron-Cohen & Swettenham, 2000, p. 880). Children with autism have been found to be impaired in this ability (Baron-Cohen et al, 1985). Tasks used to test Theory of Mind are sub-divided into whether they test for ‘first-order belief attribution’ or ‘second-order belief attribution’. The Sally-Ann Test is a classic first order belief task. The child is shown a cartoon strip or a puppet show of Sally and Ann. Sally has a basket in front of her and she places a marble in it. Ann has an empty box in front of her. Sally leaves the room and Ann puts the marble into her box. Sally then re-enters the room and the child is asked where Sally

will look for her marble. Results showed that whereas 3½ year old normally-developing children and children with Down's Syndrome of less than average intelligence succeeded on this task, 80% of autistic children whose intelligence was in the normal range showed no evidence of such ability (Baron-Cohen et al, 1985). The authors therefore hypothesised that there was a specific developmental delay in autism with regards to Theory of Mind. Second-order belief attributions are slightly more complex. Flavell, Botkin, Fry, Wright & Jarvis (1968) paradigm is useful here in understanding the difference. They used the term 'Level 1 perspective-taking' and 'Level 2 perspective-taking'. They defined Level 1 perspective taking as "the ability to think about another person's thoughts about an objective event". Level 2 perspective taking is the "ability to think about another person's thoughts about a third person's thoughts about an objective event". Normally developing 6-7 year olds are able to make second-order belief attributions.

### **Executive Function in Autism**

**Executive function** is the postulated mechanism that enables the normal person to shift attention flexibly, inhibit pre-potent responses, generate goal-directed behaviour, and solve problems in a planful, strategic way (Baddeley, 1991).

Patients with frontal lobe function have been found to fail tests of Executive Function. I.e. Wisconsin Card Sorting Test, Tower of Hanoi, Verbal Fluency Test, Detour Reaching Test. Hughes & Russell, (1993) showed patients with autism also fail Executive Function tests. This led to the conclusion that children with autism may have frontal lobe damage. They also conclude that children with autism may fail theory-of-mind tests because they cannot "disengage from the salience of reality".

There is little doubt that there are Executive Function deficits in those with autism or that this is likely to be as a result of frontal pathology. However, Executive Function deficits also occur in a large number of clinical disorders, i.e. Schizophrenia, PKU, OCD, Tourette's Syndrome, ADHD, Parkinsons, Frontal lobe syndrome and learning disabilities.

Therefore, Executive Function in itself cannot explain autism. In addition, studies have now shown a dissociation between EF and ToM in some disorders, i.e. Tourette's Syndrome (Baron-Cohen, Moriarty, Mortimore & Robertson, 1995). They therefore appear to be relatively independent processes. A further confound being that many tests of ToM involve some attention shifting and many tests of executive dysfunction involve taking into account one's own mental states, such as one's plans and thoughts.

It may therefore be necessary to look at the specificity of deficit. Hughes and Russell's (1993) description of disengaging from the salience of reality is an example but cannot be correct in its strong form as a number of studies require this and children with autism pass these tests, i.e. Visual perspective taking, false photograph tests, false map tests, false drawing tests, false model tests and intellectual realism tests in drawing.

As a result of this, Baron-Cohen & Swettenham (2000) suggest that ToM is not reducible to Executive Function, rather, that EF deficits in autism may co-occur with ToM deficits because of their shared frontal origin in the brain. Despite this, the EF hypothesis of autism is important because of its potential to explain the perseverative, repetitive behaviours in this condition, which are not accounted for by the ToM hypothesis. Perseveration and repetitive behaviours are symptomatic of frontal lobe syndrome, in which Executive dysfunction is also

seen. In this view, two cognitive deficits may be separately responsible for different types of abnormal behaviour.

Ozonoff (1997) suggested that although difference in severity and timing of onset of underlying neuropathology causing Executive Function deficits may account for variations in its behavioural manifestations across disorders it is also possible that a specific pattern of impairment in the components of executive dysfunction may distinguish autism from other disorders. As a result more recent studies have stopped looking at omnibus clinical measures of executive dysfunction and have adopted an information processing paradigms from experimental psychology and cognitive neuropsychology that are designed to dissociate the spared and impaired components of Executive Function deficits, e.g. set-shifting and cognitive flexibility, inhibitory control and working memory.

Russell, Mauthner, Sharpe & Tidswell (1991) observed that the executive component to many Theory of Mind tests can make it hard to be sure you are only measuring Theory of Mind deficits and not executive deficits. Hughes (1996) attempted a study of Executive Function deficits using simple executive tests. They looked at inhibitory control and meta-cognitive awareness in children with autism, children with learning difficulties and normally developing 4-year-olds. These three groups were given two simple tasks. The first was a hand-game requiring inhibitory control (Luria Hand Task), and the second was a delayed-reward situation tapping meta-cognitive awareness of strategies for coping with the delay period. The Luria Hand Task has two sub-tasks. The first is an Imitation Task which requires the child to copy a hand signal that the examiner makes. This response is believed to be externally-driven and there is no executive control needed. The second is a conflict task where the child is asked to make an unrelated sign to the one the examiner makes. It is

believed that internal control is needed for this, i.e. inhibition. The second task, called "Out of Sight – Out of Mind" tested the child's ability to suppress short-term interest for the sake of a long-term goal. The child is given a choice to have one sweet now and then return to classroom or wait for 5 minutes and get 2 sweets. If they choose to wait, they are asked if they want the sweets covered. The experimenter assesses the child's strategic management of the situation both verbally and non-verbally.

On the Luria Hand Task, the normally developing children aged 4 gave a good performance: i.e. overriding externally driven behaviours to produce self-directed acts. The younger pre-schoolers (mean age 2:11) and the children with autism failed by continuing to imitate the experimenter. In the second task, fewer autistic participants than control showed strategic management of the delay situation. Also, for the autistic and MLD group, the Luria task performance significantly positively correlated with choice and category of comment on Exp. 2. No such correlation was seen in the normal children where performances on both tasks improved with age. Therefore there is a possible link between autistic impairments in inhibiting perceptually driven responses and understanding relation between perception, thoughts and desires. Unfortunately, they did not administer any false-belief tasks so they could not investigate this further.

At first glance, the findings of Experiment 1 contradict findings by Baron-Cohen et al (1994) who found only children as old as 5-6 years old were able to "edit" their intentions. This was in a study comparing normally-developing children with children with Gilles de la Tourette syndrome on two parallel intention tasks (do x and y simultaneously, then switch to the opposite pattern). Two serial intention tasks were used as control tasks (do x then y; do x then y then z). They used a Hand Alternation task followed by the Yes/No task which

allowed them to rule out that their findings were purely as result of a motor deficit. Unlike Hughes (1996) hand task, this involved a choice between 2 simultaneous internal plans of action. Normally-developing six year-olds were significantly better than normally developing four-year-olds on both tasks. As a result, Hughes (1996) in acknowledging that a failure of their research was that they had not taken any Theory of Mind measures, concluded that: "Executive capacity for inhibiting externally driven responses appears to be developmentally prior to executive editing of intentions."(Hughes, 1996, p.234)

Hughes (1996) found no correlation between meta-cognitive awareness and Executive Function in normal children, only children with autism and learning difficulties. However, Perner & Lang (2000) came to a different conclusion when they posed the question: "is there a developmental link between mastery of Executive Function tasks and Theory of Mind development?" By studying the literature they advanced five possible theories to explain the link between the development of Executive Function and Theory of Mind capabilities in young children. They concluded that the theory that had the most supporting evidence was that 'Theory of Mind development improves self-control' (Executive Function), particularly around 3-5 years old.

### Aims

Perner & Lang (2000) have reviewed the recent literature and concluded that there is a developmental link between Theory of Mind and Executive Function. If their hypothesis is correct, then one should be able to demonstrate that as a child's ability in one domain improves, it improves on the other. It has been demonstrated that children with autism have deficits both in Theory of Mind capabilities and Executive Function capabilities (Baron-Cohen & Swettenham, 2000). It will be interesting to see if the developmental process is the



same as in the normal children albeit that it develops at a later age or whether the process is altered.

### **Hypotheses:**

1. Based on the findings of Baron-Cohen et al (1994) and Hughes (1996) it is predicted that the two groups of normally developing children will be able to perform the Luria Hand task but only the older group will be able to perform the Hand Alternation Task.
2. Perner & Lang (2000) hypothesise that Executive Function capabilities relate to development of Theory of Mind especially at age 3-5 years old. It is therefore predicted that as the normal children move from first-order Theory of Mind tasks to second-order Theory of Mind, they will improve on Executive Function tasks. The children with autism are presumed to have a delay in development of Theory of Mind and will therefore not be able to perform Theory of Mind tasks until a later age and it is predicted that their ability to perform Executive Function tasks will improve along side this.

### **Sub-Hypotheses**

- Those children who demonstrate second-order Theory of Mind ability will show superior self-control, i.e. success on the Hand Alternation Task.
- Normally developing 3-4 year olds will succeed on the first-order Theory of Mind tasks but not the second order Theory of Minds tasks.
- Normally developing 3-4 year olds will succeed on the Luria Hand Task but not the Hand Alternation Task.
- The group of normally developing 5-6 year-olds will demonstrate a second-order Theory of Mind and therefore superior self-control (as demonstrated by success on the Hand

Alternation Task) compared to normally developing 3-4 year-olds who will achieve only first-order Theory of Mind. Happé (1995) has found that on average “a verbal mental age of nine years-old is needed before passing of [second-order false belief tasks] is seen, and that the youngest mental age of an individual with autism passing such tests is five and a half years” (Baron-Cohen, 2000, p.15). First order tasks roughly correspond to a mental age of four and second-order tasks roughly correspond to a mental age of six. (Baron-Cohen, 2000).

- The group of normally developing 5-6 year-olds will have a similar level of Theory of Mind and self-control as 9-10 year-old children with autism. The children with autism aged 5-6 years old will fail the Theory of Mind tests and therefore have poorer performance on the Executive function tests than all the other groups.
- The children with autism aged 5-6 years old will fail the Theory of Mind tests and therefore have poorer performance on the Executive Function tests than all the other groups.

## **METHODOLOGY**

**Participants** – All children in the ‘autism’ group will need to have a definite clinical diagnosis of autism.

All children in the ‘normal’ groups will have no clinical diagnosis.

A power calculation has been calculated using the Baron-Cohen et al (1993) paper. I used the UCLA website to calculate this. I entered a desired power of 0.8 and used the data from the normal 3-4 year olds. May two sample sizes were  $N-1 = 13$  and  $N-2 = 18$ . Therefore a sample size of 16 for each group will give me a power of 0.8018.

All children will be access through schools in Glasgow and Renfrew .

In particular, it is hoped that the children with autism will be accessed through St. Anthony’s school, Renfrew.

Group 1 – Normally developing 3-4 year-olds

Group 2 – Normally developing 5-6 year-olds

Group 3 – 9-10-year-old children with autism

Group 4 – 5-6 year-olds children with autism

## **Measures**

BPVS – verbal fluency

## EF tasks

### Luria Hand Task

Firstly, the child is asked to imitate a hand signal that the experimenter makes. Once the child has mastered this, the child is asked to make a different hand signal to the one the experimenter makes.

### Hand Alternation Task

The child is asked to clench one fist and stretch out their other hand. They are then asked to alternate these two actions with their hands so that each hand is always doing the opposite action to the other.

### Serial Intention Tasks

The child is asked to clench their hand, then stretch it out and then to turn it palm up

### Yes/No game

The child is asked a series of questions that would normally elicit a 'yes' or 'no' response. However, the only rule of the game is that they cannot answer 'yes' or 'no'.

### Out of Sight/Out of Mind task

The child is told that as a reward for doing well on previous task, they can choose two sweets from a jar. At this point someone else enters the room. The experimenter then asked the child to make a choice; take

one sweet and go back to their class; or wait a few minutes while the care assistant goes outside for something she needs to do. If they wait they will get two sweets.

### Theory of Mind Tasks

#### Sally-Ann Task (First order false-belief task) (Baron-Cohen et al, 1985)

The child is shown two figures named Sally and Ann. In front of Sally there is a basket with a marble in it. In front of Ann there is an empty box. The child is shown Sally leaving and Ann taking the marble from the basket and putting it in the box. Sally returns and the experimenter asks where Sally will look for her marble.

#### Ice-cream Van Task (Second order false-belief task) (Baron-Cohen, 1989b)

The child is shown the layout of a village which has a church, a road, a park, Mary's house and John's house. John wants an ice-cream but has no money. The ice-cream man tells him he'll wait in the park all day and John can go home to get money which John then does. The ice-cream man then tells Mary he is going to the church to sell his ice-creams. On the way he sees John and tells him where he is going. John therefore goes to the church to buy his ice-cream. Mary goes to John's house to ask if he is in and is told he has gone to buy an ice-cream. The test question is "where does Mary think John has gone to buy his ice-cream". The child is also asked five prompt

questions and three control questions to ensure they had grasped important aspects of the story.

### **Design and Procedure**

This is a between-subjects design. The Independent Variables are age and diagnosis of autism and the dependent variables are level of ability on Theory of Mind and Executive Function Tests.

All children will be assessed with the BPVS to determine their verbal fluency. The experimenter will then administer the Executive Function and Theory of Mind Tasks in randomised order. It is predicted that testing will take approximately 45 minutes per patient.

### **Settings and Equipment**

Children will be assessed on location in school or nursery. The Ice-cream van task requires a small toy village to be set up so children's toys will be used to create this.

The Out of Sight/Out of Mind game requires sweets which will also be provided. In order to remove the need to rely on a colleague to be there for this game, I will use a mobile phone as a decoy to take me from the room.

### **Data Analysis** – Data stored and analysed on SPSS 9.0.

A Chi-Square will be used to look at the association between ability on Theory of Mind tests and ability on Executive Function tests and t-tests for independent samples and unrelated ANOVA will be used to look at the differences between groups.

### **Practical Applications**

This piece of research is the first step in investigating the “developmental link between mastery of Executive Function and Theory of Mind development” by attempting to discover if the development of one function co-varies with the other. It will not be able to answer if the development of one function is necessary for the other to develop (i.e. a causal link)

### **Time-scales**

Once the proposal is approved, an Ethics form will be submitted, approximately at the end of May/beginning of June. I will then approach schools and Local Authorities in June to ask for permission to use their pupils for this piece of research. I then expect to be able to start seeing participants in September once the schools return from their summer holidays.

### **Ethical Approval**

An Ethics form will be submitted to both Renfrew and Glasgow Ethics Committees as soon as the proposal is approved (See Appendices B1 & B2)

Approval will also need to be sought from LEAs (See Appendices B3, B4 & B5)

Parent Information Sheets and Consent Forms will be given to Parents (see Appendices B6, B7, B8, B9, B10, B11)

## **Major Research Proposal Amendments**

Amendments have been made to the original design as outlined in the proposal. Not enough young children could be recruited, especially from nursery schools. It is presumed that parents from nursery schools were wary about their children participating in the study given the high profile nature of autism and the MMR vaccination. In addition, the approach to the Primary School revealed that there was a bigger response from the older children than the younger children. There may be several reasons for this: older children may be more likely to give the letter to their parents than younger children; parents with younger children may have more concerns, as above, about autism given the recent media hype; older children may be more willing to participate than younger children.

A decision has been made to match children on age and sex to the children with autism. This means there is a danger of the typically-developing children performing at ceiling on some or all of the tasks. In addition, it is predicted that there will be a significant difference in the verbal mental age of the two groups as measured by the BPVS-II, thereby meaning that some of the differences between younger and older children may not be possible. If this is the case an investigation of the relationship between Theory of Mind and Executive Function will be analysed in the Experimental Group alone. However, differences in performance on the tests between the two groups can still be analysed and the difference in performance between the simple and complex tasks in both groups can be compared.



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# **MAJOR RESEARCH PAPER**

## **An Investigation of the Developmental Relationship between Theory of Mind and Executive Function in Children with Autism**

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Prepared in accordance with the guidelines for submission to *Journal of Child  
Psychology and Psychiatry and Allied Disciplines*  
See Appendix C1 for notes to contributors

## **Abstract**

Recent research into the cognitive deficits of children with autism has focussed on the relationship between two cognitive deficits: Theory of Mind and Executive Function. One review has suggested that Theory of Mind improves Executive Function at a young age. This study investigates the relationship between Theory of Mind and Executive Function in children with autism and typically developing children. 32 children with autism and 32 typically developing children were administered a range of simple and complex false belief (Theory of Mind), inhibitory control, and intention-editing (Executive Function) tasks. Groups were matched on age and sex and all children had a Verbal Mental Age of at least four. A significant difference was found between groups on all tasks, except the Sally-Ann task, with the typically-developing children performing better. All the children with autism performed better on the simple tasks than the complex tasks. The relationship between Theory of Mind and Executive Function was examined and it was found that Theory of Mind was not necessary for Executive Functioning but it enhanced Executive Function abilities. The implications of these results are discussed with reference to future research and the use of certain tests is discussed.

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# **An Investigation of the developmental relationship between Theory of Mind and Executive Function in Autism**

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## **INTRODUCTION**

Autism is a developmental disorder characterised by impairments in social, communicative and imaginative functioning. Recent epidemiological studies have shown an increase in incidence (Powell, Edwards et al, 2000) and prevalence rates (Baird et al, 2000). The reason for this increase is unknown but better information, a wider conception of autism and better screening have been suggested as possible explanations (Jordan, 1999). Currently, the exact cause of autism is unknown and there is no known 'cure'. Theories to explain autism come from different stems of medicine and science, e.g. neurology and genetics (for summary see Russell, 2002). However, psychological theories have been most helpful for understanding autism at the treatment level as they provide theoretical constructs that help to "make sense of observable behaviours, while fitting the constraints imposed by the little that is known of the biological basis of that behaviour" (Jordan, 1999, p.59).

Psychological research into Autism has been dominated by cognitive deficit theories in the last 15-20 years. In particular, Theory of Mind deficits (Baron-Cohen, Leslie & Frith, 1985; Baron-Cohen, 1989b) and Executive Function deficits (Ozonoff, Pennington & Rogers, 1991; Hughes & Russell, 1993) have attracted the most attention as plausible primary deficits in Autism. Indeed, the question as to which is the primary deficit remains unanswered with the majority of researchers in the field being divided between the two schools of thought.

*Theory of Mind (ToM)* concerns the appreciation of other's mental states and understanding the links between mental states and action (Baron-Cohen & Swettenham, 2000). Baron-Cohen et al (1985) found that children with autism performed poorly on tests of first-order Theory of mind relative to a control group. They hypothesised that this was evidence of a specific developmental delay in children with autism. Furthermore, Baron-Cohen (1984b) found that those who had initially passed first-order Theory of Mind tests (i.e. the Sally-Ann task, a false belief task) failed second-order Theory of mind tests (i.e., the Van Task, a false belief task).

*Executive function (EF)* is the postulated mechanism that enables a person to shift attention flexibly, inhibit pre-potent responses, generate goal-directed behaviour, and solve problems in a planful, strategic way (Baddeley, 1991). As such it is an umbrella term used to describe a range of abilities and it is now perceived that EF in itself may be too broad a level of analysis. As a result, recent studies have focused on EF components such as generativity, inhibition, attention-shifting and disengaging rather than EF as a global function. Using this model, it is possible that findings may show that people with autism have specific deficits within EF with other parts remaining intact (Baron-Cohen & Swettenham, 2000).

### **The Nature of the Relationship between ToM and EF**

In a study designed to examine the nature of ToM and EF deficits in children with high-functioning Autism compared to matched controls, Ozonoff et al (1991) found both second-order Theory of mind deficits and Executive function deficits were widespread in children with autism but found that Executive function deficits were the only deficits found both in children with High Functioning Autism and Asperger's Syndrome. They argued that this meant Executive function may be the primary deficit. Hughes & Russell (1993) concluded

that false-belief tasks (the most commonly used Theory of Mind tests) actually require the child to inhibit the most salient response, therefore requiring Executive Function abilities. They also found that children with autism would continue to persevere on a task even though they received constant feedback that they were making the wrong response. They concluded from this that it made more sense to view Executive function as the primary deficit in autism rather than Theory of Mind.

Perner & Lang (2000) reviewed the current evidence for and against five current theories that attempt to explain the nature of the developmental relationship between two widely researched components of ToM and EF; false belief and inhibitory control. They found that the theory which had the most evidence to support it was that Theory of Mind development improves self control (i.e. executive control). Perner (1998) has proposed that if we understand the false-belief task as an index of understanding the causal consequence of mental states (representational understanding = metarepresentation) then it can be clearly predicted that this “should be mastered at about the same time as and correlate with Executive Function tasks requiring inhibition of competing schemas (metarepresentational control)” (Perner & Lang, 2000, p.153). However, they also found that the theory directly opposing this, i.e. that action monitoring requires Theory of Mind, was also well supported by experimental evidence. Russell (1996, 1998) has argued that “the monitoring of action and the ability to act at will are the bedrock of a pre-theoretical self-awareness, and that such self awareness is a *sine qua non* for a conceptual grasp of the mind (Theory of Mind)” (Perner & Lang, 2000, p.154). Perner & Lang (2000) argue that Russell’s analysis only explains how early problems in action monitoring can be the cause of early and later Theory of Mind problems and not how later EF problems relate to Theory of Mind development at a later age.

This review by Perner & Lang (2000) was well-conducted and thorough. However, it suffers from the fact that it is only a literature review and as such is subject to bias, e.g. the author can choose what evidence to report in a paper such that it supports one view. In this way evidence contradictory to this view can be excluded. In addition, it is a narrative that has no systematic appraisal of study methods. A systematic review, Russell (2002), highlights the lack of experimental studies in this area and the need for more good quality research. Russell (2002) found no conclusive evidence either for or against a developmental relationship or evidence that the two were indeed related.

The aim of this study is to examine the relationship between ToM (false belief) and EF (inhibitory control) in typically-developing children and children with autism, for whom there is a known developmental delay or deficit. In order to do this both a first-order false belief task (the Sally-Ann task) and a second-order false belief task (the Van Task) will be used. Typically developing children aged four-years and older are expected to pass the Sally-Ann task (Baron-Cohen, 2000) and typically-developing children aged six-years and older are expected to pass the Van Task (Baron-Cohen, 2000). In addition, two simple inhibitory control tasks (the Luria Hand Task and the Out of Sight/Out of Mind Game) will be used as well as two more complex intention-editing tasks (the Hand Alternation Task and the Yes/No Game). Hughes (1996) found that typically developing children aged four-years and older could pass the two simple inhibitory control tasks. Baron-Cohen, Cross, Crowson & Robertson (1994) found that typically-developing children of five-years and older could pass the Hand Alternation Task and those of six-years of older could pass the Yes/No Game.



## **HYPOTHESES**

1. Children with autism have marked deficits in Theory of Mind and Executive Function. It is predicted that a between-group analysis will demonstrate that a greater percentage of the control group will pass each task than the experimental group.
2. It is predicted that a within-group analysis of both groups will find that a greater percentage of the group pass the simple tests (Sally-Ann Task, Luria Hand Task, Out of Sight/Out of Mind game) than the complex tasks (Van Task, Hand Alternation Task, Yes/No Game)
3. A within-group analysis of the typically-developing children and children with autism will be conducted separately to investigate the nature of the relationship between Executive Function and Theory of Mind in children with autism. Perner & Lang (2000) concluded that "Theory of Mind improves self control". In order to test this theory, it is hypothesised that if there is a relationship between the two, those who pass the first-order false belief task will pass the simple inhibitory control tasks as typically-developing children of the same age can do both tasks. Similarly, those who pass the second-order false belief tasks will pass the intention-editing tasks.

## **METHOD**

### ***Design***

In order to test these hypotheses, a matched control between-group design was utilised to compare the developmental process of ToM and EF in children with autism with the same process in typically-developing children. Matching by age and sex was done on a case-by-case basis. Within-group analyses were performed to compare the developmental process of ToM against the developmental process of EF in each group.

### *Participants*

Data from Baron-Cohen et al (1994) was used to calculate the number of participants required. Using children with Tourette's syndrome (which is recognised as a Tic disorder but has been conceptualised by Baron-Cohen et al (1994) as being characterised by cognitive deficits) rather than children with autism, the power calculation indicated that a sample of 32 participants per group would be adequate to test these hypotheses with a power of 0.8 at  $p < 0.05$ . This study was used for the calculation because it contained the complex Executive Function tasks described below and because other studies containing the Theory of Mind tasks and Executive Function tasks did not publish enough data with which to make the calculation. Ethical approval was first obtained from Greater Glasgow Primary Care NHS Trust (Appendix A1). Approval was also given from West Lothian Council Education Services (Appendix A4) and Greater Glasgow Council Education Services (Appendix A3).

The group containing children with autism was recruited from children attending Autism units attached to mainstream primary schools. None of the participants with autism had a learning disability (i.e.  $IQ < 70$ ). Two units were situated within the Greater Glasgow Local Education Authority area and one from within the West Lothian Council Local Education Authority. Each unit contained approximately 25 children and all children were given the opportunity to take part. There was a 42% response rate. The group containing the typically developing children were recruited from one large primary school in the West Lothian area. The school has approximately 400 children and again all were given the opportunity to participate. There was a 53% response rate allowing the experimenter to match for age and gender with the experimental group. No data was collected on the reasons for parents opting out of the study on behalf of their children. However, teachers did comment on the current concern that parents express about autism given its high media profile at the minute.

The group of children with autism were recruited first. The typically developing children were recruited next and they were matched to the experimental group on age and gender. Children from the mainstream school were excluded from the study if they had a diagnosis of autism, Asperger's syndrome, communication disorder or motor disorder. They were also excluded if they had a history of head injury.

### ***Procedure***

All participants from both groups completed the same tests. The BPVS-II was administered as a measure of receptive vocabulary. It was included to ensure that all participants had a verbal mental age equivalent of 4 years and above as this is approximately the age that research has shown first-order ToM abilities become apparent in normal children (Baron-Cohen et al, 1985). All tests were administered in the same order in the same way by the same experimenter. A Proforma was created to record data and an Instruction sheet devised so that the presentation of tests was standardised (Appendix C2). The order of presentation was as follows:

### ***Executive function Tests***

- *Luria Hand Task*

Firstly, the child is asked to imitate a hand signal that the experimenter makes. Once the child has mastered this, the child is asked to make a different hand signal to the one the experimenter makes. This is therefore a task of inhibitory control (Hughes, 1996). Hughes (1996) found that all typically developing preschoolers of the age of four and above could pass this test.

- *Hand Alternation Task*

The child is asked to clench one fist and stretch out their other hand. They are then asked to alternate these two actions with their hands so that each hand is always doing the opposite action to the other. This is a Parallel Intention Task and is a task of editing intentions (do  $x$  and  $y$  simultaneously: activate intention  $x$  and  $y$  simultaneously, then edit one, then execute the other) (Baron-Cohen et al, 1994). Baron-Cohen et al (1994) found that all typically developing children of five-years and above could pass this test.

- *Serial Intention Tasks*

The short-form required the child to close their hands then open them (do  $x$  then  $y$ ). The long-form required the child to clench their hand, then stretch it out and then to turn it palm up (do  $x$  then  $y$  then  $z$ ). These tasks do not require editing of intentions and are therefore control tasks to the above (Baron-Cohen et al, 1994).

- *Yes/No game*

The child is asked a series of questions that would normally elicit a 'yes' or 'no' response. However, the only rule of the game is that they cannot answer 'yes' or 'no'. This is a verbal equivalent of the Hand Alternation (motor) Task as the child has to inhibit the strongly activated intention to say the word and think of an alternative there by making it a Parallel Intention Task also (Baron-Cohen et al 1994). Children with autism have known problems with motor coordination, especially those with Asperger's Syndrome (Jordan.

1999). A verbal Parallel Intention tasks allows the variation that may be caused by motor coordination difficulties to be assessed. Baron-Cohen et al (1994) only tested four- and six-year-olds on this test but found that all six-year-olds could pass this test.

- *Out of Sight/Out of Mind task*

The child is told that as a reward for doing well on a previous task, they can choose two sweets from a jar. At this point a phone rings. The experimenter then asked the child to make a choice; take one sweet and go back to their class; or wait a few minutes while the phone call is taken. If they wait they will get two sweets (Hughes, 1996). This is a measure of inhibitory control and therefore should be related to the Luria Hand Task.

### *Theory of Mind tests*

- *Sally-Ann Task* (First order false-belief task) (Baron-Cohen, 1985)

The child is shown two figures named Sally and Ann. In front of Sally there is a basket with a marble in it. In front of Ann there is an empty box. The child is shown Sally leaving and Ann taking the marble from the basket and putting it in the box. Sally returns and the experimenter asks where Sally will look for her marble.

- *Ice-cream Van Task* (Second order false-belief task) (Baron-Cohen, 1989b)

The child is shown the layout of a village which has a church, a road, a park, Mary's house and John's house. John wants an ice-cream but has no money. The ice-cream man tells he he'll wait in the park all day and John can go home to get money which John then does. The ice-cream man then tells Mary he is going to the church to sell his ice-creams. On the way he sees John and tells him where he is going. John therefore goes to the church to buy his ice-cream. Mary goes to John's house to ask if he is in and is told he has gone to buy an ice-cream. The test question is "where does Mary think John has gone to buy his ice-cream". The child is also asked five prompt questions and three control questions to ensure they had grasped important aspects of the story.

## **RESULTS**

### ***Descriptive Analysis – Age/BPVS***

[INSERT TABLE 1]

Thirty-five children with autism agreed to take part. Three were excluded: one was unable to participate due to his poor level of communicative functioning and inability to attend to the tests; the two others had an Age-Equivalence of less than four year on the BPVS-II. The experimental group age range varied from 5 years and 5 months to 12 years (mean age = 8.24). The control group age range varied from 5 years 3 months to 11 years 10 months (mean age = 8.43). Both groups had 25 boys and 7 girls. As groups were matched case by

case on age and sex there is no significant difference between groups in age or sex but a significant difference in verbal mental age as assessed by the BPVS-II was found ( $t = -4.852$ ,  $p=0.000$ ,  $df = 62$ ).

Preliminary analyses of the data indicated that both groups had not performed as expected on the Sally-Ann task. As a result, the results of other studies using the Sally-Ann task are presented below to demonstrate in which way the data has differed from expectation.

[INSERT TABLE 2]

### ***Performance on Theory of Mind tasks***

In the control group, 53.1% passed the Sally-Ann task. This is a smaller percentage than expected. In a study by Shimmon & Lewis (2001), two control groups comprising normal preschoolers and children with MLD were used and they had a pass rate of 81% and 72% respectively. Similarly, in Baron-Cohen et al's (1985) study, 75% and 85% passed respectively. In this control group, 81.3% passed the Van task. This is more in line with expectations as 90% of normal children passed this test in the original study by Baron-Cohen (1989b).

In the experimental group, 62.5% passed the Sally-Ann test which is a greater percentage than expected. In comparison, only a third of the children with autism in Shimmon & Lewis's (2001) study, who had a similar mean VMA to this sample, and only 20% of Baron-Cohen et al's (1985) sample, who had a slightly lower mean VMA, passed this test. Only 31.3% of the experimental group passed the Van task. In comparison, none of Baron-

Cohen's (1989) original study passed the test but other studies have shown a similar pass rate of a third. (Ozonoff et al, 1991; Ozonoff & McEvoy, 1994).

[INSERT TABLE 3]

*Performance on Executive Function tasks*

On the EF tasks, 96.9% of the control group passed the Luria Hand task which is in accordance with a study by Hughes (1996) where 100% of normal controls and 88% of MLD controls passed. Only 75% waited for two sweets on the Out of Sight Game compared with 100% of normal controls and 90% of MLD controls in Hughes (1996) sample. In addition, 93.8% passed the Hand Alternation Task and 100% passed the Yes/No Game which is in accordance with Baron-Cohen et al (1994) who found 100% of six-year-olds and above passed these tests. Therefore the only test on which the control group have not performed as expected is the Sally-Ann task.

On the EF tasks, 62.5% of the experimental group passed the Luria Hand task which is similar to Hughes (1996) findings of a 57% pass-rate with a group with autism who had a similar mean VMA. In addition, 53.1% passed the Out of Sight Game compared with 50% of Hughes (1996) sample. Only 53.1% passed the Hand Alternation Task and 53.1% passed the Yes/No Game. There are currently no comparisons with children with autism to make for these tests. However, fewer children have passed this test than the Luria task which is as predicted and the pass rate for these tests is the same which is as predicted. Again, the Sally-Ann test is the only test on which the group does not appear to have performed as expected.



As a result of the above, the within-group relationships between the ToM and EF tasks will still be computed for the Experimental group. However, they will not be computed for the Control Group as their performance on the Sally-Ann Task is unexpected and the ceiling effects on the EF tasks would make an analysis meaningless.

***Hypothesis 1** - It is predicted that a between-group analysis will demonstrate that a greater percentage of the control group will pass each task than the experimental group.*

Given that all data were nominal, Chi-square analyses were carried out on all data for the between-group analysis. It was hypothesised that a greater percentage of the control group would pass all the tests than the experimental group. The difference in performance between groups on the Sally-Ann Task was statistically non-significant (Fishers Exact Test  $X^2=0.256$ ,  $p=0.307$ ). However, the difference in performance between groups (i.e. Children with autism performing less well than typically developing children) on all the other tasks is highly statistically significant: the Van Task (Fishers Exact Test  $X^2=14.286$ ,  $p=0.000$ ); the Luria Hand Task (Fishers Exact Test  $X^2=9.653$ ,  $p=0.001$ ), the Hand Alternation Task (Fishers Exact Test  $X^2=11.534$ ,  $p=0.000$ ); the Yes/No Game (Fishers Exact Test  $X^2=17.067$ ,  $p=0.000$ ) and the Out of Sight/Out of Mind Game (Fishers Exact Test  $X^2=2.443$ ,  $p=0.05$ ).

***Hypothesis 2 – Experimental Group** – It is predicted that a within-group analysis will find that a greater percentage of the group pass the simple tests (Sally-Ann Task, Luria Hand Task, Out of Sight/Out of Mind game) than the complex tasks (Van Task, Hand Alternation Task, Yes/No Game)*

Chi-square analyses is used again as all data were nominal. The experimental group performed significantly better on the Sally-Ann Task than the Van Task as predicted (Fishers Exact Test  $X^2=3.142$ ,  $p<0.05$ ). They have also performed significantly better on the Luria

Hand Task than the Hand Alternation Task (Fishers Exact Test  $X^2=1.882$ ,  $p<0.1$ ) and the Yes/No Game (Fishers Exact Test  $X^2=4.426$ ,  $p=0.01$ ) thus supporting the hypothesis.

It should be noted that a Point Biserial Correlation indicates that the Age Equivalence score as produced by the BPVS-II is statistically significantly correlated with the Van Task ( $R = -0.662$ ,  $p<0.01$ ), the Luria Hand Task ( $R = -0.490$ ,  $p<0.01$ ), and the Yes/No Game ( $R = -0.539$ ,  $p<0.01$ ) in the Experimental Group.

*Hypothesis 2 – Control Group – It is predicted that a within-group analysis will find that a greater percentage of the group pass the simple tests (Sally-Ann Task, Luria Hand Task, Out of Sight/Out of Mind game) than the complex tasks (Van Task, Hand Alternation Task, Yes/No Game)*

There was no statistically significant difference in performance between the Sally-Ann task and the Van Task ( $X^2=0.389$ ,  $p=0.267$ ). The difference in performance between the Luria Hand Task and the Hand Alternation Task was nearing significance ( $X^2=3.372$ ,  $p=0.063$ ) and no calculation could be done between the Luria Hand Task and the Yes/No game as all the children passed the Yes/No Game. Thus these results did not meet criteria. This is as a result of the control group performing at ceiling on the complex EF tasks. A Point Biserial Correlation found no correlation between the BPVS-II Age Equivalence Score and test performance.

*Hypothesis 3 – Experimental Group - to investigate the nature of the relationship between Executive Function and Theory of Mind*

In order to look at the relationship between Theory of Mind and Executive Function, it is necessary to investigate if performances on tasks are related, i.e. is there a relationship

between awareness of other people's mental states and mastering inhibitory control and editing intentions? If they are related, is one a cognitive pre-requisite for the other?

Firstly, the Cramers V Chi-square test was used to investigate the association between the simple Theory of Mind task (Sally-Ann task) and the simple Executive Function task (Luria Hand Task) and between the complex Theory of Mind task (Van Task) and the complex Executive Function tasks (Hand Alternation Task/Yes-No Game). The association between the simple tasks was not statistically significant. On the complex tasks, the association between the Van Task and the Yes/No Game was statistically significant ( $X^2= 0.363, p=0.04$ ) but not between the Van task and the Hand Alternation Task.

The information provided by the above analysis is limited and does not indicate the nature of the relationship. Therefore, to further test this relationship, calculations called the predictive value of a positive test and predictive value of a negative test were computed (Dawson-Saunders & Trapp, 1990). These calculations are used when trying to discover the sensitivity and specificity of diagnostic tests. The predictive value of a positive test (passing Executive Function if one has already passed Theory of Mind) between Test 1 and Test 2 is:

$$\frac{\text{n passing (Test 1 + Test 2)}}{\text{n passing Test 1}}$$

The predictive value of a negative test (failing Executive Function if one has already passed Theory of Mine) between Test 1 and 2 is:

$$\frac{\text{n failing (Test 1 + Test 2)}}{\text{n failing Test 1}}$$

These calculations, in other words, tell us the probability of passing Test 2 having passed Test 1 and the probability of failing Test 2 having failed Test 1 respectively.

[INSERT TABLES 4 & 6]

*Simple to Simple Relationship*

The predictive value of a positive test when using the Luria Hand Task with the Sally-Ann Task is 65% and the predictive value of a negative test is 42%. Therefore there is a 65% chance that if a child passes the Sally-Ann Task they will pass the Luria Hand Task and a 42% chance that if the child fails the Sally-Ann task they will fail the Luria Hand Task.

[INSERT TABLE 5]

The predictive value of a positive test when using the Sally-Ann task with the Out of Sight Game is 45% and the predictive value of a negative test is 33%. There is a 45% chance that if a child passes the Sally-Ann task they will pass the Out of Sight Game and a 33% chance if the child fails the Sally-Ann task they will fail the Out of Sight Game. The predictive value of a positive test is nearly at chance and the predictive value of a negative value indicates that if a participant fails the Sally-Ann Task, they are more likely to pass the Out of Sight Task.

[INSERT TABLE 7 & 9]

*Complex to Complex Relationships*

The Van Task has a 70% predictive value of a positive test and a 54% predictive value of a negative test when used with the Hand Alternation Task.

[INSERT TABLE 8]

However, the Van Task has an 80% predictive value of a positive test and a 59% predictive value of a negative test with the Yes/No Game. This is similar to the Hand Alternation Task which is predicted as they are motor and verbal equivalent tasks to each other. It is highly probable that if a child passes the Van Task they will pass both the Hand Alternation Task and Yes/No Game. Although the probability is not as great, it is also likely that if they fail the Van Task they will fail the Hand Alternation Task and the Yes/No Game

An interesting relationship to investigate is the relationship between first-order ToM tasks and the more complex EF tasks. If we are predicting that second-order ToM is a necessary cognitive pre-requisite to the complex EF tasks and it is understood that second-order ToM is only achievable once first-order ToM is achieved then all those who pass complex EF tasks should have passed first-order ToM.

[INSERT TABLES 10 & 12]

#### *Simple to Complex Relationship*

The predictive value of a positive test using the Sally-Ann task with the Hand Alternation Task is 65% and the predictive value of a negative test is 66%. There is a 65% chance that if a participant passes the Sally-Ann Task they will pass the Hand Alternation Task. There is a 66% chance that if they fail the Sally-Ann task they will fail the Hand Alternation Task.

[INSERT TABLE 11]

The predictive value of a positive test when using the Sally-Ann task with the Yes/No Game is 55% and the predictive value of a negative test is 50%. There is 55% chance that if a participant passes the Sally-Ann Task they will pass the Yes/No Game. There is a 50% chance that if they fail the Sally-Ann Task they will fail the Yes/No Game.

## **DISCUSSION**

Prior to discussing the specific hypotheses of this study, it is necessary to highlight the unexpected and previously unreported findings that were made relating to the Sally-Ann task. It became obvious during testing that many of the control group were failing the Sally-Ann task while passing the Van task. As a result, six of the children were asked to explain why they had chosen their particular answer. Their responses indicated that they actually assumed the task to be harder than it was. A typical response was that Sally would know that Ann was naughty and that she would move the marble. In giving this response they are actually displaying an advanced Theory of Mind. However, they have still failed the Sally-Ann task.

In addition, the children with autism did not perform as poorly on the first-order ToM tests or simple EF tasks as predicted. In particular, it was the children with the youngest verbal mental age, as measured by the BPVS-II, who did not perform as expected. Performance on the second-order ToM tests and more complex EF tasks was more in line with predictions. As mentioned in the results, the Age Equivalence score on the BPVS-II correlated with the Van Task, Luria Hand Task and the Yes/No Game but not with the Sally-Ann Task or Hand Alternation Task. This indicates that in this sample receptive verbal ability does not explain

the unexpectedly high rate of passing the Sally-Ann Task in the Experimental Group. It was not possible to investigate this association in the Control Group due to ceiling effects.

Although the two groups were administered the tests in the same way by the experimenter, the teachers and schools prepared the children for the tests in different ways and as such have confounded the results. In the autism units, the author was invited to meet the children beforehand and spend some time doing activities with them in the classroom or have lunch with them. This was done in order to increase the chance of them cooperating. The children were also prompted by being told that the activities they were going to do with the author would be fun and that they were lucky to get a chance to take part. The author was invited to come and collect each child from the classroom to take them to the testing room. In the Primary School, the children were on a rota system and no arrangements were made for the author to meet them prior to the testing period. Teachers prompted the children that it was 'tests' that were being carried out and that they should perform as best they could. These two different styles of prompting may well have set up different expectations within the child of what was being required of them. Children in the autism units were also used to being taken out of the classroom to see other adults for various types of assessment. The assumption that this was a 'test' rather than a game could explain why many of the control group seem to have assumed the Sally-Ann Task could not be so simple. Future research could investigate the role of psychological factors such as expectations on performance on the Sally-Ann Task.

Another possible explanation for this finding is that the Sally-Ann task is not a valid measure of Theory of Mind. It is a measure that asks children who have known difficulties with imagination to answer questions about a short story acted out with two dolls. This would appear to be paradoxical. In addition, it does not allow for variability instead relying on a

strict pass/fail marking system. Hughes & Russell (1993) have argued that Theory of Mind tasks like the Sally-Ann Task require the subject to inhibit reference to a salient object or location thus requiring a degree of Executive Functioning. If this is the case then it is not a 'pure' measure of Theory of Mind.

These results raise the difficulty inherent in laboratory approaches to investigating deficits in children's cognitive abilities. The research in this field measures children's abilities by their performance on abstract tasks in laboratory style experiments. There is a need to find other ways of measuring children's performance on Theory of Mind and Executive Function tasks that have more ecological validity. Some studies have shown that Theory of Mind and Executive Function can both be observed in, e.g. the conversational skills of the child (Capps, Kehres & Sigman, 1998).

### *Discussion of Analyses*

The above analyses confirmed the first hypothesis that a greater percentage of the typically-developing children would pass each test than the children with autism. This is, of course, with the exception of the Sally-Ann Task which is discussed above. This finding concurs with both the Theory of Mind (Baron-Cohen, 2000) and Executive Function (Ozonoff et al. 1991) account of autism that there are deficits in these two areas of functioning in children with autism.

The second hypothesis that, within each group, participants would perform significantly better on the simple tasks than the complex tasks, was confirmed for the experimental group alone. There is a wide age-range within this group and not all children will have achieved second-order Theory of Mind. There was no statistically significant difference in



performance on the simple and complex tasks within the control group. Again, this non-significant ToM finding was due to the large number of children in this group who failed the Sally-Ann task. The non-significant findings on the EF tasks were due to ceiling effects.

The third hypothesis focused on the nature of the relationship between ToM and EF. To do this analysis the conclusion of Perner & Lang (2000) was adopted: "Theory of Mind improves self-control". Firstly, a Cramers V chisquare analysis revealed that there was an association between some of the tests. There was no association between the simple tasks or between the Van Task and Hand Alternation Task. However, there was an association between the Van Task and the Yes/No Game. To investigate the association further, the probability of passing an EF task given the outcome of passing a ToM task was calculated as was the probability of failing.

In the experimental group, the calculation between the Sally-Ann task and the Luria Hand Task indicates that without awareness of the mental states of others it is possible to have inhibitory control but having awareness of the mental states of others enhances inhibitory control skills. The calculations between the Sally-Ann Task and the Out of Sight game were at chance. On the complex tasks, those who have passed the Van Task are very likely to pass both the Hand Alternation Task and Yes/No Game and those who don't pass are quite likely to fail either of these tasks. Therefore, having second-order Theory of Mind enhances the ability to edit intentions and without second-order Theory of Mind it is quite likely that the participant cannot edit their intentions.

An additional analysis looking at the development of skills in children with autism indicates that these children can have intention-editing skills without having first-order ToM therefore

it is not dependent on ToM. Passing the Hand Alternation Task is more dependent than the Yes/No Game on passing the Sally-Ann Task. Having second-order Theory of Mind is more important in enhancing intention-editing skills than first-order Theory of Mind.

Both the Cramers V and the Predictive probability tests have shown that the association between Theory of Mind and Executive Function is stronger at the complex than the simple level. Therefore as these skills develop they become more interdependent.

This study has produced some tentative findings about the nature of the relationship between EF and ToM. In summary, there does appear to be a relationship between ToM and EF such that there is a greater likelihood of children with autism passing EF tasks if they have certain ToM skills. However, passing EF tasks is not solely *dependent* on these ToM skills. This suggests that other skills are needed. These may be other EF skills, e.g. set-shifting, as these tests may not be 'pure' inhibitory control tasks or intention-editing tasks. It may be other ToM tasks, e.g. deception. In addition, these tasks may be dependent on a third factor, i.e. working memory. In addition, it is clear the receptive verbal ability is associated with test performance. It is therefore possible that intellectual ability could also affect test performance. IQ was not measured in this sample but is a possible confounding variable. Yirmiya, Erel, Shaked & Solomonica-Levi (1998) found that children with learning disabilities may fail Theory of Mind tests. Further research in this area is required. Although it has been concluded that there is a relationship between EF and ToM it is not clear that this relationship is developmental, i.e. ToM is primary. However, finding a relationship is the first step on the path to discovering the nature of the relationship.

It should be noted that cognitive function such as executive functioning is associated with age and IQ and the effects of age and IQ on test performance have not been measured in this study. Turner (1997) found that low ability and high-functioning individuals with autism show contrasting types of repetitive motor stereotypies in conjunction with distinct patterns of EF impairment. This indicates that level of ability may be associated with specific EF impairments. Welsh, Pennington & Groisser (1991) studied age and EF performance in typically-developing children and found contrasting developmental trajectories for different aspects of EF, e.g. high-level attentional switching was not found in children under 6 years of age. It is therefore unlikely that this function will be seen in young children with autism. This study has matched the groups case-by-case on age but not on IQ and future studies would benefit from matching their groups on IQ. In addition, the two groups differed significantly on Age Equivalence with regards to receptive verbal ability and it would be interesting to investigate what effect matching for this variable would have on the difference in performance between the two groups. It is possible that a certain IQ or verbal ability is required to pass some of these tests and this has confounded the results. Unlike Executive Function, Theory of Mind has been found to be independent of general intelligence, language ability and mental age (Senju, Tojo, Konno, Dairoku & Hasegawa, 2002).

These results are tentative but have clinical implications in that it is possible to surmise that helping children with autism to develop their Theory of Mind skills will increase their Executive Function skills (e.g. intention editing and inhibitory control). However, McGregor, Whiten & Blackburn (1988) has found that although children with autism can be trained to improve on a Theory of Mind task this improvement does not generalise to everyday skills. More studies are required in this area to test this hypothesis further. These results provide support for Perner & Lang's (2000) conclusion that Theory of Mind improves

self-control as they suggest that possessing certain Theory of Mind skills improves Executive functioning. The data collected in this study would allow the alternative hypothesis to be tested, i.e. is Executive Function a cognitive pre-requisite for Theory of Mind. This will be the focus of a future study.

It is interesting that the strongest association between ToM and EF is found at the complex level when Executive Functioning is more mature. Given this, an analysis of whether the Editing of Intentions is a cognitive prerequisite for Theory of Mind would be an interesting discussion for a future paper. Tager-Flusberg (2001) has also raised the possibility that those children with autism who pass false-belief tasks have “acquired the cognitive capacity to interpret the contents of other minds via a different developmental pathway” (Tager-Flusberg, 2001, p. 184). She suggests that children rely on language rather than social-perceptual knowledge or more general logical reasoning skills to “hack” out a solution. If this theory is adopted then it would mean that passing a Theory of Mind task need not necessarily require a Theory of Mind. At the time that Theory of Mind is developing, other cognitive systems and information processing capacities are also developing and separating the effects of each is a complex task. Theory of Mind tasks assume that one either has or does not have Theory of Mind which reduces a complex, mentalistic conception of people to a categorical capacity. False belief understanding is now viewed as just one developmental milestone along a pathway that begins at birth with the ability to imitate facial expressions to the interpretation of non-literal language during later childhood. Tests should be reflecting the differences in the rate of developmental change both compared to other populations and to other cognitive domains within the child with autism. (Tager-Flusberg, 2001).

### ***Conclusions***

This experimental design has made an interesting finding about the Sally-Ann Task regarding the role that participant's expectations may have on the outcome of the task. This is a previously unreported finding and requires further research. In addition, this research has highlighted the gap in knowledge that exists in this field about the nature of the relationship between Executive Function and Theory of Mind deficits: children with autism have deficits in ToM and EF when compared to typically-developing children; and a greater percentage pass simple ToM and EF tasks than complex Tom and EF tasks. This paper has only focussed on components of Theory of Mind (false belief) and Executive Function (inhibitory control and intention editing). Future studies could investigate whether different components of Executive Function or Theory of Mind play a greater role.

# Tables

Table 1	Age, Sex and Verbal Mental Age (VMA) of Experimental Group and Control Group
Table 2	Results of Theory of Mind Tests for the Experimental Group and Control Group
Table 3	Results of Executive Function Tests for the Experimental Group and Control Group
Table 4	Number of Experimental Group passing and failing the Sally-Ann Test and the Luria Hand Task
Table 5	Number of Experimental Group passing and failing the Sally-Ann Test and the Out of Sight Game
Table 6	Predictive value of a positive test and Predictive value of a negative test in the simple-simple analysis
Table 7	Number of Experimental Group passing and failing the Van Task and the Hand Alternation Task
Table 8	Number of Experimental Group passing and failing the Van Task and the Yes/No Game
Table 9	Predictive value of a positive test and Predictive value of a negative test in the complex-complex analysis
Table 10	Number of Experimental Group passing and failing the Sally-Ann Task and the Hand Alternation Task
Table 11	Number of Experimental Group passing and failing the Sally-Ann Task and the Yes/No Game
Table 12	Predictive value of a positive test and Predictive value of a negative test in the simple-complex analysis

**Table 1: Age, Sex and Verbal Mental Age (VMA) of Experimental Group and Control**

**Group**

	<b>Experimental Group</b>	<b>Control Group</b>
<b>Age</b>	8.43 (5.05-12.03)	8.24 (5.03-11.10)
<b>Sex (m:f)</b>	27:5	25:7
<b>Verbal Mental Age (VMA)</b>	6.46 (4.10-13.1)	9.45 (5.01-16.08)

**Table 2: Results of Theory of Mind tests for the Experimental Group and Control Group**

	<b>Experimental Group</b>	<b>Control Group</b>
<b>Sally-Ann Task (Pass:Fail)</b>	20:12	17:15
<b>Van Task (Pass:Fail)</b>	10:22	26:6

**Table 3: Results of Executive Function tests for Experimental Group and Control Group**

	<b>Experimental Group</b>	<b>Control Group</b>
<b>Luria Hand Task (Pass:Fail)</b>	20:12	31:1
<b>Hand Alternation Task (Pass:Fail)</b>	17:15	30:2
<b>Yes/No Game (Pass:Fail)</b>	17:15	32:0
<b>Out of Sight/Out of Mind (Take Sweet: Wait for Two)</b>	17:15	24:8

**Experimental Group – Simple to Simple Relationship**

**Table 4: Number of Experimental Group passing and failing the Sally-Ann Task and the**

**Luria Hand Task**

		Luria Hand Task	
		Pass	Fail
Sally-Ann Task	Pass	13	7
	Fail	7	5

**Table 5: Number of Experimental Group passing and failing the Sally-Ann Task and the**

**Out of Sight Game**

		Out of Sight Game	
		Pass	Fail
Sally-Ann Task	Pass	9	11
	Fail	8	4

**Table 6: Predictive value of a positive test and Predictive value of a negative test**

	Positive	Negative
Sally-Ann – Luria	65%	42%
Sally-Ann – Out of Sight	45%	33%



**Experimental Group – Complex to Complex Relationship**

**Table 7: Number of Experimental Group passing and failing the Van Task and the Hand**

**Alternation Task**

		<b>Hand Alternation Task</b>	
		Pass	Fail
<b>Van Task</b>	Pass	7	3
	Fail	10	12

**Table 8: Number of Experimental Group passing and failing the Van Task and the Yes/No**

**Game**

		<b>Yes/No Game</b>	
		Pass	Fail
<b>Van Task</b>	Pass	8	2
	Fail	9	13

**Table 9: Predictive value of a positive test and Predictive value of a negative test**

	<b>Positive</b>	<b>Negative</b>
<b>Van – Hand Alternation</b>	70%	54%
<b>Van- Yes/No Game</b>	80%	59%

**Experimental Group – Simple to Complex Associations**

**Table 10: Number of Experimental Group passing and failing the Sally-Ann Task and the Hand Alternation Task.**

		<b>Hand Alternation Task</b>	
		Pass	Fail
<b>Sally-Ann Task</b>	Pass	13	7
	Fail	4	8

**Table 11: Number of Experimental Group passing and failing the Sally-Ann Task and the Yes/No Game**

		<b>Yes/No Game</b>	
		Pass	Fail
<b>Sally-Ann Task</b>	Pass	11	9
	Fail	6	6

**Table 12: Predictive value of a positive test and Predictive value of a negative test**

	<b>Positive</b>	<b>Negative</b>
<b>Sally-Ann – Hand Alternation</b>	65%	66%
<b>Sally-Ann – Yes/No Game</b>	55%	50%

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# CLINICAL CASE RESEARCH STUDY

## Abstract

The cognitive therapy approach to the treatment of Panic attacks and Health Anxiety is very similar. Both target the misinterpretation of bodily sensations. The use of safety behaviours has become an area of interest recently within the cognitive arena for their importance in the maintenance of anxiety. This research case study investigates the efficacy of removing safety behaviours in the treatment of a young man presenting with panic attacks who has a congenital heart disorder (Study 1). The removal of safety behaviours results in a decrease in the frequency and severity of panic attacks. The patient's conviction in three cognitive-dependent measures is also significantly reduced. However, one belief related to the negative effect of exercise on his heart demonstrates less change and self-report reveals that exercise is still being avoided. Therefore, a linked study investigates the efficacy of using a behavioural experiment (Study 2) with a belief that has proved resistant to change in Study 1. This experiment is carried out in a Cardiac Rehabilitation Unit and produces a rapid reduction in belief within session accompanied by a rapid increase in confidence. The relative benefits of these two components of Cognitive Therapy are discussed as well as the usefulness of this type of approach in an unusual case.

# APPENDICES

**Appendix A - Systematic Review**

**Appendix B - Major Research Proposal**

**Appendix C - Major Research Paper**



# **APPENDIX A**

A1 Contributors Notes

## Notes for Contributors

### General

1. Submission of a paper to the Journal will be held to imply that it represents an original contribution not previously published (except in the form of an abstract or preliminary report); that it is not being considered for publication elsewhere; and that, if accepted by the Journal, it will not be published elsewhere in the same form, in any language, without the consent of the Editors. When submitting a manuscript, authors should state in a covering letter whether they have currently in press, submitted or in preparation any other papers that are based on the same data set, and, if so, provide details for the Editors.

### Ethics

2. Authors are reminded that the Journal adheres to the ethics of scientific publication as detailed in the *Ethical principles of psychologists and code of conduct* (American Psychological Association, 1992). These principles also imply that the piecemeal, or fragmented publication of small amounts of data from the same study is not acceptable.
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Alternatively, papers may be submitted directly to any of the Corresponding Editors whose addresses are shown on the first page. Upon acceptance of a paper, the author will be asked to transfer copyright to the ACP. P.

### Manuscript Submission

1. Manuscripts should be typewritten, **double spaced throughout including references and tables**, with wide margins, on good quality A4 paper, using one side of the page only. Sheets should be numbered consecutively. Four copies should be sent. The author should retain a copy of the manuscript for personal use. Fax and electronic mail should **not** be used for initial submission of manuscripts.
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4. Authors whose papers have been given **final acceptance** are encouraged to submit a copy of the final version on computer disk, together with two hard copies produced using the same file. Instructions for disk submission will be sent to authors along with the acceptance letter. Do **not** send a disk with initial submission of paper.

### Layout

1. **Title:** The first page of the manuscript should give the title, name(s) and address(es) of author(s), and an abbreviated title (running head) of up to 80 characters. Specify the author to whom reprint requests should be directed. The covering letter should clearly state the name and address of the person with whom the Editors should correspond, giving also if possible a fax and email address. Authors requesting **masked review** should provide a first page with the title only and adapt the manuscript accordingly.
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5. **Acknowledgements:** These should appear on a separate sheet at the end of the text of the paper, before the References.

### Referencing

The Journal follows the text referencing style and reference list style detailed in the *Publication manual of the American Psychological Association*.

#### (a) References in text.

References in running text should be quoted as follows: Smith and Brown (1990), or (Smith, 1990), or (Smith, 1980, 1981a, b), or (Smith & Brown, 1982), or (Brown & Green, 1983; Smith, 1982).

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(Smith, Brown, & Jones, 1981). Subsequent citations should use "et al." (not underlined and with no period after the "et"), e.g. Smith et al. (1981) or (Smith et al., 1981).

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Join the names in a multiple author citation in running text by the word "and". In parenthetical material, in tables, and in the Reference List, join the names by an ampersand (&).

References to unpublished material should be avoided.

#### (b) Reference list.

Full references should be given at the end of the article in alphabetical order, and not in footnotes. **Double spacing must be used.**

References to journals should include the authors' surnames and initials, the full title of the paper, the full name of the journal, the year of publication, the volume number, and inclusive page numbers. Titles of journals must not be abbreviated and should be italicised (underlined).

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These should be constructed so as to be intelligible without reference to the text. The approximate location of figures and tables should be clearly indicated in the text. Figures will be reproduced directly from the author's original drawing and photographs, so it is essential that they be of professional standard. Computer generated figures must be laser printed. Illustrations for reproduction should normally be twice the final size required. Half-tones should be included only when essential, and they must be prepared on glossy paper and have good contrast. All photographs, charts and diagrams should be referred to as "Figures" and numbered consecutively in the order referred to in the text. Figure legends should be typed on a separate page.

### Nomenclature and Symbols

No rigid rules are observed, but each paper must be consistent within itself as to nomenclature, symbols and units. When referring to drugs, give generic names, not trade names. Greek characters should be clearly indicated.

### Refereeing

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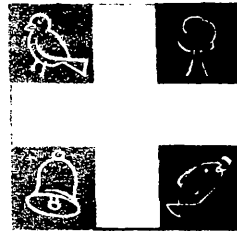
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# **APPENDIX B**

- B1 Ethical Consent Form from Glasgow
- B2 Ethical Consent Form from Renfrew
- B3 Letter to Glasgow LEA
- B4 Consent from Glasgow LEA
- B5 Consent from West Lothian LEA
- B6 Parent Information Sheet for Children  
with Autism
- B7 Consent Form for Children with Autism
- B8 Personal Information for Children with  
Autism
- B9 Parent Information Sheet for Typically-  
developing Children
- B10 Consent Form for Typically-developing  
Children
- B11 Personal Information for Typically-  
developing Children



**GREATER GLASGOW  
PRIMARY CARE  
NHSTRUST**

Ref: AmcM/0132

21 June, 2001

Miss Katherine Russell  
Department of Psychological Medicine  
Academic Centre  
Gartnavel Royal Hospital  
1055 Gt Western Road  
Glasgow  
G12 0XH

Dear Miss Russell

**PROJECT:** *An investigation of the developmental link between theory of mind and executive function in autism*

Many thanks for sending the above named submission to the Research Ethics Committee - it was discussed at our meeting on Thursday, 14 June 2001. I am pleased to be able to tell you that ethical approval has been granted subject to change -

- a) It is requested that you ensure that the participants in this study are not also involved in the study by Miss Laithwaite.
- b) The Control Information Sheet requires to be simplified in more layman terms.
- c) The participants should be given "breaks" if this is required and this should be inserted into the PIS
- d) It should be noted in all information sheets/consent forms that the data collected will be kept confidential
- e) The participant should give consent if this is at all possible
- f) It was unclear as to the number of groups involved e.g. one section refers to 4 groups and other sections refer to 2 groups.
- g) It was felt that the tests in the statistics, p10, are looking at different points and this section could be revised.

I hope these comments are helpful and look forward to receiving the necessary amendments.

Yours sincerely

**A W McMahon**  
**Administrator – Research Ethics Committee**



Direct Line: 0141 842 7266

Karen Harkins

Direct Fax: 0141 842 7308

E-mail: karen.harkins@achb.scot.nhs

Your Ref:

Our Ref: **LREC 43/01**

Date: 9<sup>th</sup> July 2001

Miss K Russell  
Flat 6  
3 Dyke Road  
Yoker  
GLASGOW  
G14 OJH

Dear Miss Russell

**AN INVESTIGATION OF THE DEVELOPMENTAL LINK BETWEEN THEORY OF MIND AND EXECUTIVE FUNCTION IN AUTISM**

Thank you for submitting the Protocol for the above study.

The Argyll and Clyde Local Research Ethics Committee considered your request at its meeting on 4<sup>th</sup> July 2001.

I can confirm that there is no objection on ethical grounds to the proposed study and I write to give you our approval to proceed on the understanding that: -

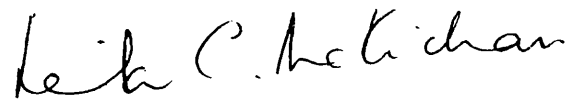
- a. All patients recruited to the study will be interviewed by the Clinician responsible for the conduct of the trial or a member of the Clinical Team who will obtain consent. This will not be delegated to an external agency.
- b. You will notify the Medical Director of any hospital whose facilities you may use during the conduct of the study.
- c. It is the local Researcher's responsibility to ensure compliance to the Data Protection Act 1998.
- d. You submit a progress report to this Committee one-year from the date of this letter.

In reaching the decision, the following documents were reviewed: -

LREC Application Form  
Protocol  
Patient/Carers Information Sheet  
Patient/Carers Information Sheet Control Group  
Child Participation Consent Form  
Child Participation Consent Form Control Group  
C.V.

A list of Committee Members present on the above date is appended.

Yours sincerely

A handwritten signature in cursive script that reads "Leith C. McKichan".

L.C. McKichan  
Vice-Chairman

cc. Mrs M. Gilchrist, Research Co-ordinator, RENVER Primary Care Trust

**Division of Clinical Psychology**

*Direct Line:* 0141-211

*Fax:* 0141-357 4899

*E-mail:*

20<sup>th</sup> September 2001

Margaret Orr  
Senior Education Officer  
Education Services  
Glasgow City Council  
Nye Bevan House  
20 India Street  
Glasgow G2 4PF



**UNIVERSITY**  
*of*  
**GLASGOW**

Dear Ms Orr

We are both trainee clinical psychologists studying at the University of Glasgow. For our doctoral theses, we are both studying aspects of autistic spectrum disorders. In particular, I am investigating the strategies employed by brothers and sisters of children with an autistic spectrum disorder to complete various tasks, compared with matched controls.

Katharine Russell is investigating the relationship between the development of executive functioning and theory of mind in children with autism.

Dr Fiona Knott, who is half-time clinical lecturer at the Department of Psychological Medicine, Gartnavel Royal, and a half-time clinical psychologist at Hawkhead Child and Family Centre, will be supervising both these projects.

For this study, I am hoping to recruit approximately 26 children (who have a brother or sister with an autistic spectrum disorder) and 26 children who have no such family history. These children will be aged between 7 and 12 years old. I am hoping to recruit these children from local authority education mainstream and special needs schools. I have written to East Dunbartonshire Local Authority Education who have given me permission to contact some of their schools.

Katharine Russell is hoping to recruit 32 normally developing children and 32 children with autism ranging in age from 3-10 years old. She is also hoping to recruit these children from local education authority mainstream schools, autism units attached to mainstream schools and nursery schools. She has also applied to West Lothian Local Education Authority.

We have both been granted permission by Greater Glasgow and Renfrewshire ethics committees to proceed with these projects. However, we are aware that permission also needs to be granted by the education authority. We were hoping that you may be able to inform us of who we should contact regarding this matter (if it is not yourself) and whether there is an ethics committee we should submit to.

Enclosed are copies of our patient information leaflets and consent forms.

If you require further information, please do not hesitate to contact either myself or Katharine Russell, at the address below.

Thank you very much for your assistance

Yours Sincerely

*Heather Laithwaite*

Heather Laithwaite  
**Trainee Clinical Psychologist**

*Katharine A Russell*

Katharine Russell  
**Trainee Clinical Psychologist**

**Department of Psychological Medicine**  
**Gartnavel Royal Hospital**  
**1055 Great Western Road**  
**Glasgow**





Education Services

Phone Direct Line 0141-287-6833

Fax 0141-287 6786

Email [john\\_scougall@education.glasgow.gov.uk](mailto:john_scougall@education.glasgow.gov.uk)

Our Ref JS/Rsrch Your Ref

Date 10 October 2001

If phoning please ask for John Scougall

Ms Heather Laithwaite  
Dept of Psychological Medicine  
Gartnavel Royal Hospital  
1055 Great Western Road  
GLASGOW G12 0XH

Dear Miss Laithwaite

**Proposed Research Project – Aspects of autistic spectrum disorders.**

Thank you for your further letter of 2 October regarding the above.

I now write to advise you that this department has no objection to you approaching our Primary Schools for assistance with your research. We do require however to be advised which schools you intend requesting assistance from.

I must emphasise that it is very much up to individual schools to decide whether or not they participate in such research.

**A copy of this letter should be sent to the Head Teacher when contacting the schools.**

This approval is also on the understanding that as there is pupil involvement parental/guardian consent **must be requested, and given**, before such involvement. A further condition of this approval is that two copies of your final research findings are sent to me, at the above address, when completed.

I hope that this is helpful and that you have success with your research.

Yours sincerely

JOHN SCOUGALL  
Assistant Principal Officer  
Budget & Central Support



# West Lothian Council

Education Services

Lindsay House  
South Bridge Street  
Bathgate  
West Lothian  
EH48 1TS

Tel 01506 776030  
Fax 01506 776378

Ms Katharine Russell  
Trainee Clinical Psychologist  
Flat 6  
3 Dyke Road  
YOKER  
Glasgow  
G14 0JH

Dear Katharine

Further to your telephone conversation with myself this morning (18/09/01) I am writing to advise you that permission has been granted for you to undertake work on your thesis – Investigating Cognitive Defects in Children With Autism – in West Lothian. I will be your point of contact for any problems that might arise out of your research, and my details are at the bottom of this letter.

I think it might be a good idea for you to come through to Bathgate one day and discuss any problems which you might encounter. We could also discuss which schools you would like to approach, as well as any other details. I have approached Sally Boyle (Headteacher Dedridge PS) who is okay with you approaching parents. Please bear in mind that Dedridge Primary School also accommodates normally developing children, who could form part of your control group. There is also a nursery school within the grounds of Dedridge Primary – Glenvue Nursery.

I would like to wish you well with your research, and West Lothian Council–Education Services look forward to seeing a copy of your final thesis

*Louis Costello*

Louis Costello  
PERFORMANCE OFFICER

Phone: 01506-776022  
Fax: 01506-776031  
Mailto: [louis.costello@westlothian.gov.uk](mailto:louis.costello@westlothian.gov.uk)



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**GLASGOW**

**Division of Clinical Psychology**

*Direct Line:* 0141-211

*Fax:* 0141-357 4899

*E-mail:*

(Information for Parents/Carers of Child Participants)

**Investigating the developmental link between Theory of Mind and Executive Function in Autism**

Thank you for taking the time to read this information sheet. I am a Psychologist at the University of Glasgow investigating the differences between normally-developing children and children with autism. In particular:

- The differences in awareness of their own mental state and the mental state of others and
- Their ability to control their own thoughts and actions and
- The relationship between the above.

This kind of research can increase our knowledge about autism.

**Who am I looking for?**

I would like to hear from children aged 4 to 11 years old who have a formal diagnosis of an autistic spectrum disorder. Personal information about your child shall be confidential (i.e. known only to my research supervisor and myself). You and/or your child are also entirely free to withdraw from the study at any point, without giving any reason.

**What do you have to do?**

The study requires your child to carry out 7 different short tasks. It is estimated that this will take no longer than 45 minutes. Three tasks will require your child to make different shapes with their hands. One task is a simple Yes/No game where the child is asked questions that normally demand a 'yes' or 'no' answer except the child will be asked not use these words. They must think of an alternative way to respond. There is a task involving sweets (or alternative reward if sweets are unsuitable) where the child is given the alternative of taking one sweet immediately or waiting for five minutes and then getting two. Finally, there are two tasks where a short story is enacted using props and the child is then asked a series of questions about the story.

There will also be a short test of word understanding where your child shall be asked the meaning of a short list of words, and shall add only another 5-10 minutes onto the procedure.

All participants will be given breaks if required and all data collected will be kept confidential.

**Where?**

The study will be conducted at the school (home or nearby health centre if you prefer). Expenses shall be paid.

Your child's participation would be very much appreciated and would enhance our understanding of this little understood syndrome. If you would like to take part please complete the attached consent form and return to the school. If you have any questions, please contact me at Department of Psychological Medicine, Gartnavel Royal, 1055 Great Western Road, Glasgow.

Thank you for your attention

Katharine A Russell MA(Soc Sci) (Hons)  
Doctoral Student in Clinical Psychology  
University of Glasgow & Greater Glasgow Community and Mental Health Care NHS Trust

Version 3



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**Division of Clinical Psychology**

*Direct Line:* 0141-211

*Fax:* 0141-357 4899

*E-mail:*

**Child Participant's Consent Form**

Title of study: Investigating the developmental link between Theory of Mind and Executive Function in autism

Researchers: Katharine A Russell MA (Soc Sci) (Hons)  
Doctoral Student in Clinical Psychology  
Trainee Clinical Psychologist  
University of Glasgow  
&  
Greater Glasgow Primary Care NHS Trust

Name of Participant: .....

Name of Participant's Parent/Carer: .....

(delete as appropriate)

- I have read the attached information letter YES/NO
- I agree to my child taking part in this study YES/NO
- I understand that I can decline to include my child from this study YES/NO
- I understand that I am free to withdraw my child from this study YES/NO  
without giving any reason for withdrawal
- I understand that all data collected will be kept confidential YES/NO
- I understand that upon withdrawal all information regarding YES/NO  
my child will be destroyed

- I wish to receive a summary of the study results

YES/NO

Participant's signature: .....

Date:.....

Parent/Carer's signature: .....

Date: .....

Principal Investigator's signature: .....

Date: .....

Signature of Witness: .....

Version 1



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**Division of Clinical Psychology**

*Direct Line:* 0141-211

*Fax:* 0141-357 4899

*E-mail:*

**Personal Information**

**Name:**

**Date of Birth:**

**Place of Birth:**

**Any associated medical conditions:**      **Yes / No** (please circle appropriate answer)

If yes, please explain in detail below:

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**Any history of Head Injury:**      **Yes / No** (please circle appropriate answer)

If yes, please explain in detail below:

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Division of Clinical Psychology

Direct Line: 0141-211

Fax: 0141-357 4899

E-mail:



UNIVERSITY  
of  
GLASGOW

(Information for Parents/Carers of Child Control Participants)

### **Investigating the developmental link between Theory of Mind and Executive Function in Autism**

Thank you for taking the time to read this information sheet. I am a Psychologist at the University of Glasgow investigating the differences between normally-developing children and children with autism. In particular:

- The differences in awareness of their own mental state and the mental state of others and
- Their ability to control their own thoughts and actions and
- The relationship between the above.

This kind of research can increase our knowledge about autism.

**As part of the study I need to look at children who do not have autism to provide a comparison**

#### **Who am I looking for?**

I would like to hear from children aged 4 to 11. Personal information about your child shall be confidential (i.e. known only to my research supervisor and myself). You and/or your child are also entirely free to withdraw from the study at any point, without giving any reason.

#### **What do you have to do?**

The study requires your child to carry out 7 different short tasks. It is estimated that this will take no longer than 45 minutes. Three tasks will require your child to make different shapes with their hands. One task is a simple Yes/No game where the child is asked questions that normally demand a 'yes' or 'no' answer except the child will be asked not to use these words. They must think of an alternative way to respond. There is a task involving sweets (or alternative reward if sweets are unsuitable) where the child is given the alternative of taking one sweet immediately or waiting for five minutes and then getting two. Finally, there are two tasks where a short story is enacted using props and the child is then asked a series of questions about the story.

There will also be a short test of word understanding where your child shall be asked the meaning of a short list of words, and shall add only another 5-10 minutes onto the procedure.



All participants will be given breaks if required and all data collected will be kept confidential.

**Where?**

The study will be conducted at the school (home or nearby health centre if you prefer). Expenses shall be paid.

Your child's participation would be very much appreciated and would enhance our understanding of this little understood syndrome. If you would like to take part please complete the attached consent form and return to the school. If you have any questions, please contact me at Department of Psychological Medicine, Gartnavel Royal, 1055 Great Western Road, Glasgow

Thank you for your attention

Katharine A Russell MA(Soc Sci) (Hons)  
Doctoral Student in Clinical Psychology  
University of Glasgow & Greater Glasgow Community and Mental Health Care NHS Trust

Version 3



**Division of Clinical Psychology**

Direct Line: 0141-211  
Fax: 0141-357 4899  
E-mail:

**Control Children's Consent Form**

Title of study: Investigating the developmental link between Theory of Mind and Executive Function in autism

Researchers: Katharine A Russell MA (Soc Sci) (Hons)  
Doctoral Student in Clinical Psychology  
Trainee Clinical Psychologist  
University of Glasgow  
&  
Greater Glasgow Primary Care NHS Trust

Name of Participant: .....

Name of Participant's Parent/Carer: .....

(delete as appropriate)

- I have read the attached information letter YES/NO
- I agree to my child taking part in this study YES/NO
- I understand that I can decline to include my child from this study YES/NO
- I understand that I am free to withdraw my child from this study YES/NO  
without giving any reason for withdrawal
- I understand that all data collected will be kept confidential YES/NO
- I understand that upon withdrawal all information regarding YES/NO  
my child will be destroyed

- I wish to receive a summary of the study results

YES/NO

Participant's signature: .....

Date: .....

Parent/Carer's signature: .....

Date: .....

Principal Investigator's signature: .....

Date: .....

Signature of Witness: .....

Version :

Division of Clinical Psychology

Direct Line: 0141-211

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E-mail:



B11

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**Personal Information**

**Name:**

**Date of Birth:**

**Place of Birth:**

**Any significant medical history:**                      **Yes / No** (please circle appropriate answer)

If yes, please explain in detail below:

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**Any history of Head Injury:**                      **Yes / No** (please circle appropriate answer)

If yes, please explain in detail below:

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**Any learning difficulties:**                      **Yes / No** (please circle appropriate answer)

If yes, please explain in detail below:

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# **APPENDIX C**

C1 Contributors Notes

C2 Proforma

## Notes for Contributors

### General

1. Submission of a paper to the Journal will be held to imply that it represents an original contribution not previously published (except in the form of an abstract or preliminary report); that it is not being considered for publication elsewhere; and that, if accepted by the Journal, it will not be published elsewhere in the same form, in any language, without the consent of the Editors. When submitting a manuscript, authors should state in a covering letter whether they have currently in press, submitted or in preparation any other papers that are based on the same data set, and, if so, provide details for the Editors.

### Ethics

2. Authors are reminded that the Journal adheres to the ethics of scientific publication as detailed in the *Ethical principles of psychologists and code of conduct* (American Psychological Association, 1992). These principles also imply that the piecemeal, or fragmented publication of small amounts of data from the same study is not acceptable.
3. Papers should be submitted to the Joint Editors, care of:

The Journal Secretary,  
St Saviour's House,  
39/41 Union Street,  
London SE1 1SD, U.K.  
Telephone: +44 (0)20 7403 7458  
Facsimile: +44 (0)20 7403 7081 E-Mail: jcpp@acpp.co.uk

Alternatively, papers may be submitted directly to any of the Corresponding Editors whose addresses are shown on the first page. Upon acceptance of a paper, the author will be asked to transfer copyright to the ACP.

### Manuscript Submission

1. Manuscripts should be typewritten, **double spaced throughout including references and tables**, with wide margins, on good quality A4 paper, using one side of the page only. Sheets should be numbered consecutively. Four copies should be sent. The author should retain a copy of the manuscript for personal use. Fax and electronic mail should **not** be used for initial submission of manuscripts.
2. Papers should be concise and written in English in a readily understandable style. Care should be taken to avoid racist or sexist language, and statistical presentation should be clear and unambiguous. The Journal follows the style recommendations given in the *Publication manual of the American Psychological Association* (4th edition, 1994), available from the Order Department, APA, PO Box 2710, Hyattsville, MD 20784, USA.
3. The Journal is **not** able to offer a translation service, but, in order to help authors whose first language is not English, the Editors will be happy to arrange for accepted papers to be prepared for publication in English by a sub-editor.
4. Authors whose papers have been given **final acceptance** are encouraged to submit a copy of the final version on computer disk, together with two hard copies produced using the same file. Instructions for disk submission will be sent to authors along with the acceptance letter. Do **not** send a disk with initial submission of paper.

### Layout

1. **Title:** The first page of the manuscript should give the title, name(s) and address(es) of author(s), and an abbreviated title (running head) of up to 80 characters. Specify the author to whom reprint requests should be directed. The covering letter should clearly state the name and address of the person with whom the Editors should correspond, giving also if possible a fax and email address. Authors requesting **masked review** should provide a first page with the title only and adapt the manuscript accordingly.
2. **Abstract:** The abstract should not exceed 300 words.
3. **Acronyms:** In order to aid readers, we encourage authors who are using acronyms for tests or abbreviations not in common usage to provide a list to be printed after the abstract.
4. **Headings:** Original articles and research reports should be set out in the conventional form: Introduction, Materials and Methods, Results, Discussion, and Conclusion. To save space in the Journal, the Method will be printed in smaller typeface. Descriptions of techniques and methods should be given in detail only when they are unfamiliar.
5. **Acknowledgements:** These should appear on a separate sheet at the end of the text of the paper, before the References.

### Referencing

The Journal follows the text referencing style and reference list style detailed in the *Publication manual of the American Psychological Association*.

#### (a) References in text.

References in running text should be quoted as follows: Smith and Brown (1990), or (Smith, 1990), or (Smith, 1980, 1981a, b), or (Smith & Brown, 1982), or (Brown & Green, 1983; Smith, 1982).

For up to five authors, all surnames should be cited the first time the reference occurs, e.g. Smith, Brown, Green, Rosen, and Jones (1981) or

(Smith, Brown, & Jones, 1981). Subsequent citations should use "et al." (not underlined and with no period after the "et"), e.g. Smith et al. (1981) or (Smith et al., 1981).

For six or more authors, cite only the surname of the first author followed by "et al." and the year for the first and subsequent citation. Note, however, that **all** authors are listed in the Reference List.

Join the names in a multiple author citation in running text by the word "and". In parenthetical material, in tables, and in the Reference List, join the names by an ampersand (&).

References to unpublished material should be avoided.

#### (b) Reference list.

Full references should be given at the end of the article in alphabetical order, and not in footnotes. **Double spacing** must be used.

References to journals should include the authors' surnames and initials, the full title of the paper, the full name of the journal, the year of publication, the volume number, and inclusive page numbers. Titles of journals must not be abbreviated and should be italicised (underlined).

References to books should include the authors' surnames and initials, the full title of the book, the place of publication, the publisher's name and the year of publication.

References to articles, chapters and symposia contributions should be cited as per the examples below:

Kiernan, C. (1981). Sign language in autistic children. *Journal of Child Psychology and Psychiatry*, 22, 215-220.

Jacob, G. (1983a). Development of coordination in children. *Developmental Studies*, 6, 219-230.

Jacob, G. (1983b). Disorders of communication. *Journal of Clinical Studies*, 20, 60-65.

Thompson, A. (1981). *Early experience: The new evidence*. Oxford: Pergamon Press.

Jones, C. C., & Brown, A. (1981). Disorders of perception. In K. Thompson (Ed.), *Problems in early childhood* (pp. 23-84). Oxford: Pergamon Press. Use Ed.(s) for Editor(s); ed. for edition; p.(pp.) for page(s); vol. 2 for Volume 2.

### Tables and Figures

These should be constructed so as to be intelligible without reference to the text. The approximate location of figures and tables should be clearly indicated in the text. Figures will be reproduced directly from the author's original drawing and photographs, so it is essential that they be of professional standard. Computer generated figures must be laser printed. Illustrations for reproduction should normally be twice the final size required. Half-tones should be included only when essential, and they must be prepared on glossy paper and have good contrast. All photographs, charts and diagrams should be referred to as "Figures" and numbered consecutively in the order referred to in the text. Figure legends should be typed on a separate page.

### Nomenclature and Symbols

No rigid rules are observed, but each paper must be consistent within itself as to nomenclature, symbols and units. When referring to drugs, give generic names, not trade names. Greek characters should be clearly indicated.

### Refereeing

The Journal has a policy of anonymous peer review and the initial refereeing process seldom requires more than three months. Authors may request that their identity be withheld from referees and should follow the procedure for masked review, as above. Most manuscripts require some revision by the authors before final acceptance. Manuscripts, whether accepted or rejected, will not be returned to authors. The Editor's decision on the suitability of a manuscript for publication is final.

### Proofs

Proofs will be sent to their designated author. Only typographical or factual errors may be changed at proof stage. The publisher reserves the right to charge authors for correction of non-typographical errors.

### Offprints

Fifty offprints of each paper will be provided free of charge to the senior author. Additional offprints may be purchased according to a set scale of charges if ordered using the offprint order form supplied with the proofs. Offprints are normally despatched by surface mail two weeks after publication.

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Whilst every effort is made by the publishers and editorial board to see that no inaccurate or misleading data, opinion or statement appear in this journal, they wish to make it clear that the data and opinions appearing in the articles and advertisements herein are the sole responsibility of the contributor or advertiser concerned. Accordingly, the publishers, editorial board and editors, and their respective employees, officers and agents accept no responsibility or liability whatsoever for the consequences of any such inaccurate or misleading data, opinion or statement.

**PROFORMA**

**Name:** \_\_\_\_\_ **Age:** \_\_\_\_\_ **D.o.B.** \_\_\_\_\_

**School:** \_\_\_\_\_

• **BPVS Raw Score:** \_\_\_\_\_ **BPVS VMA Equivalent:** \_\_\_\_\_

• **Luria Hand Task:** Pass / Fail = strict measure

No. of errors/15 trials: \_\_\_\_\_ = lenient measure

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 (circle if correct)

• **Hand Alternation Task:**

10 correct alterations = Pass

Trial 1: \_\_\_\_\_ correct alterations. Pass / Fail

Trial 2: \_\_\_\_\_ correct alterations. Pass / Fail

Trial 3: \_\_\_\_\_ correct alterations. Pass / Fail

Trial 4: \_\_\_\_\_ correct alterations. Pass / Fail

Trial 5: \_\_\_\_\_ correct alterations. Pass / Fail

Best Score: \_\_\_\_\_

• **Serial Intentions Task:**

**Short Form:** Pass / Fail = strict measure

No. of errors / 15 trials = lenient measure

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 (circle if correct)

**Long form:** Pass / Fail = strict measure

No. of errors / 15 trials = lenient measure

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 (circle if correct)

- **Sally-Ann Task:** Correct/Incorrect (circle appropriate answer)
- **Ice-cream van Task:** Correct/Incorrect (circle appropriate answer)
- **Out of Sight/Out of Mind Game:**
  - Take Sweet / Wait for two sweets
  - Cover Bowl / Leave sweets in view
- **Yes/No Game:**

**Control Task:** Correct / Incorrect

5 Training Questions:

Question until error or until 10 correct responses

Trial 1: No. of correct responses = \_\_\_\_ . Pass / Fail

Trial 2: No. of correct responses = \_\_\_\_ . Pass / Fail

Trial 3: No. of correct responses = \_\_\_\_ . Pass / Fail

Trial 4: No. of correct responses = \_\_\_\_ . Pass / Fail

Trial 5: No. of correct responses = \_\_\_\_ . Pass / Fail



**Long form:** Pass / Fail = strict measure

No. of errors / 15 trials = lenient measure

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 (circle if correct)

- **Sally-Ann Task:** Correct/Incorrect (circle appropriate answer)
- **Ice-cream van Task:** Correct/Incorrect (circle appropriate answer)
- **Out of Sight/Out of Mind Game:**
  - Take Sweet / Wait for two sweets
  - Cover Bowl / Leave sweets in view
- **Yes/No Game:**

**Control Task:** Correct / Incorrect

5 Training Questions:

Question until error or until 10 correct responses

Trial 1: No. of correct responses = \_\_\_\_ . Pass / Fail

Trial 2: No. of correct responses = \_\_\_\_ . Pass / Fail

Trial 3: No. of correct responses = \_\_\_\_ . Pass / Fail

Trial 4: No. of correct responses = \_\_\_\_ . Pass / Fail

Trial 5: No. of correct responses = \_\_\_\_ . Pass / Fail

## Out of Sight/Out of Mind Task

### Target Behaviours:

No. of repeated attempts to touch the sweets: \_\_\_\_

No. of deliberate looks or actions directed away from target sweet: \_\_\_\_

Spontaneous or elicited comments during the delay period in following way:

- a) simple reference to target:
- b) reference to distractor:
- c) explicit reference to self's ability to cope with the delay:

### Comments:

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**Sally-Ann Task**

This is Sally and this is Ann. Sally and Ann are friends.

***Naming Question:*** Which is Sally/Ann? \_\_\_\_\_

Sally has a marble and she puts it in her basket. She then leaves the room. Ann takes the marble and puts it in her box. Sally then comes back into the room.

***Belief Question:*** Where will Sally look for her marble? \_\_\_\_\_

***Reality Question:*** Where is the marble really? \_\_\_\_\_

***Memory Question:*** Where was the marble in the beginning? \_\_\_\_\_

## Ice-cream Van Task

**Test Question:** Where does Mary think John has gone to buy his ice-cream?  
(pass if child says or points to 'the park')

### Story

This is John and this is Mary. They live in this village.

**Naming Question:** Which is John/Mary? \_\_\_\_\_

Here they are in the park. Along comes the ice-cream man. John would like to buy an ice-cream but he has left his money at home. He is very sad. Don't worry. Says the ice-cream man, "you can go home and get your money and buy some ice-cream later. I'll be here in the park all afternoon. . .". "Oh good", says John, "I'll be back in the afternoon to buy an ice-cream".

**Prompt Question [1]:** Where did the ice-cream man say to John he would be all afternoon? \_\_\_\_\_

So John goes home. He lives in this house. Now, the ice-cream man says "I am going to drive my van to the church to see if I can sell my ice-creams outside there".

**Prompt Question [2]:** Where did the ice-cream man say he was going?

---

**Prompt Question [3]:** Did John hear that? \_\_\_\_\_

The ice-cream man drives over to the church. On his way he passes John's house. John sees him and says "Where are you going". The ice-cream man says "I'm going to sell some ice-cream outside the church". So off he drives to the church.

**Prompt Question [4]:** Where does the ice-cream man tell John he was going?

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**Prompt Question [5]:** Does Mary know that the ice-cream man has talked to John? \_\_\_\_\_

Now Mary goes home. She lives in this house. Then she goes to John's house. She knocks on the door and says "Is John In?". "No," says his mother, "he's gone to buy an ice-cream".

**Belief Question:** Where does Mary think John has gone to buy an ice-cream?

---

**Justification question:** Why? \_\_\_\_\_

**Reality Question:** Where did John really go to buy his ice-cream?

---

**Memory Question:** Where was the ice-cream man in the beginning?

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