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Executive functioning, social cognition, and coping in the broad autism phenotype

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EXECUTIVE FUNCTIONING, SOCIAL COGNITION, AND COPING IN THE BROAD AUTISM PHENOTYPE

By

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ABSTRACT

The current study purported to investigate executive function and social cognitive weaknesses in the Broad Autism Phenotype (BAP) population and identify how weaknesses in either of these areas could influence coping repertoire and coping flexibility in parents of children with Autism Spectrum Disorders or Other Developmental Disabilities. Two samples were collected; Sample 1 (*N*=147) completed neuropsychological measures and self-report questionnaires of executive function and social cognition. Sample 2 (online only; *N*=104) completed a subset of these measures. Results indicated no differences in proportion of the Broad Autism Phenotype in parents of children with Autism Spectrum Disorders in either sample. With regard to the neuropsychological measures utilized in Sample 1, Letter-Number Sequencing score (working memory) only was predictive of total correct on the Reading the Mind in the Eyes Task (RMET); no other neuropsychological measures predicted BAP characteristics, nor were these measures predictive of self-reported coping strategy use or scores on a measure of social inference making. However, in both samples, self-report of Planning and Organizing behaviour as measured by the Behavior Rating Inventory of Executive Functioning (BRIEF) predicted Rigidity; BRIEF Working Memory score was predictive of Pragmatic Language in both samples as well. Interestingly, BRIEF Working Memory was not predictive of the total correct on RMET. RMET total correct score did not differ between those with and without the BAP Coping strategy use, nor did RMET significantly predict Pragmatic Language scores. However, for Sample 2 only, RMET response latency was significantly shorter in those with the BAP. Although Planning and

Organizing best predicted Problem Focused coping strategy use in both Sample 1 and Sample 2, overall coping strategy use was best predicted by Aloofness in both samples.

The results of this study suggest some separation of social and non-social skills (task-based or academic/abstract) at a basic level, but at higher levels of reasoning these skills are less separable and are likely both mediated by executive functions. These results also suggest that that those with the BAP may have weaknesses with regard to more complex social interactions. Finally, these results indicate global weaknesses in executive functioning in the BAP as assessed by self-report, although the importance of planning weaknesses as a specific marker for the BAP was also supported.

DEDICATION

For Tulip and Darla Ann, synactically a dissimilitude from tedium vitae.

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LIST OF ABBREVIATIONS

Abbrev.	Referent	Referent type
ASD	Autism Spectrum Disorder	Construct
AUT	Parent of child with Autism Spectrum Disorder	Participant Variable (PV)
BAP	Broad Autism Phenotype	PV
BAPQ	Broad Autism Phenotype Questionnaire	Measure
BRIEF-A	Behaviour Rating Inventory of Executive Functioning—Adult Version	Measure
D-KEFS	Delis-Kaplan Executive Function Scales	Measure
DF	Design Fluency	Measure
EF	Executive Function	Construct
ODD	Parent of child with Other (non-autism) Developmental Disability	PV
RMET	Reading the Mind in the Eyes Test	Measure
UOT	Unexpected Outcomes Test	Measure
VF	Verbal Fluency	Measure

INTRODUCTION

Overview

Autism Spectrum Disorders are a group of developmental disorders characterized by deficits in communication, social skills, and flexible behaviour, including thinking of new ideas to solve a problem (Yamada et al., 2007; Weiss, 2002; Pisula, 2006). Parenting a child with autism is fraught with significant challenges. Even compared to parents of children with other developmental disabilities, parents of children with autism consistently report higher levels of stress, depression, anxiety and burnout (Dunn, Burbine, Bowers, & Tantleff-Dunn, 2001). Some research suggests that the parents' psychological symptoms are directly related to their childrens' unique needs and challenging behaviours (Schieve, Blumber, Rice, Visser, & Boyle, 2006; Yamada et al., 2007). However, it is also possible that increased psychological distress in these parents is related to genetic traits they may share with their children. The parents may show similar, but less obvious, deficits that influence their ability to cope with parenting challenges (Piven & Palmer, 1999; Sivberg, 2002; Twoy, Connolly, & Novak, 2007).

Coping strategies may include actively trying to solve the problem or modify the situation causing the stress, or trying to manage the feelings provoked by the stressor, such as by seeking social support. Adaptive coping requires cognitive fluency and flexibility for generating and acting on problem solutions, as well as communication and social skills to facilitate benefiting from social support (Lazarus & Folkman, 1984).

Parents who show cognitive deficits similar to that of their children with autism may have difficulty generating and implementing ideas aimed at solving problems, and any deficits in social skills and communication may impede development of close

relationships and interfere with helpful discussion of stressors (Austin, 2004; Bolte & Poustka, 2006; Robinson, Wilkowski, Kirkeby, & Meier, 2006). Finally, problems with flexible behaviour could thwart efforts to effectively switch between coping strategies when the situation warrants (Cheung & Cheung, 2005).

The goal of the present study is to identify the identify potential cognitive and social deficiencies in parents of children with autism spectrum disorders compared to parents of children with other developmental disabilities and to investigate the relation between any observed deficiencies and coping strategy use in these populations.

The following section will review the research related to coping strategies and coping flexibility. The current literature on executive functioning and problem focused coping, as well as the limited literature regarding social cognition and social support, will then be examined. Finally, a review of the extant literature on the executive functioning and social-cognitive capabilities of first degree relatives of children with autism as well as individuals with subclinical autism characteristics will be presented.

Coping

Coping is conceptualized as the dynamic cognitions and behaviours aimed at managing internal or external demands considered to be beyond an individual's current resources (Lazarus & Folkman, 1984). One frequently utilized theory of coping is the Transactional Model of Stress and Coping, put forth by Lazarus (Lazarus & Folkman, 1984). Lazarus' model identifies two different types of coping: problem focused and emotion focused. Problem focused coping refers to taking active steps to solve the problem or to change the situation causing the stressor. Information gathering or talking with the person causing the problem are examples of problem focused coping. Emotion

focused coping refers to behaviours directed at managing the feelings associated with the stressor. Seeking social support is the most frequently utilized emotion focused coping mechanism (Lazarus & Folkman, 1984). However, passive reappraisal, in which an individual attempts to change the emotional salience of a situation, can also be considered emotion focused coping (Henry, Green, Rendell, McDonald, & O'Donnell, 2008). Parker and Endler (1996) expanded on Lazarus' model to include avoidance as a coping mechanism (Parker & Endler, 1996). Avoidant coping refers to trying to forget about or distracting oneself from the problem (Parker & Endler, 1996; Lazarus & Folkman, 1984). Lazarus' theory also postulates that the use of problem focused coping in a situation that is controllable, and the use of emotion focused coping in a situation that is uncontrollable, are conducive to good psychological outcome. Avoidant coping is not conducive to good psychological outcome regardless of the controllability of the situation (Stuart & McGrew, 2009). This systematic use of problem focused and emotion focused coping strategies based on the controllability of the situation is termed "goodness of fit" (Lazarus & Folkman, 1984; Brannon & Petite, 2008).

More recently, coping researchers have developed the construct of coping flexibility as an efficient way to measure goodness of fit. Coping flexibility refers to the ability to engage in different coping strategies (i.e., problem focused *and* emotion focused coping) across different situations. Implicit in this definition is that the degree of control of stressors varies across situations (Cheung, 2003; Cheung & Cheung, 2005). Reduced coping flexibility has been shown to predict negative affect, such as anxiety and anger (Sasaki & Yamasaki, 2007; Fresco, Williams, & Nugent, 2006; Cheung, 2003; Cheung & Cheung, 2005).

Coping flexibility is associated with the evaluation of benefits and negative consequences of different choices and with being less concrete and absolute in thinking. These findings suggest that flexible (effective) coping requires planning, problem solving, abstract reasoning, and the ability to change a behaviour when the current one is not effective (Cheung & Cheung, 2005). These higher level cognitive skills are associated with the construct of executive functioning.

Executive Functioning

Executive functioning (EF) refers to a collection of cognitive skills and behaviour competencies essential for goal-directed, socially appropriate behaviour (Jurado & Roselli, 2007; Chan, Shum, Touopoulou, & Chen, 2008; Stuss et al., 2005). Research on the relation between general cognitive ability (IQ) and EF is equivocal, but mostly supports IQ and EF as distinguishably separate constructs (Ardila, Pineda, & Rosselli, 2001; Crinella & Yu, 2000, Friedman, Miyake, Corley, Young, Defries, & Hewitt, 2006; Obonsawin, Crawford, Page, Chalmers, Cochrane, & Low, 2002; Salthouse, 2005; Salthouse, Atkinson, & Berish, 2003; Salthouse, Siedlecki, & Krueger, 2006). Some researchers are proponents of the unitary conceptualization of EF, which states that all EF abilities are best accounted for by one, two, or three underlying constructs (e.g. working memory, inhibition, attention; Barkley, 1997; Pennington, Bennetto, McAleer, & Roberts, 1996; Salthouse, 2005). However, more recent researchers believe that EF is made up of conceptually and psychometrically distinguishable constructs (Anderson et al., 2001; Delis et al., 2001) or support a middle, semi-unified stance, citing small or insignificant correlations between different tests of EFs (Jurado & Roselli, 2007).

Cognitive skills that are commonly researched as components of executive functioning are problem solving skills (knowing what to do in novel tasks), planning (thinking ahead about what steps to take), set shifting or cognitive flexibility (changing an approach to a task based on feedback), concept formation (thinking about how different things are related), verbal fluency (coming up with words quickly), and working memory (remembering information while carrying out a related task) (Anderson, Northam, Hendy, & Wrennall, 2001; Alvarez & Emory, 2006; Banich, 2004; Delis, Kaplan, & Kramer, 2001; Elliot, 2003; Fisk & Sharp, 2004; Hobson & Leeds, 2001; Latleche & Albert, 1995; Pennington et al., 1996; Piguet et al., 2002; Salthouse, 2005; Weissman, Perkins, & Woldorff, 2008).

Executive Functioning in Problem Focused Coping

Research consistently supports the idea that intact executive functioning, particularly in the domain of overall problem solving ability, working memory and cognitive flexibility, is associated with more problem focused coping strategies. The vast majority of this research has been conducted with male persons with schizophrenia. In this population, poorer problem solving skill was associated with more avoidant coping and passive reappraisal (a form of emotion focused coping in which an individual attempts to change the emotional salience of a situation), and less planful problem solving (Henry, Green, Rendell, McDonald, & O'Donnell, 2008; Lysaker, Bryson, Lancaster, Evans, & Bell, 2002). In this study problem solving skill was assessed by the Wisconsin Card Sorting Task (WCST; Heaton, Chelune, Talley, Kay, & Curtiss, 1993). This task requires the examinee to sort cards with pictures of shapes of different colours according to an a priori rule that they need to figure out based on trial and error. The rule

changes after a given number of correct responses, requiring the examinee to "switch"—, i.e., realize that the rule has changed and figure out a new rule (Bolte & Poutska, 2006).

Research suggests that working memory is related to the development of improved reasoning skills; thus, it is not surprising that working memory deficits are associated with decrements in problem solving abilities in laboratory and real-world situations (Kail, 2007; Lysaker, Davis, Lightfoot, Hunter, & Stasburger, 2005; Buhner, Kroner, & Ziegler, 2008). Deficits in verbal working memory (i.e., Letter-Number Sequencing, which requires the examinee to verbally repeat, in numerical and alphabetical order, a group of out of order verbally presented letters and numbers; Wechsler, 1997) have been associated with use of passive reappraisal as a coping mechanism and less consideration of problem solving strategies in laboratory role play situations (Lysaker et al., 2002; Lysaker et al., 2005). Finally, increased perseverative errors on the WCST have been found to be related to decrements in social problem solving abilities and more avoidance coping strategy use (Lysaker et al., 2002; Lysaker et al., 2005; Wilder-Willis, Shear, Steffen, & Borkin, 2002).

It appears that intact ability in the cognitive domains of working memory, problem solving, and cognitive flexibility is associated with use of problem focused coping strategies, and that deficits in these cognitive domains are associated with less use of problem focused coping strategies. A limitation of the above research is that the majority has been conducted in male persons with schizophrenia. However, the association between EF deficits and less use of problem focused coping has been observed in other populations with EF dysfunction as well. For example, EF deficits in individuals surviving traumatic brain injury or chemotherapy/radiation treatment are

related to less use of problem focused coping (Krpan, Levine, Stuss, & Dawson, 2007; Baron, 2004).

Social Cognition and Theory of Mind

Social cognition refers to a broad range of thought processes involved in interpreting interpersonal behaviours. These thought processes include making inferences about others' thoughts, feelings, and intentions based on verbal and/or nonverbal cues, generating and evaluating different verbal/nonverbal responses in terms of the situation, and adapting future responses based on feedback or situational changes (Crick & Dodge, 1994; Meyer & Shean, 2006). Crick & Dodge (1994) proposed that the interpretation of others' thoughts, feelings, and intentions is the first step in social interactions. In order for these interpretations to be consistently accurate, a child must first understand how mental states such as thoughts, feelings, and intentions relate to their own behaviour and that of others; this understanding is termed Theory of Mind (ToM) (Peterson, Wellman, & Liu, 2005).

The most frequently utilized tasks for evaluating ToM involve "false belief" tasks such as the Sally-Anne Task. The examinee is told that Anne puts a marble in a box and then leaves. Sally takes the marble from the box and puts it in a basket. The child is asked: "When Anne comes back, where will she look for her marble? ". Children who correctly state that Anne will look for her marble where she left it, in the box, are considered to have "passed" the task and achieved ToM (Peterson et al., 2005). More recent research has indicated that ToM is not limited to inferring false belief (Flavell, 1999). As such, other tasks of ToM have been developed that involve making inferences about emotional cues, concealed emotions (such as what a character in a story is actually

feeling), apparent emotions (what a character in a story is likely to show to others), and what might have happened to cause an emotion-related behaviour (Dyck, Ferguson, & Sochet, 2001; Peterson et al., 2005; Gokcen, Erermis, Kesikei, & Aydin, 2009).

Research generally supports the idea that Theory of Mind development occurs at age 4-5 in typically developing children as evidenced by their performance on prototypical ToM tasks (Peterson et al., 2005). Children with developmental disabilities, autism spectrum disorders, and deafness often pass ToM tasks at much older ages (middle childhood or adolescence) or not at all (Baron-Cohen, Leslie, & Frith, 1985; Happe, 1995; Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998). Performance on ToM tasks has been shown to be related to language development, pretend play abilities, and having parents who talk about feelings and provide developmentally appropriate behavioural guidance (Cutting & Dunn, 1999; Cutting & Dunn, 2005; Dunn, Cutting, & Demetriou, 2005; Hughes & Ensor, 2005). As well, developmentally appropriate performance on ToM has been consistently associated with age-appropriate prosocial skills in laboratory and natural settings in both children and adults (Lerner, Hutchins, & Prelock, 2010; Hua Feng, Shuling, & Cartledge, 2008).

Social Cognition and Coping

As such, research does show that impaired social cognition is consistently associated with social skill weaknesses in both non-autism clinical samples (schizophrenia, traumatic brain injury, psychopathy) and in the general population (Bornhofen & McDonald, 2008; Voracek & Dressler, 2006; Richell, Mitchell, Newman, Leonard, Baron-Cohen, & Blair, 2003). Having poor social skills may make it difficult to make friends and to have high quality friendships in which shared feelings are discussed.

However, few studies have assessed friendship quality and ToM performance. One study of preschoolers did indicate that aggregated performance on a set of ToM tasks (false belief and inferred emotion task) was associated with higher levels of shared imaginary play in which "bids" (initiated conversation by one child to the other in the dyad) were reciprocated; in this study this reciprocation was considered an index of friendship quality (Peterson et al., 2005). Survey research with adults supports the idea that those with weaker ToM skills also report fewer high quality friendships (Mugno, Ruta, D'Arrigo, & Mazzone, 2007). Research with clients with schizophrenia, who consistently show deficits in theory of mind, shows that support seeking as a coping skill is diminished overall compared to problem focused coping and avoidant coping (Bornhofen & McDonald, 2008; Lysaker, Bryson, Marks, Greig, & Bell, 2004), but the relation between theory of mind and support seeking has not been addressed.

There is a paucity of research assessing social support seeking in relation to social cognition constructs such as ToM. The above research suggests that individuals with impaired ToM may have fewer high quality friendships to use as social support, but this relation has not been assessed directly. The current study will examine the relation between social cognition and coping that involves seeking social support.

Autism

Autism Spectrum Disorders (ASDs) refer to a group of developmental disabilities characterized by language delays, social reciprocity deficits, and stereotyped behaviour (American Psychological Association, 1994; Tager-Flusberg, 2007). Individuals affected by an ASD may have varying levels of impairment and constellations of symptoms, and have different diagnoses (i.e., Autism, High Functioning Autism, Asperger's Disorder, or

Pervasive Developmental Disorder). The prevalence of ASDs is estimated at 1 in 150 and occurs three times as often in boys than girls (Center for Disease Control, 2007). Persons with ASD have relative strengths in visual skills, attention to detail, and rote memory, but have problems with give and take in social interactions, making inferences about others' intentions, and show less than typical interest in other people (Constantino et al., 2003; Shafritz, Dichter, Baranek, & Belger, 2008; Whitehouse, Barry, & Bishop, 2007). As well, people with ASD can show persistence in favourite topics, objects, or behaviours or insist on following of routines when it would be in their best interest to be flexible. Although ASD is conceptualized as a social disorder, research consistently shows that persons with ASD have deficiencies in all executive functioning domains except inhibition (Hill, 2004; Kleinhans, Akshoomoff, & Delis, 2008; South, Ozanoff, & McMahon, 2007; Tager-Flusberg, 2007).

Based on observed strengths and deficits, three primary theories have been put forth to explain ASD (Rajendran & Mitchell, 2007). One theory is that of Weak Central Coherence, which states that people with autism see details of objects and learning situations as opposed to seeing the larger "whole", which prevents them from organizing information conceptually. This theory primarily explains the strong attention to detail and difficulties in learning (Happe, Briskman, & Frith, 2001). The Theory of Mind (ToM) hypothesis states that deficits in understanding what others are thinking or feeling underlies the symptoms of autism; this theory best explains the deficits in social cognition and communication observed in autism (Baron-Cohen et al., 1985). However, the insistence on sameness and routine and other stereotyped behaviours (repetitive self stimulatory behaviour) observed in autism has been shown to be related to a secondary

deficit in executive dysfunction (Yerys, Hepburn, Pennington, & Rogers, 2007). This finding supports the third theory of autism development, the Executive Function hypothesis (Kleinhaus et al., 2005).

Social cognitive abilities are well studied in the autism spectrum disorder population. Consistent deficits in perspective taking (ToM or mentalizing), attentional bias towards less emotionally informative facial areas, and decreased facial affect recognition are consistently observed (Schnieder & Tessier, 2007; Peterson, Garnett, Kelly, & Attwood, 2009; Corden, Childers, & Skuse, 2009). These social cognitive deficits appear to be associated with increased social problems. Children with autism have been consistently reported to have both poor theory of mind and social skill deficits (Schnieder & Tessier 2007). Even individuals with high functioning autism, who may pass simpler theory of mind tests, have deficits in social interaction due to poor affect recognition, problems with social communication, and weaknesses in more complex theory of mind skills, and report fewer and lower quality friendships than do persons without autism (Dawson, Webb, & McPartland, 2005; Bauminger et al., 2008; Peterson et al., 2009).

The Broad Autism Phenotype

None of the above theories adequately explain the etiology of the behavioural symptoms of ASD in their entirety. However, researchers do agree that a genetic predisposition gives rise to the phenotypic (behavioural) signs of ASD, and that ASD is polygenetic (Folstein & Rutter, 1977; Tager-Flusberg, 2007). Many genes have been targeted as increasing susceptibility to ASDs, such as the SHANK2 and SHANK3 and DLX1 and DLX2 genes that mediate excitatory synapses (Liu et al., 2009; State, 2010),

the OXTR gene related to oxytocin expression, implicated in social bonding behaviour (Tansey et al., 2010), the MET and WNT2 genes related to development of various brain structures through neural migration, (Sousa et al., 2009; Marui et al., 2009). Linkage studies have implicated chromosome 7, 10, 15, 17, 22, and the X chromosome (Freitag, Staal, Klauck, Duketis, & Waltes, 2010). The mechanism by which chromosomal mutations—monogenetic disorders such as Fragile X syndrome or mutations on particular genes, or polygenetic disorders such as duplications, deletions, copy number variations, translocations—develop is unknown and many cases of ASD are sporadic (no first degree relative with ASD) and thought to be the result of de novo mutations (Whibley et al., 2004; Kinney et al., 2009; Bill & Geschwind, 2009; Freitag et al., 2010); one candidate is the MTHFR gene, related to the activation and deactivation of genes through enzyme production (Liu et al., 2010). However, research suggests that a genetic predisposition in combination with environmental interaction can lead to de novo mutations that phenotypically merit a diagnosis of ASD (Reichenberg et al., 2006; Kinney Munir, Crowley, & Miller, 2008; Whibley et al., 2010). As well, common variants can shape the phenotype of ASD through interaction with another, ASD specific mutation. Finally, it is possible that, particularly for females, heritable mutations may be passed onto offspring without parents showing diagnosable ASD even though they have mutations (Zhao et al., 2007).

With this research in mind, it seems that not all parents of children with ASD would show ASD characteristics. However, for a subset of cases, the genes that in combination make up the diathesis portion of the diathesis-stress model of autism lead to the behavioural and cognitive dysfunction for the diagnosis of ASD in the child could be

phenotypically evident in the parents or siblings of the child with ASD. This collection of "personality and language characteristics that reflect the phenotypic expression of the genetic liability to autism" has been termed the Broad Autism Phenotype (BAP) (Hurley, Losh, Parlier, Reznick, & Piven, 2007, p. 1679).

The BAP was first identified by Kanner (1943), who noted that some parents of children with ASD showed low social interest, intense interest in specific areas, and had rigid and perfectionistic personality characteristics (Hurley et al., 2007). The BAP is characterized by difficulties in social skills, communication deficits, and cognitive and behavioural rigidity that are not sufficient for a diagnosis of autism (Piven, 1999; Baron-Cohen et al., 1998). Researchers of the BAP have performed between group comparisons of parents of children with autism and those with other developmental disabilities or no disabilities; these researchers then examine between group differences in scores on tasks requiring attention to detail, visual skills, or affect recognition (Baron-Cohen, Wheelwright, & Hill, 2001; Bishop, Mayberry, Maley, Wong, Hill, & Hallmayer, 2004; Palermo, Pasqualetti, Barbati, Intelligente, & Rossini, 2006). Other researchers classify persons as "having" the BAP based on higher than average scores on the Autism Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001), a self report questionnaire which assesses autism symptomatology, below average performance on theory of mind tasks, or a combination of at least two below average scores on tasks or ratings of behavioural flexibility, sociability, or pragmatic language (the ability to apply social contexts and showing appropriate rate, prosody, and tone in speaking) (Jobe & White, 2006; Losh, Childress, Lam, & Piven, 2008; Scheeren & Studer, 2008; Philofsky, Fidler, & Hepburn, 2007).

The characteristics of the BAP are normally distributed throughout the population (Best, Moffat, Power, Owens, & Johnstone, 2008). However, a higher proportion of first degree relatives (siblings and parents) of persons with autism show characteristics of the BAP compared to the general population and parents of children with other developmental disabilities. For siblings, the risk of showing the BAP increases with higher shared genes (i.e., monozygotic versus dizygotic twins) (Couter et al., 1996; Lainhart et al., 2002; Micali, Chakrabarti, & Fombonne, 2004). For parents, having multiple children with autism is associated with an increased likelihood that they will show characteristics associated with the BAP (Losh et al., 2008; Piven, Palmer, Jacobi, Childress, & Arndt, 1997). For example, one study showed that in families with multiple children with ASD, 92% had at least one parent who showed the BAP, defined by showing at least one of the following observer or self-rated characteristics: poor pragmatic language, low sociability, behavioural rigidity, and anxiety (Losh et al., 2008). In families with a single child with ASD, 70% had at least one parent with the BAP; the BAP incidence rate in multiple ASD incidence or single ASD incidence families was significantly higher than observed in families of children with Down Syndrome (33%) (Losh et al., 2008).

Relative strengths characteristic of individuals with ASD (visual skills, attention to detail, and rote memory) are observed in persons considered to show the BAP, as well as in first degree relatives of children with ASD (hereafter referred to as autism families), who are at increased risk for showing the BAP (Hill, 2004; Hughes, Plumet & Leboyer, 1999). For example, strong visual skills and attention to detail correlate with higher scores on the AQ (Scheeren & Stauder, 2008). Research consistently shows that parents

of children with autism perform significantly faster than do parents of control children on the Embedded Figures Test (EFT; Witkin, Oltman, Raskin, & Karp, 1971), a task involving identifying a previously seen shape embedded within a visually complex background (Baron-Cohen & Hammer, 1997; Pisula, 2003; Bolte & Poustka, 2006).

The Broad Autism Phenotype and Executive Function

Deficits related to the core symptoms of autism (disordered communication, poor social interest, and stereotyped behaviours) are observed in autism families as well (Baron-Cohen & Hammer, 1997; Pisula, 2003; Bolte & Poustka, 2006; Scheeren & Studer, 2008). However, research on EF deficits in the BAP is more equivocal. One study indicated a higher incidence of self-reported stereotyped behaviour, which is associated with impairments in EF, by parents of children with autism (Piven et al., 1997; South et al., 2007); but EF was not assessed in that study (Piven et al., 1997).

There is evidence that fluency may be impaired in relatives of individuals with autism. The limited research in this area shows that autism siblings obtain lower scores on tasks of ideational, nonverbal, and verbal fluency compared to control children (Wong, Mayberry, Bishop, Maley, & Hallmayer, 2006; Hughes et al., 1999). However, other findings indicate that although autism parents show evidence of decrements in ideational fluency, control and autism parents show no differences in verbal or nonverbal fluency scores (Hughes et al., 1999).

The limited research on cognitive flexibility suggests impairment in this domain of EF as well. One study indicated that autism siblings had more perseverative errors than controls on a problem solving task, indicating difficulty with set-shifting (Hughes et al., 1999). Another study found that autism siblings showed more inflexible language and

behaviours compared to controls, which may be related to cognitive flexibility deficits, although cognitive flexibility was not explicitly assessed in that study (Giorgiades et al., 2007). Similarly, other research suggests that fathers of children with autism have set-shifting deficits; however, this finding has not been observed in mothers (Wong et al., 2006). Finally, no differences in the "switching" condition of the Trail Making Task (TMT; Army Individual Test Battery, 1944; as cited in Baron, 2004), a paper and pencil task that requires switching back and forth between a sequence of letters and numbers, was observed in autism families. This finding may be a reflection of task demands that capitalize on relative strengths in this population (i.e., visual scanning and rote sequencing skills). Also, on this task, the examinee is not required to initiate the idea to switch based on feedback; the examinee is told to do this at the outset of the task (Barnard, Muldoon, Hasan, O'Brien, & Stewart, 2008; Hughes et al., 1999).

In terms of problem solving skill, one study found no differences between parents of children with autism, early onset schizophrenia, or mental retardation in the number of categories achieved in the WCST, although all groups scored below the normative standard (Bolte & Poutska, 2006). This finding implies some degree of executive functioning deficit in parents of children with autism, as EF deficits are typically observed in parents of children with learning disabilities and mental retardation as well (Delorme et al., 2007; Barnard et al., 2008). However, another research study indicated no relation between AQ scores and EF measures, including that of problem solving tasks, which does not support the above study (Kunihara, Senju, Dairoku, Wakabayashi, & Hasegawa, 2006). Sample selection and cultural differences likely influence the applicability of the latter study to the current research. First, the sample utilized was a

subset (n=96) of a much larger sample (n=613) of university students in Tokyo who had agreed to participate in follow up testing (Kunihara et al., 2006). Additionally, the Autism Quotient was adapted for use in Japan by translating items into Japanese, but at the time of publication, the psychometric properties of this measure were still pending. As well, normative data for the AQ in the sample were not available (Kunihara et al., 2006). Due to cultural differences in communication and social behaviour expectancies, as well as the differences in schooling between North American and Japanese Universities, it is unlikely that these findings would necessarily apply to the current study.

Another research study found that parents of children with autism showed poorer performance on Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1994) nonverbal intelligence score (Performance IQ; PIQ) compared to control parents. This finding suggests problems with fluid intelligence (tasks for which there is not a specific, factual answer to be memorized) which could be related to problem solving skill. Support for this notion is found in the fact that the overall lower PIQ score was primarily the result of poorer performance on the subtests of Picture Completion and Picture Arrangement, both of which draw relatively less on visuospatial skills compared to Block Design; Picture Arrangement also relies more heavily on generating language-based problem solving strategies (Folstein et al., 1999). Although all parents in this study had above average intelligence, which may make these results less generalizable to the overall population, this finding supports the results of another study indicating lower PIQ in parents of children with autism (Piven & Palmer, 1997). Still, Folstein et al.'s (1999) research study indicated that siblings of children with autism did not differ in PIQ

compared to siblings of children with Down Syndrome, and a recent study of parents of multiple children with ASDs found no differences in block design performance in a matched control sample (de Jonge, Kemner, Naber, & van Engeland, 2009).

The equivocal evidence on problem solving skills in autism families does put forth the idea that lesser language demands may be associated with fewer decrements on problem solving tasks. Perhaps a more complex sorting test would elucidate any differences between relatives of children with autism and those with other developmental disabilities. This possibility will be addressed in the current study.

In spite of the equivocal evidence in terms of problem solving, one relatively consistent finding is a deficit in the specific EF domain of planning in autism families. Poorer performance on the Tower of London (ToL; Shallice, 1982), a planning task that requires moving three beads on three pegs from a starting position to an ending position without violating constraints on moves, has been observed in parents of children with autism. Parents in autism families make more moves and errors in solving questions compared to controls (Piven & Palmer, 1997), and have more difficulty passing questions that require a higher number of moves (Hughes, Leboyer, Bouvard, 1997). This finding was replicated in a study of both siblings and parents of children with autism and controls (Hughes et al., 1999). Another study concluded that planning deficits were specific to autism families, as lower ToL scores and working memory scores were the only differences between parents of children with autism and parents of children with LD assessed on a battery of executive functions (Bolte & Poutska, 2006). Replication of this difficulty with planning was reported in a 2010 study of parents of children with autism and those showing the BAP (without children with autism), in which the authors asserted

that planning difficulties may be a more specific trait of the BAP than weak central coherence or poor ToM (Goussé & Rastam, 2010).

Summary

The above research suggests that contrary to what is observed in persons diagnosed with autism, relatives of persons with autism appear to have at least some intact domains of executive function (EF) as opposed to a more global deficit across all domains. The most consistent EF deficit finding has been in the areas of planning and fluency. However, even this finding is not replicated over all studies. The inconsistent findings of EF deficits in persons with the BAP and/or parents and siblings of persons with autism, may be due to the fact that deficient EF is not one of the primary symptoms of autism but an associated secondary deficit (Yerys et al., 2007). Additionally, it is possible that, like the BAP itself, only a subset of parents will exhibit these executive functioning difficulties, or that more pronounced executive functioning deficits (i.e., in problem solving) will be observed on more complex tasks. As well, more research needs to be conducted on EF deficits in the BAP, as although research has examined EF in persons more likely to exhibit the BAP, only one study examined EF related to the AQ (Kunihara et al., 2006), and that study likely has limited applicability to the current research.

The Broad Autism Phenotype and Social Cognition

Research suggests that impairments in social communication are found in families of children with autism. Siblings of children with autism show significantly poorer performance in expressive language, receptive language, and social skills, and show less frequent social smiles, atypical responses to direct gaze, lower rates of joint attention and

lower rates of requesting behaviours compared to controls (Toth, Dawson, Meltzoff, Greenson, & Feing, 2007; Elsabbagh, et al., 2009; Gamliel, Yirmiyal, Jaffe, Manor, & Sigman, M. 2009; Rozga et al., 2010). As well, with few exceptions (see Gousee et al., 2010) deficits in Theory of Mind (ToM) is a robust finding in parents and unaffected siblings in autism families (Losh et al., 2008; Szatmari, Georgiades, Duku, Zwaigenbaum, Goldberg, & Bennett, 2008; Gokcen, et al., 2009).

One study of parents of children with ASD showed that both fathers and mothers of children with autism performed significantly worse than did controls on the Reading the Mind in the Eyes Test (RMET; Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997), a measure of social cognition that requires identifying, from four options, the emotion word matching the emotional state of a person inferred from a picture of the eye region (Losh & Piven 2007; Palermo et al., 2006). Inference of negative emotions such as anger and disgust were particularly difficult for parents of children with ASD (Losh & Piven, 2007). Although one study with a select sample of Tokyo university students indicated that scores on the AQ were not associated with social cognitive functioning scores (Kunihara et al., 2006), this study's generalizability to a North American population is questionable. The finding of poorer performance on the understanding of emotion through the eye area was replicated in a sample of Turkish parents of children with ASDs; furthermore, these parents also scored lower than control parents on a task that required making an inference about a person's emotional state based on a story, although no differences were found on a task requiring understanding an indirect social direction or "hint" (Gokcen et al., 2009). Poorer social cognition performance was replicated in a 2009 study of parents of children with ASD and persons with the BAP

(Losh et al., 2009), and another study found significant negative correlations between the Autism Spectrum Quotient (AQ), a measure of autism-like traits, scores on the Test of Nonverbal Cue Knowledge, as well as a positive correlation between AQ score and number of errors related to facial reading accuracy on the Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2) (Ingersoll, 2009).

It is possible that impairment in social cognitive functioning is not a universal finding, and is just found in a subset of parents, which could explain the equivocal evidence of Goussé & Rastam (2010). One study indicated that although in general, parents were unimpaired socially, a subgroup was classified as "aloof" based on their scores on the Broader Autism Phenotype Questionnaire (BAPQ; Hurley et al., 2007), a self-report measure of autism-phenotype characteristics (Hurley et al., 2007). Fathers of children with autism particularly seem to show social cognition deficits, performing lower than mothers on the RMET (although in this study both performed lower than controls) (Palermo et al., 2006) and on measures of attention to social versus non-social cues (Scheeren & Stauder, 2008).

It might be expected that persons with aloof personality characteristics would be less likely to seek out and benefit from social support. One study did find that higher AQ scores were associated with more loneliness and fewer and shorter frequency of friendships in university students (Jobe & White, 2007), similar to the findings reported for autism (Schnieder & Tessier, 2007). As well, another study indicated that parents of children with Pervasive Developmental Disorders (PDD) reported poorer social relationships compared to parents of children with mental retardation or cerebral palsy (Mugno et al., 2007). One study did assess the BAP, RMET, and self-reported friendship

quality; parents classified as aloof performed lower on the RMET compared to controls and reported having fewer friendships, which were of lower quality compared to those who were not classified as "aloof" (Hurley et al., 2007). However, these connections need to be studied more closely in the BAP in relation to social support.

Another area that may be related to social support seeking and benefiting from social support is that of communication, which may be impaired in autism family members. For example, impaired pragmatic language scores on clinical observation measures have been found in parents of children with autism classified as "aloof" by the BAPQ (Losh & Piven, 2007), and in autism parents in general (Whitehouse et al., 2007), although one study found impaired pragmatic language just in fathers (Scheeren & Stauder, 2008). More communicative deficits, such as lower than average receptive and expressive language, are observed in families with multiple children with autism, providing support for the idea that the communicative deficits are related to the BAP (Piven & Palmer, 1997). Interestingly, one study showed that compared to parents of children with Prader Willi Syndrome, parents of children with autism scored significantly higher on the Toronto Alexithymia Scale (TAS; Bagby, Taylor, & Parker, 1994), indicating that autism parents have more difficulty with expressing their feelings in words compared to other clinical samples (Szatmari et al., 2008). The above research suggests that not only may persons with the BAP have difficulty with social cognition, social skills, and social language necessary in maintaining conversation, they may also be weak at effectively shareing their feelings and thus obtaining social support. The current study will attempt to determine the relation between pragmatic language and social support as well.

Summary

Impairments in social cognition are likely to be observed in at least a subset of first degree relatives of children with autism. Social cognitive deficits have been associated with poorer social skills in both non-autism clinical samples and the general population; however, few studies have specifically assessed the Broad Autism Phenotype (BAP), social cognition, and quality of friendships/social support. Limited research suggests that those with the BAP may have difficulty benefiting from a social support system compared to those without aloof personality characteristics.

Executive Function and Social Cognition

Social cognition and EF are believed to involve two different brain systems (Wellman, Lopez-Duran, LaBounty, & Hamilton, 2008). It is possible that deficits in executive functioning can exist independent of deficits in social cognition, implying that an individual may be able to engage effectively in problem focused coping but not in seeking social support or vice versa; as well, individuals with deficits in either EF or social cognition may not be as able to engage in flexible coping strategies as do individuals who have at least average level skills in EF or social cognition.

Evidence for the independence of social cognition and executive function can be found in the research suggesting no relation between EF and social function in individuals with HFA, although this may not necessarily be applicable to those without a diagnosis of autism (Landa & Goldberg, 2005). However, research related to the BAP indicated that parents who were classified as “rigid” using the BAPQ had similar scores to controls on the RMET and did not report lower quality friendships. It is possible that this behavioural rigidity is associated with decrements in executive function, but a

limitation of this study was that executive functioning was not assessed (Losh & Piven, 2007).

Other research suggests that effective social skills draw on at least some domains of executive functioning. Many populations with compromised EF (e.g., traumatic brain injury, attention deficit hyperactivity disorder, and schizophrenia) have difficulty with social skills (Henry, Phillips, Crawford, Ietswaart, & Summers, 2006; Diamantopoulou, Rydell, Thorell, & Bohlin, 2007), and some research indicates interconnectivity between the areas of the brain purportedly involved in non-social reasoning and social reasoning skills (Tyson, Laws, Flowers, Mortimer, & Schulz, 2008). A study of persons with schizophrenia indicated that executive function scores predicted social functioning (Tyson et al., 2008). Other research, mostly conducted with persons with schizophrenia, has been more specific in implicating domains of executive function in social cognition.

The research investigating executive function and social cognition in schizophrenia has consistently implicated working memory and verbal memory as influential in social cognition and interpersonal behaviour (Laes & Sponheim, 2006; Bowie et al., 2007; Sitzer, Twamley, Patterson, & Jeste, 2007; Williams et al., 2008; Lysaker et al., 2004; Reeder, Smedley, Butt, Bogner, & Wykes, 2006). The relation between working and verbal memory and social cognition was examined in a study of individuals with traumatic brain injury and controls using the Video Social Inference Test, in which persons watched a social interaction and answered questions about the thoughts, feelings, and desires of the persons in the video, and what might happen next (Turkstra, 2008). All participants had lower scores on social inference items that required remembering past information to make a prediction. Additionally, those with traumatic

brain injury had weaker performance overall on immediate and delayed prediction questions about what would happen next (Turkstra, 2008). Interestingly, deficient working memory is among the most commonly reported traumatic brain injury symptoms, which may explain some of these findings (Turkstra, 2008). As well, in an experimental task with university undergraduates in which working memory load was manipulated across tasks, it was found that increased demands on verbal working memory (more distractor choices) impaired performance on a task requiring choosing which emotion word accurately represented a facial expression (Phillips, Channon, Tunstall, Hedenstrom, & Lyons, 2008). As such it appears that intact working memory abilities, particularly in the verbal realm, as a pre-requisite for good social communication is a particularly robust finding (Kerns & Becker, 2007). Some support for this idea was observed in a study of parents of children with autism who showed both verbal working memory deficits as well as deficits in social cognition (Gokcen et al., 2009).

Another rather robust finding concerning the association between executive function and social cognition is related to freedom from perseveration or ability to shift set, which has been associated with social skills and social cognition, particularly inferring emotion from language, in samples of persons with depression and schizophrenia (Yamashito, Mizuno, Nemoto, & Kashima, 2005; Ucok, Cakur, Duman, Discigil, Kandemir, & Atli, 2006; Sitzer et al., 2007). One study suggested that this difficulty in set shifting is related to verbal, but not non-verbal, visually cued, switching tasks (Yamashito et al., 2005). Since maintaining social interaction relies extensively on

conversational (verbal) give and take as well as the ability to change topics when it is indicated, it is likely that perseveration could negatively impact social interaction.

In terms of the BAP, EF and social cognition have not been researched together. The available research shows conflicting findings related to working memory and autism relatives. One study indicated no group difference in working memory performance in siblings of children with autism (Hughes et al., 1999), whereas another study suggested that working memory could differentiate parents of children with autism from parents of children with learning disabilities. However, research does implicate language difficulties, including difficulties with verbal fluency and pragmatic language, in the BAP (discussed previously) (Losh & Piven, 2007; Whitehouse et al., 2007; Szatmari et al., 2008).

Summary

Most of the research relating executive function (EF) and social cognition has been conducted with persons with schizophrenia. However, replication of findings in other samples suggests that these findings, which implicate verbal working memory and flexibility most consistently, may be observed in the Broad Autism Phenotype (BAP) population. However, the working memory and flexibility deficits have not been consistently observed in relatives of those with autism. The current study will attempt to improve upon these equivocal findings.

Limitations of the Current Literature

The literature on the BAP, EF, and social cognition is scant. Although much research is devoted to the influence of EF, social cognition, and coping in schizophrenia, no studies have addressed these constructs in relation to the autism phenotype. Finally,

many research studies use the same neuropsychological tests (i.e., the Wisconsin Card Sorting Task, the Tower of London). However, other, similar tests with comparable psychometric properties would allow for assessment of different domains (e.g., verbal versus nonverbal sorting concepts) and additional comparisons to be made which could elucidate characteristics of individuals showing the BAP compared to parents of children with developmental disabilities who do not show the BAP.

Purpose of the Current Study

Children with ASDs have deficits in language, social skills, flexible behaviour, and higher order thinking skills (Whitehouse et al., 2007; Shafritz et al., 2008). Parents of children with autism report high levels of stress compared to those with other developmental disabilities (Twoy et al, 2007). Research suggests that these high stress levels may not be entirely explained by the child(ren)'s high needs. Difficulties in using problem focused coping and social support, or not changing a coping strategy when the current strategy is not working, coupled with the demands of raising a child with autism, could contribute to parent stress (Lazarus & Folkman, 1984; Cheung, 2003).

The heritability of autism has been established in research. These shared genes are related to the exhibition of a BAP, which is associated with deficits in social cognition as well as EF, specifically planning (Whitehouse et al., 2007; Hurley et al., 2007). In clinical samples, persons with these skill deficits show difficulty creating and benefiting from a social support system as well as difficulty using problem focused coping when faced with a stressor (Lysaker et al., 2005). Research has yet to examine executive functioning, particularly perseveration and fluency, in coping strategies in parents of children with autism. Social cognition and social support seeking have also not been addressed in this

population. This lack of research is significant because an inability to effectively engage in a given coping mechanism (problem solving, seeking support), may limit the ability to switch between coping strategies, effectively and decreasing coping flexibility (Cheung, 2003; Lysaker et al., 2005).

The current study aims to address the limitations of the current literature by assessing both social cognition and executive functioning as related to the BAP. Additionally, the impact of the BAP characteristics, possible executive function deficits, and coping strategies will be assessed. The current study will attempt to address some of the methodological problems in past research by including a more complex measure of problem solving which not only includes both verbal and nonverbal concept formation but also has more possible concepts that can be formed.

Hypotheses

Hypothesis 1: Prevalence of the Broad Autism Phenotype.

The Broad Autism Phenotype will occur more frequently in parents of children with Autism Spectrum Disorders than in parents of children with Other Developmental Disabilities.

Hypothesis 2: Executive Function and the Broad Autism Phenotype.

2a: Those individuals with the Broad Autism Phenotype will have lower executive functioning scores in the areas of problem solving, cognitive flexibility, planning, and verbal fluency.

2b. The Broad Autism Phenotype characteristics of problems with pragmatic language and rigidity will be negatively predicted by executive function, specifically the

domains of problem solving, cognitive flexibility, planning, working memory, and verbal fluency.

Hypothesis 3: Social Cognition and the Broad Autism Phenotype.

3a. Those individuals with the Broad Autism Phenotype will have lower social cognition scores in the areas of theory of mind and social inference making.

3b. The Broad Autism Phenotype characteristic of problems with pragmatic language will be negatively predicted by social cognition.

3c. Social Cognition will be positively predicted by Working Memory.

Hypothesis 4: Cognitive Function and Coping.

4a. Problem focused coping will be positively predicted by executive functioning, specifically the executive function areas of problem solving, working memory, and planning.

4b. Social support seeking as coping will be positively predicted by social cognition.

Hypothesis 5: Coping Flexibility.

The Broad Autism Phenotype characteristics (problems with pragmatic language, aloof personality characteristics, and rigidity) will be negatively predictive of coping flexibility, and executive functioning (problem solving, planning, and switching) and social cognition will be positively predictive of coping flexibility.

See Appendix A for a summary of hypotheses, test variables, and analyses.

Method

Data for the present study were collected from September 2009 until June 2010. Data were collected for two samples for the purposes of generalizability and replicability of findings. Participants in sample 1 included parents of a child with Autism Spectrum Disorders (ASD), parents of a child with another (non-autism) developmental disability, and individuals who were either childless or parents of typically developing children. Individuals in Sample 1 completed screening measures on-line and then were seen individually for administration of additional measures. Individuals in Sample 2 were all parents, some with a child with autism and some with a child with another disability, and they participated in the study through on-line completion of measures only. Participants in Sample 2 (on-line) completed a subset of the measures completed by participants in Sample 1. The participants, recruitment methods, and measures used for the two samples are described in detail below.

Participants: Sample 1 (Assessment)

The assessment sample (N=147, M_{age}=36.72 (10.65)) consisted of three subgroups: persons who had either no children or a child with no disability (No Diagnosis: NoDx), parents of children with Autism (Autism: AUT), and parents of children with another (non-autism) developmental disability (Other Developmental Disability: ODD), described in detail below.

Description and response rate of NoDx group. The NoDx group (n=69) consisted of 13 males (18.8%) and 56 females (81.2%) (see Table 1) with a mean age of 24.68 (SD=8.04) (see Table 2). The majority (82.60%) had no children; 21.7% were married, 31.9% were in a dating relationship, and 37.70% were single. The majority

Table 1

General Demographic Information for Assessment Sample, Separated by Diagnostic Group (Categorical Variables)

	All Groups (n = 147)	NoDx (n = 69)	AUT (n = 42)	ODD (n = 36)
Characteristic	n (%)	n (%)	n (%)	n (%)
Gender				
Male	25 (17.00)	13 (18.84)	7 (16.67)	5 (13.89)
Female	122 (82.99)	56 (81.16)	35 (83.33)	31 (86.11)
Marital Status				
Single	42 (28.57)	39 (56.52)	5 (11.90)	29 (80.55)
In relationship	105 (71.43)	30 (43.48)	37 (88.10)	7 (19.44)
Has Children	90 (61.22)	12 (17.39)	42 (100.00)	36 (100.00)
Handedness				
Right	126 (85.71)	53 (78.26)	38 (90.48)	34 (94.44)
Left	21 (14.29)	15 (21.74)	4 (9.52)	2 (5.56)
ESLStatus				
Yes	18 (12.24)	5 (7.20)	11 (26.20)	2 (5.60)
No	29 (87.76)	64 (92.75)	31 (73.81)	34 (94.44)
Educational Level				
Less than High School	8 (5.44)[1]	7 (10.10)	0 (0.00)	1 (2.80)
High School Graduate/GED	21 (14.30)	4 (5.80)	4 (9.50)	4 (11.10)
Some College/ University	19 (12.90)	6 (8.70)	9 (21.40)	4 (11.10)
College/University Graduate	69 (46.90)	29 (42.00)	17 (40.50)	23 (63.90)
Graduate/Professional Training	27 (18.40)	14 (20.30)	11 (26.20)	2 (5.90)
Ethnicity				
Canadian	88 (59.86)	40 (57.97)	23 (54.76)	25 (69.44)
Other Census Categories	29 (19.73)	17 (24.64)	6 (14.29)	6 (16.67)
Other	30 (20.41)	12 (17.39)	13 (30.95)	5 (13.89)

[1]Three participants, 2 from the AUT group and 1 from the ODD group, did not indicate their educational achievement.

(78.30%) were right handed and spoke English as their first language (92.8%) (see Table 1).

The majority of participants for the NoDx group were recruited via a screening process (termed "Stage 1", refer to Figure 1) through the University participant pool. After completing measures of social cognition and autism personality characteristics (described in detail in the measures section), those who met screening criteria of the autism personality characteristics measure were invited via automatic email to Stage 2 of the study, which involved completing two additional questionnaires and an individual assessment session.

Of the 310 people who were eligible for Stage 2, 178 (57.42%) consented to continue to stage 2. Of these, 66 (37.08% of those who consented and 21.29% of those eligible) individuals were ultimately scheduled for assessment. Two of those individuals were unable to complete the assessment portion due to scheduling conflicts, resulting in 64 of the NoDx group coming from the participant pool.

Description and response rate of AUT/ODD groups. The AUT group (n=42) consisted of 7 males (16.70%) and 35 females (83.3%) with a mean age of =39.98 (SD=6.65). All participants in this subsample had children (*M* number of children= 2.40, SD=1.06) and 83.30% were married. The majority (90.50%) were right handed and spoke English as their first language (73.80%) (see Tables 1 and 2).

The ODD group (*n*=36) consisted of 5 males (13.90%) and 35 females (86.1%) with a mean age of 42.11 (*SD*=6.44). All participants in this subsample had children (*M* number of children= 2.31, *SD*=.856) and 77.10% were married. The majority (94.40%)

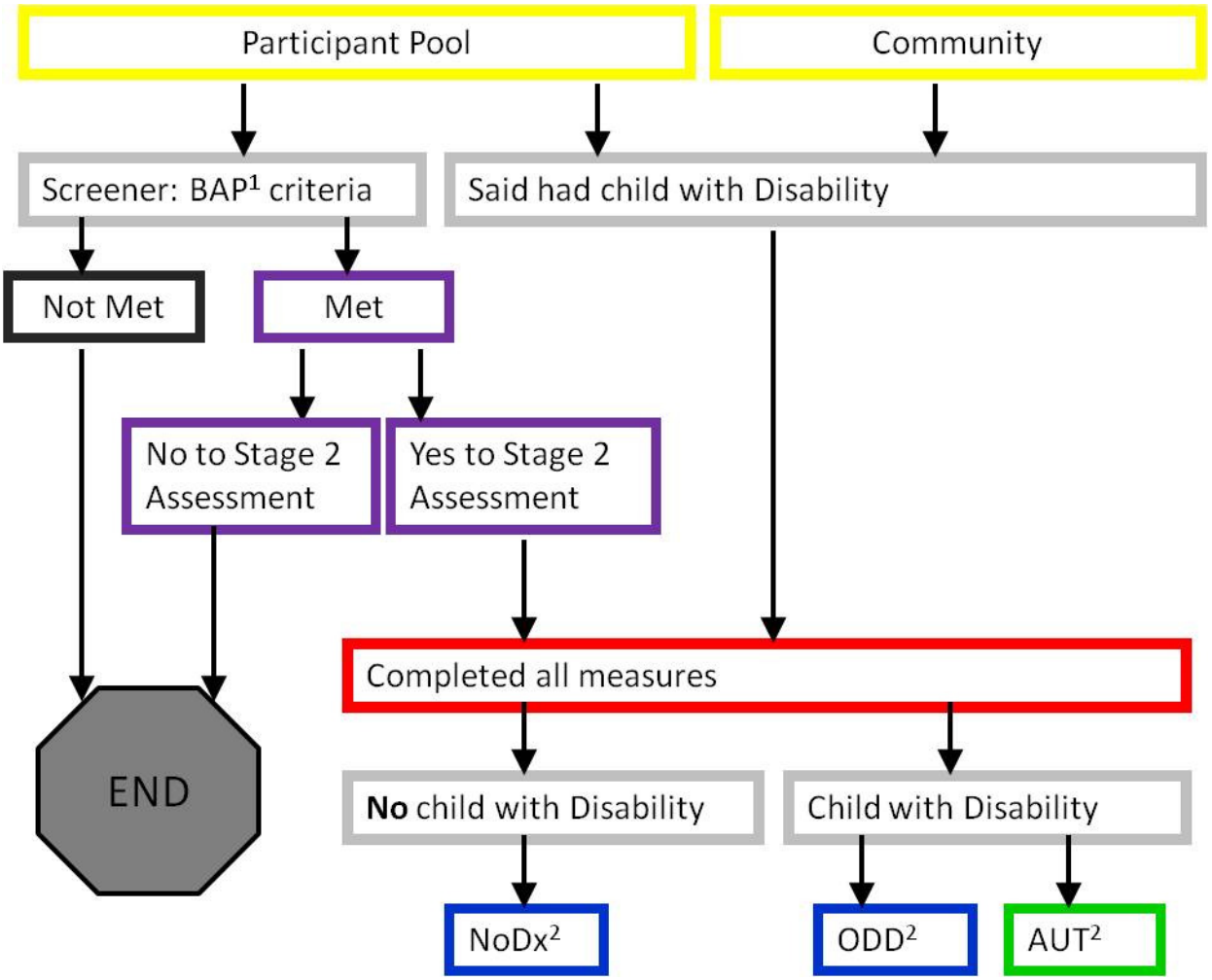

Figure 1.

Sample 1 Recruitment Procedures

[1]BAP=Broad Autism Phenotype

[2] NoDx=No Diagnosis; ODD=Parent of a child with other developmental disability; AUT=Parent of child with Autism Spectrum Disorder

Table 2

General Demographic Information for Assessment Sample, Separated by Diagnostic Group (Continuous Variables)

	All Groups (n = 147)	NoDx (n = 69)	AUT (n = 42)	ODD (n = 36)
Characteristic	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Age	33.32 (10.93)	24.68 (8.04)	39.98 (6.65)	42.11 (6.44)
Number of Children	1.38 (1.34)	1.58 (0.90)	2.40 (1.06)	2.31 (.86)
SES	44.94 (14.49)	45.32 (13.82)	46.50 (15.56)	42.36 (14.54)

were right handed and spoke English as their first language (94.40%) (see Tables 1 and 2).

Participants for the AUT and ODD samples were recruited from the University participant pool and through community venues. In the participant pool, participants were screened into the study via a screening question that asked if they had a child with a developmental disability. Twenty-two people indicated they had a child with a disability; three of those had done so by mistake (one completed the study as a NoDx), and three of those were excluded from participation due to a conflict of interest (a current student in the primary researcher's class). Of the 16 people with children with disabilities who were eligible to participate, 14 individuals were scheduled for assessment. Although all completed the assessment, one participant did not complete the online questionnaires; this participant was excluded from the study as demographic and BAP information was not available. As such, a total of 13 participants (one AUT participant and 12 ODD) participants were recruited from the participant pool.

It is difficult to assess the sample pool contacted through the community as many participants heard about the study through multiple venues (flier postings, mailings, community events, past research participation) As well, it is unknown how many participants received the flier via mail, posting, or email. However, of those who scheduled an assessment appointment (n= 68), only two individuals did not complete the study (one AUT diagnosis and one ODD diagnosis group), for a total of 66 community sample recruits (n=25 ODD and n=41 AUT) for this study.

Recoding demographic variables. Due to unacceptably small cell counts for Chi Square tests, ethnicity and relationship status were recoded to form larger groups (see

Table 2). For ethnicity, the Canadian and Other groups were kept, but the remaining census based categories (Italian, n=7; African-Canadian, n=6; French, n=5; Chinese, Scottish, and Indian, n=3 each; German and Irish, n=1 each) were grouped into an "Other Census" category. This grouping was chosen as the categories for ethnicity were based on frequencies obtained from the Canadian census.

Relationship status was recoded based on the participant reporting currently being in a relationship with someone (married, cohabiting, or dating a significant other) or not (divorced, single, or widowed). This grouping method was chosen due to this study's focus on coping strategies and the demonstrated relation between having a current significant other and more effective coping strategies (Papalia, Sterns, Feldman, & Camp, 2007).

Rules for AUT/ODD Participant Grouping

The 68 parents in the AUT and ODD groups had a total of 204 children, 114 males and 90 females. Based on diagnoses/delays reported in the literature regarding families of children with ASD or LD, participants were given the following options to endorse/not endorse based on diagnostic history their child(ren): Autism/High Functioning Autism; Asperger's Disorder; Anxiety Disorder; Depression; History of Speech Delay; Learning Disability in Reading, Math, Spelling, or Writing (hereafter referred to as Language Learning Disability); Nonverbal Learning Disability; Obsessive-Compulsive Disorder, and Tourette's Syndrome. Parents could also endorse "Other" and write in another diagnosis.

Many participants did not adhere to DSM-IV criteria or usual neuropsychological diagnoses when identifying diagnoses in themselves or their children. Participants

separately endorsed diagnoses that were associated features or neuropsychological syndromes associated with a diagnosis that ordinarily would not be considered an additional diagnosis in the child (i.e., dysgraphia in the context of ASD or LD). Some participants also provided diagnoses that specifically trumped each other (i.e., PDD-NOS and Autism; Depression and Bipolar Disorder). Finally, some children had diagnoses across categories (i.e., learning disability and anxiety disorder). As such totals discussed below do not equal 100%. However, based on the grouping rules, described in more detail below, these problems did not interfere with group membership assignment. Note that parent *n*s are reported here.

Similar to past research, parents were classified into the AUT group (*n*=42) based on report of least one child with an ASD regardless of any other diagnoses in that child or any other children. ASD classification included reporting having a child with Autistic Disorder/High Functioning Autism (*n*=36), Aspergers Disorder (*n*=5), or Pervasive Developmental Disorder Not Otherwise Specified [PDD-NOS] (*n*=3)) Parents were classified into the ODD group if they had no child with autism and at least one child with a disability that was not autism. Frequency and kind of non-autism diagnosis, including the "other" category were examined before creating the final diagnostic groupings. : ADHD/ODD[sic] (*n*=7); Chromosomal Disorder (Down Syndrome; *n*=2); Learning Disability (Language Learning Disability, *n*=35; Nonverbal Learning Disability, *n*=8); and Miscellaneous Neuropsychological Disorder (Sensory Impairment, *n*=3; Tourette's Disorder, *n*=4; Cerebral Palsy, *n*=1; Executive Function Disorder, *n*=1).

History of Speech Delay (*n*=24), Psychiatric disorders (Obsessive-Compulsive Disorder, *n*=7; Depression, *n*=6; Anxiety Disorder, *n*=15; Oppositional Defiant Disorder,

n=1; Bulimia, *n*=1); Physical disorders (none in this sample), and Intellectual Giftedness (*n*=1) were not considered disabilities. In the assessment sample, history of speech delay without a diagnosis of any other disability in that child or other children in the family (*n*=3) was followed up with a question about the child's continued development, specifically if the child had caught up with peers through intervention. This information was unavailable for 1 participant and for one participant the child no longer had a speech delay; these participants were put into the NoDx group. The other participant reported the child as having a continued severe speech delay; this participant was put into the ODD group.

Participants: Sample 2 (Online)

Recruitment. The online sample was recruited from online social networking sites, listservs, and support groups, and via organization websites, all of which were targeted for recruitment via their focus on parents of children with various disabilities (see Figure 2).

Demographics and response rate of the On-AUT and On-ODD sample. The On-AUT sample (*n*=52) consisted of 4 males (7.70%) and 48 females (93.30%) with a mean age of 42.6 (*SD*=8.01). The average number of children had by On-AUT participants was 2.25 (*SD*=.98) and 76.90% were married. See Tables 3 and 4 for additional breakdown of the On-AUT sample.

The On-ODD sample (n=52) consisted of 5 males (9.60%) and 47 females (90.40%) with a mean age of 40.65 (SD=7.94). The average number of children had by On-ODD participants was 2.13 (SD=.93) and 78.80% were married. See Tables 3 and 4 for additional breakdown of the On-ODD sample.

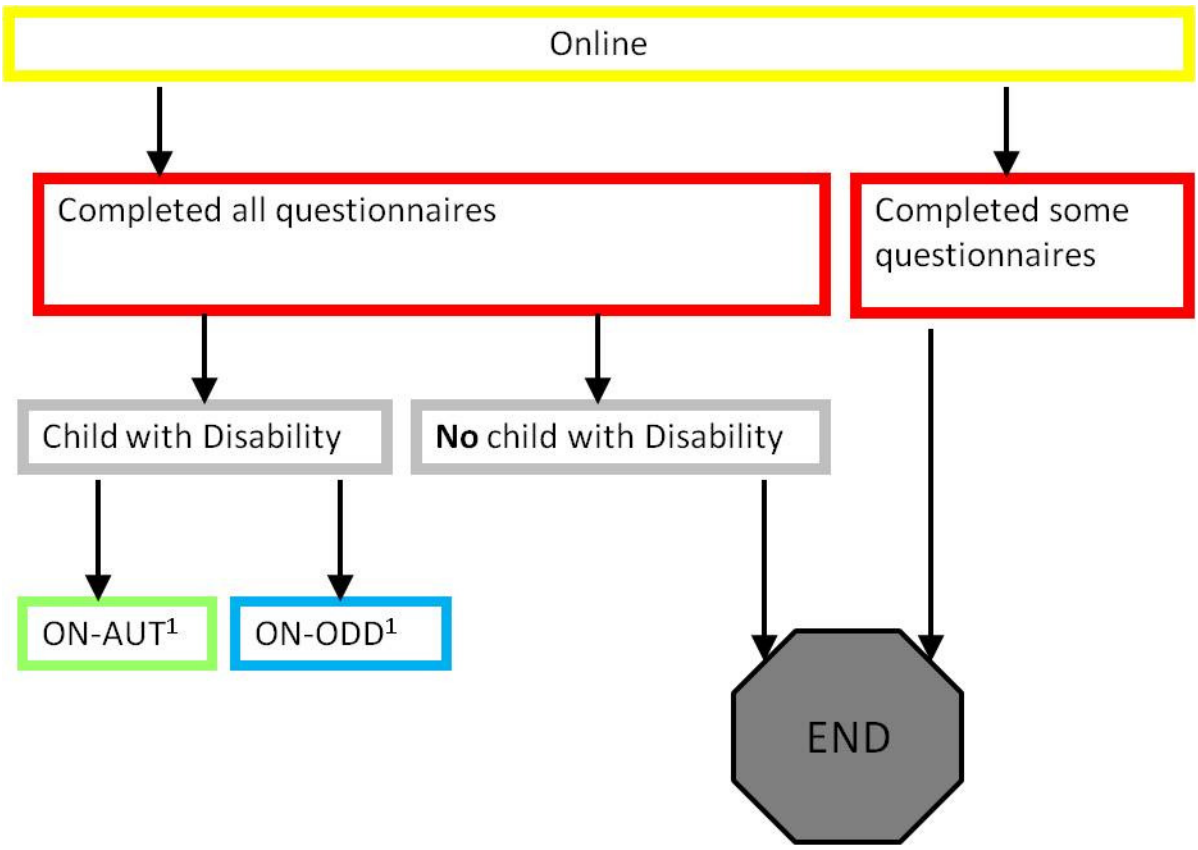

Figure 2.

Sample 2 Recruitment Procedures

[1]ON-AUT=Online Sample-Parent of child with Autism Spectrum Disorder; ON-ODD=Online Sample-Parent of child with other developmental disability.

Table 3

General Demographic Information for Sample 2, Separated by Diagnostic Group (Categorical Variables)

	Both Groups (n = 104)	On-AUT (n = 52)	On-ODD (n = 52)
Characteristic	n (%)	n (%)	n (%)
Gender			
Male	9 (8.65)	4 (7.70)	5 (9.62)
Female	95 (91.35)	48 (92.30)	47 (90.38)
Marital Status			
Single	12 (11.53)	7 (13.46)	5 (9.62)
In relationship	92 (88.46)	45 (86.54)	47 (90.38)
Has Children	104 (100.00)	52 (100.00)	52 (100.00)
Educational Level			
Less than High School	0 (0.00)	0 (0.00)	0 (0.00)
High School Graduate/GED	9 (8.70)	2 (3.80)	7 (13.50)
Some College/ University	22 (21.20)	14 (26.92)	8 (15.40)
College/University Graduate	39 (37.50)	20 (38.46)	19 (36.50)
Graduate/Professional Training	34 (32.70)	16 (30.77)	18 (34.60)
Ethnicity			
Canadian	23 (22.12)	11 (21.15)	12 (23.15)
Other Census	17 (16.35)	9 (17.31)	8 (15.38)
Other	64 (61.50)	32 (61.50)	32 (61.50)

Table 4

General Demographic Information for Sample 2, Separated by Diagnostic Group (Continuous Variables)

	Both Groups (n = 104)	AUT (n = 52)	ODD (n = 52)
Characteristic	Mean (SD)	Mean (SD)	Mean (SD)
Age	41.64 (8.00)	42.63 (8.01)	40.65 (7.94)
Number of Children	2.19 (0.96)	2.25 (0.99)	2.13 (0.93)
SES	49.18 (13.43)	48.60 (13.83)	49.77 (13.11)

It is unknown how many individuals received information about this study via online venues. Of the 256 individuals who initiated participation in the study, 95 (37.11%) had no children or had children but no child with a disability and were automatically excluded from analyses.

The remaining online sample *pool* (n=161) consisted of 15 males (9.30%) and 146 females (90.7%) with a mean age of 41.14 (*SD*=7.91). All participants had children (*M* number of children=2.14, *SD*=.89) and the majority (75.8%) were married. Handedness and ESL status were not assessed in this sample.

Only participants who completed all measures were included in the online sample. The 104 participants in this study (64.59% of the online sample initiaters) completed all measures. Many participants (19.88%, *n*=32) completed the demographics information only. Completers were not significantly different from non-completers on every demographic variable considered (age, gender, number of children, marital status, ethnicity, education level of participant or significant other, occupational status of participant or significant other, diagnostic grouping (On-AUT versus On-ODD disability), or total number of endorsed diagnoses in the child). Only completers were included due to the inability to impute values for entire measures and similarities between completers and non-completers.

Recoding demographic variables. As in the Assessment sample, due to unacceptably small cell counts for Chi Square tests, ethnicity and relationship status were recoded to form larger groups (see Table 3). For ethnicity, the Canadian and Other groups were kept, but the remaining census based categories (German, n=7; Irish, n=4; Italian and Scottish, n=3 each; African American and French, n=2 each) were grouped into an

"Other Census" category. This grouping was chosen as the categories for ethnicity were based on frequencies obtained from the Canadian census. The high "Other" category endorsement observed in this sample was due to the lack of a White/Caucasian/US Citizen option on the ethnicity question.

As in Sample 1, relationship status was recoded based on the participant reporting currently being in a relationship with someone (married, cohabiting, or dating a significant other) or not (divorced, single, or widowed). This grouping method was chosen due to the study's focus on coping strategies and the demonstrated relation between having a current significant other and more effective coping strategies (Papalia, Sterns, Feldman, & Camp, 2007).

AUT/ODD Participant Groupings

The 104 parents in the on-line AUT and ODD groups had a total of 228 children, 114 males and 90 females. The parents were given the same options as the Assessment sample to endorse/not endorse based on diagnostic history of their children, and the same grouping rules for the Assessment sample were applied. The same errors in diagnosis reporting were observed in the online sample as well. As such totals discussed below do not equal 100%. Note that parent *n*s are reported here.

The AUT group (n=52) included parents of children reported as having Autistic Disorder/High Functioning Autism (n=22), Aspergers Disorder (n=24), or Pervasive Developmental Disorder Not Otherwise Specified [PDD-NOS] (n=12). The ODD group included parents of children reported as having ADHD/ODD[sic] (*n*=23); Chromosomal Disorder (Down Syndrome; *n*=10, Other Chromosomal Disorder, *n*=2); Learning Disability (Language Learning Disability, *n*=48; Nonverbal Learning Disability, *n*=17);

and Miscellaneous Neuropsychological Disorder (Sensory Impairment at the level of input or processing, *n*=6; Tourette's Disorder, *n*=4; Cerebral Palsy, *n*=3; Verbal/Speech or Motor Dyspraxias, n=7; Global Developmental Delay, *n*=2).

History of Speech Delay (*n*=40), Psychiatric disorders (Obsessive-Compulsive Disorder, *n*=8; Depression, *n*=23; Anxiety Disorder, *n*=32; Oppositional Defiant Disorder, *n*=1; Bipolar Disorder, *n*=1); Physical disorders (n=5), and Intellectual Giftedness (*n*=2) were not considered disabilities.

Power Analyses

For all tests, alpha = .01 and power = .80 (Cohen, Cohen, West, & Aiken, 2003). The effect size of EF is reported as medium (.40-.60) (Bora, Yucel, & Pantelis, 2008). The effect size of ToM is reported as large (>1) in clinical samples, but as medium (.64-.68) in non-clinical samples (Chung, Kang, Shin, Yoo, & Kwon, 2008; Sprong, Schothorst, Vos, Hox, & Van Engeland, 2007). The effect size of the BAP has yet to be considered in research. Past studies involving the BAP have used between 20 and approximately 100 people.

Power analyses indicate that for t-tests with the above variables (medium effect size), an n of 50 per group is needed. Thus 50 people "with" and 50 people "without" the BAP are required (Cohen, 1988; Cohen et al., 2003). For regression analyses with 6 predictors (the most of any hypotheses in this study), with a medium effect size, at least 97 people are needed (Cohen et al., 2003). Sample size is sufficient in Sample 1 for all analyses. For Sample 2, low power in the t-tests may be observed; sample size is sufficient for regression analyses, however.

Measures

Demographics

Demographics sheet. A demographics sheet created by the researcher was utilized to assess characteristics such as age, gender, ethnicity, major in college or University, and family history of disabilities and/or mental illness (see Appendix B).

Executive Functioning

Trail Making Test. The Trail Making Test (TMT) is a widely utilized assessment measure with two parts, Trails A and Trails B (Army Individual Test Battery, 1944; as cited in Baron, 2004). Trails A consists of a sheet of dots numbered 1-25 that the examinee is required to connect in numerical order as quickly as possible. Trails B consists of dots numbered 1-13 and lettered A-I that the examinee is required to connect in order according to a switching rule: first a number, then a letter, then the next number, the next letter, etc. (Baron, 2004). Typical scores derived from this measure are time to completion in seconds for Trails A and B. As well, some research suggests that the ratio score of Trails B/Trails A provides a valid measure of executive functioning, particularly in non-brain damaged samples, as it considers within subject variability in processing speed and visual scanning in computing the score (Baron, 2004; Aruthnott & Frank, 2000; Martin, Hoffman, & Donders, 2003).

The coefficient of concordance for Trails A is .98; for Trails B it is .67 (Cohen, Paul, Zawaki, Moser, Sweet, & Wilkenson, 2001). The TMT distinguishes between groups of persons with mild, moderate, and severe brain injuries for which deficient processing speed and executive functioning deficits would be expected (Corrigan & Hinkeldey, 2006; Martin et al., 2003). The TMT is sensitive to visual motor integration

problems and executive dysfunction in cases of schizophrenia (Wuwler, Falkai, Streit, & Gaebel, 2003). As well, the TMT is correlated with depressive symptomotology, in which psychomotor retardation is often observed (Horton, & Roberts, 2003).

Delis-Kaplan Executive Function System. The Delis-Kaplan Executive Function System (D-KEFS; Delis et al., 2001) is a standardized comprehensive executive function battery for persons aged 8-89. The D-KEFS consists of nine separate tests that can be administered alone or in combination(s) as part of an assessment battery. The tests of interest to this study are the: Color-Word Interference Test, Verbal Fluency Test, Design Fluency Test, Tower Test, and Sorting Test (Delis et al., 2001). With the exception of the Sorting Test, all tests in the DKEFS battery are similar to previously validated, widely utilized neuropsychological tests, with modifications to address methodological problems of older versions (Shunk, Davis, & Dean, 2006).

The Color-Word Interference Test (CWT) consists of four conditions and provides scores for Color Naming, Word Reading, Inhibition, and Inhibition Switching. The times to completion are used as scores on these conditions (Delis et al., 2001). The internal consistency reliability of the CWT for the age groups in this study ranged from .75-.82. Test retest reliability for the 20-49 year old age group was .86 for Color Naming, .49 for Word Reading, .71 for Inhibition, and .52 for Inhibition Switching (Delis et al., 2001).

The Verbal Fluency Test (VF) consists of three trials of letter fluency, in which the examinee must generate words that begin with a given letter, two trials of category fluency, in which the examine must generate words that correspond to a semantic category, and one trial of category switching, in which the examinee must generate words corresponding to two semantic categories and switch between them. In addition to total

correct responses generated, number of correct responses for each 15 second interval, and contrasts between letter and category fluency scores can be computed, as can number of rule violations or "set losses". All trials have a 60 second time limit and a set of rules for correct responses. The internal consistency reliability of total correct response scores for the 20-49 year age groups ranged from .77-.85 for letter fluency, .63-.76 for category fluency, and.43-.68 for category switching. Test retest reliabilities of total correct response scores were .49 for category switching, .76 for letter fluency, and .81 for category fluency (Delis et al., 2001).

The Design Fluency Test (DF) consists of three conditions in which the examinee must generate designs on a dot pattern according to a given set of rules within a 60 second time limit. The first two conditions require adhering to a rule to connect specific types of dots (filled or empty), and the third condition requires switching back and forth between types of dots. In addition to total correct responses generated, contrasts between filled/empty and switching conditions can be computed, as can number of rule violations or "set losses". Test retest reliabilities for total correct response scores were .62 for filled, .73 for empty, and .22 for switching (Delis et al., 2001).

The Tower Test (ToC) requires an examinee to plan and carry out a sequence of moves of various sized disks according to a set of rules, with the goal being to accomplish moving the disks to the desired position in the fewest moves possible (Shunk et al., 2006). In addition to the total achievement score, which considers the number of moves and number of errors taken to achieve the correct response, number of moves and errors, as well as time to first move can be calculated. The internal consistency reliabilities for

the 20-49 year age group for the total achievement score ranged from .62-.72. Test retest reliability for the total achievement score was .41 (Delis et al., 2001).

The Sorting Test is a modified version of the California Card Sorting Test (ST; Delis, 1988; as cited in Delis et al., 2001). The Sorting Test consists of two conditions; in the first, (Free Sorting) examinees are asked to sort the cards according to rules, using as many different rules as they can think of across sorts, 1 rule for each sort. The examiner identifies each sorting rule as correct or incorrect (Confirmed), and the examinee is required to describe the rule used (Description). The second condition (Sort Recognition) requires an examinee to correctly identify the rule that is being used to sort the cards. The cards are of different colours and shapes, and contain words in both upper and lower case, which allows for 16 different sorting rules. The internal consistency reliabilities in the 20-49 age group for total correct responses ranged from .78-.81 in the free sorting condition (confirmed); for free sorting (Description) .77-.83; and for sort recognition .75-.80. Test retest reliabilities were .51 for free sorting (Confirmed), .46 for free sorting (Description), and .55 for sort recognition (Delis et al., 2001).

Behaviour Rating Inventory of Executive Function-Adult Version (BRIEF-A). The BRIEF-A (Roth, Isquith, & Giola, 2005) is a 75 item self-report inventory of executive functioning. Examinees are asked to rate on a Likert Scale (1-never to 3-often) how frequently a given behaviour occurred in the last four weeks (Roth et al., 2005). This questionnaire generates standard scores on nine clinical scales (Inhibit, Self-Monitor, Initiate, Working Memory, Plan/Organize, Task Monitor, Shift, and Organization of Materials), two indices, the Behavioural Regulation Index (BRI) and Metacognition Index (MI), and an overall executive function score, the Global Executive Composite (GEC).

There are also two validity scales, Infrequency and Inconsistency, which suggest overly pathological responding and random responding, respectively (Roth et al., 2005).

Internal consistency reliability for the BRIEF-A scales ranged from .73-.90 in a normative sample and .80-.94 in a mixed sample of clinical and control adults (Roth et al., 2005). Test retest correlations over a 1-month interval were .93 or above for the BRI, MI, & GEC, and ranged from .82-.93 for the clinical scales (Roth et al., 2005). Concurrent validity studies with the BRIEF-A and the Dysexecutive Questionnaire (DEX; Wilson, Alerman, Burgess, Emslie, & Evans, 1996) showed significant correlations with all scales, with coefficients ranging from .38-.80 (Roth et al., 2005). Similar correlations were observed between the BRIEF-A and the Cognitive Failures Questionnaire (CFQ; Broadbent, Cooper, Fitzgerals, & Parkes, 1982; r's = .31-.81). As well, low to moderate correlations were observed between the BRIEF-A and the Beck Depression Inventory (r's = .29-.55), the Geriatric Depression Scale (r's = .31-.54), and the State Trait Anxiety Scale, Trait Anxiety (r's = .38-.54), which is expected given the role of the frontal lobes in emotion regulation (Roth et al., 2005). As well, statistically significant differences on all scales of the BRIEF-A have been observed between control samples and samples of persons with neurological disorders, such as ADHD, TBI, Alzheimer's Disease, epilepsy, Mild Cognitive Impairment, and Multiple Sclerosis (Roth et al., 2005), suggesting that this measure can discriminate between those with and without executive function impairment.

General Ability

General ability will be estimated using the Block Design (BD) and Vocabulary Subtests from the Wechsler Adult Intelligence Scale-IV (WAIS-IV; Wechsler, 1997). In

terms of abbreviated forms of IQ tests, these two tests have been shown to provide a highly reliable and valid estimate of an individual's overall IQ when taken together (Sattler, 2001; Wechsler, 1997; Wechsler, 2008).

Block Design. The BD subtest requires the examinee to reconstruct a shown block pattern. There are 14 items of increasing difficulty (Wechsler, 2008). The average internal consistency reliability is .88, and average test retest reliability is .80 (Wechsler, 2008). BD scores correlate at .48 with the Verbal Comprehension Index (VCI) score, .84 with the Perceptual Reasoning Index (PRI) score, and .69 with the Full Scale IQ (FSIQ) score (Wechsler, 2008).

Vocabulary. The Vocabulary subtest requires an individual to orally define a word presented to them in spoken and written form. It consists of 33 items of increasing difficulty (Wechsler, 2008). The average internal consistency reliability is .93, and average test retest reliability is .89 (Wechsler, 2008). Vocabulary scores correlate at .90 with the VCI score, .49 with the PRI score, and .75 with the FSIQ (Wechsler, 2008).

Working Memory

Working memory will be assessed using the Letter-Number Sequencing (LNS) subtests from the WAIS-IV/Wechsler Memory Scale (Wechsler, 1997).

Letter-Number Sequencing. The LNS subtest requires the examinee to listen to, sequentially organize, and verbally output a given set of both letters and numbers. The average internal consistency reliability is .81, and average test retest reliability is .80 (Wechsler, 1997). LNS scores show moderate correlations (.44-.61) with the VCI, PRI, and FSIQ scores (Wechsler, 2008). The LNS subtest correlates with the WMI at .66 (Wechsler, 2008).

Social Cognition

Reading the Mind in the Eyes Test-Revised. The Reading the Mind in the Eyes Test-Revised Version (RMET; Baron-Cohen et al., 1997; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) is a task-based measure in which examinees are required to choose the correct emotion word from a set of four choices that depicts an emotional state of another person, judging from a picture of the eyes, provides the score for this measure. The authors suggested that a computer version of this test could be utilized; the measure is in the public domain and several on-line versions are available. Research comparing the psychometric properties of these computerized versions and the original paper version have not been published. The authors also suggest that response latency could be recorded as part of the task (Baron-Cohen et al., 2001); one study indicated that response latency while making inferences related to characters' intentions in a story context was longer in children with Asperger's Disorder compared to controls, suggesting that response latency might also be a valid and discriminating score to be derived from this measure (Kaland, Smith, & Motensen, 2007). Response latency will be assessed in the current study.

The RMET has been frequently utilized in research related to social cognition. Chronbach's alpha was .63 for males and .60 for females. In a large community samples, RMET scores were significantly inversely correlated (r = -.53) with scores on the Autism Quotient (Baron-Cohen et al., 2001), and scores on the Empathy Quotient (r = -.23) (Voracek & Dressler, 2006). The RMET was also positively correlated (r = .62) with performance on the Video Social Inference Test, a social cognition task which requires theory of mind and social prediction (Turkstra, 2008). The RMET has been found to be uncorrelated with general IQ (Baron-Cohen et al., 2001; Turkstra, 2008). As well, males

have been found to score significantly lower on the RMET than females in the general population (Baron-Cohen et al., 1997; Turkstra, 2008), an expected difference given females' general propensity for better social cognition (Billington, Baron-Cohen, & Wheelwright, 2007). Finally, persons with difficulties in social skills and social cognition (persons with autism, amygdala damage, psychopathy, traumatic brain injury, or schizophrenia) show significantly lower scores on the RMET compared to controls (Richell et al., 2003; Adolphs, Baron-Cohen, & Tranel, 2002; Baron-Cohen et al., 2001; Baron-Cohen et al., 1999; McGlade et al., 2008; Turkstra, 2008).

Unexpected Outcomes Test. The Unexpected Outcomes Test (UOT) is a measure of advanced theory of mind skills. The task contains 12 stories of increasing difficulty which require the participant to make an inference and generate additional story-congruent information to explain an ironic behavioural or emotional outcome related to the feelings of the protagonist in the story (Dyck et al., 2001) (see Appendix C). Answers are given a score of 0 (incorrect) to 2 (correct). The scoring criteria are based on theory of mind concepts and prototypical answers from pilot studies with adolescents and adults (Dyck et al., 2001).

The internal consistency reliability of the UOT was .82 in pilot studies and .73 in a study of children with ASD (Dyck et al., 2001). The UOT has shown moderate (.53-.55) to high (.70) correlations with other measures of theory of mind that involve inferring emotions from facial cues and defining emotion terms (Dyck et al., 2001). Inter-rater reliability was reported as high (kappa=.83) (Dyck, Farrugia, Shochet, & Holmes-Brown, 2004). As well, significantly lower scores on the UOT have been observed in subjects with known ToM deficits compared to healthy controls in child, adolescent, and adult age

groups (Dyck et al., 2001; Dyck, Pick, Hay, & Hallmayer., 2007; Bora, Gokcen, & Veznedarolglu, 2008).

Broad Autism Phenotype

Broad Autism Phenotype Questionnaire. The Broader Autism Phenotype Questionnaire (BAPQ: Hurley et al., 2007) is a 36-item, self report questionnaire specifically developed to assess characteristics of the BAP (see Appendix D). Reponses are given in a Likert scale format (1=Very Rarely-6=Very Often), with higher scores corresponding to greater BAP characteristics. The BAPQ provides an overall score and three subscale scores: Aloof Personality, Pragmatic Language, and Rigid Personality. Cutoff scores are provided; the authors suggest using the criteria of achieving 2 or more subscale scores above the cutoffs for each subscale as BAP "present".

Cronbach's alphas are high for this measure: .94 for Aloof Personality, .91 for Rigid Personality, and .85 for Pragmatic Language. The subscales showed moderate intercorrelations in controls (r=.51-.54) and moderate to high correlations in parents of children with autism (r=.61-.72), which would be expected given the clustering of subclinical characteristics of the BAP. The BAPQ also shows good sensitivity and specificity. Participants were previously classified as "BAP present" or "BAP absent" by the MPASR and the PRS. The sensitivity of the BAPQ was 77.8% for Aloof Personality, 70% for Rigid Personality, 76.2% for Pragmatic Language, and 81.8% for the total score. Specificity was 81.4% for Aloof Personality, 81.8% for Rigid Personality, 73.8% for Pragmatic Language, and 73% for the total score. As well, using the same a priori classification system, ANCOVAs showed expected between group differences on all three subscales as well as the overall score on the BAPQ (Hurley et al., 2007).

Coping

Coping Styles and Flexibility Inventory (CSFI). The CSFI is a self report measure of coping strategy use. It consists of 12 different situations or emotions, to which the examinee is asked to indicate on a 5 point Likert scale (1-never use to 5-always use) how often they utilize each of four different coping strategies with each situation (Williams, 2002) (see Appendix E). This inventory provides coping strategies use scores for: action oriented coping, positive reappraisal, avoidance coping, and social support. The average score for each of the items representing these coping styles is utilized in computing each score for the coping styles (Williams, 2002). A coping flexibility score is obtained by calculating the standard deviation of all items, with a larger standard deviation being indicative of higher coping flexibility (Williams, 2002).

The internal consistency reliability of all four coping styles and the coping flexibility score was above .80 in the first administration of the measure, and ranged from .89-.92 in replication studies (Williams, 2002). Principal components analysis clearly provided support for the four a priori factors (coping styles), with each item loading at approximately .40 or above on its presumed factor. The majority of loadings for each item were greater than .50, and ranged from .38-.79 (Williams, 2002). The CSFI has shown good concurrent and predictive validity in predicting anxiety and depressive symptoms in conjunction with cognitive vulnerability to anxiety and depression (Williams, 2002).

Procedure: Sample 1

Community/organization recruitment. Local organizations were contacted for permission to hang up flyers about the study and to recruit participants by telling their clients about the study. Interested participants were contacted by phone or email by the

researcher. As well, persons who volunteered their participation in past research studies were contacted by the researcher and given a short description of the study.

The assessment was scheduled at a mutually convenient time, during which informed consent was obtained. Participants recruited through the community were compensated with a $20 gift card.

University of Windsor participant pool. Participants who were not parents of children with either autism or another developmental disability were recruited for screening (stage 1) and assessment (stage 2).

Participants were notified of stage 1 of the study via the University of Windsor participant pool website. Participants signed up for a time slot online, were provided with informed consent, and completed the RMET and BAPQ for a ½ mark, and were screened into the study through BAPQ scores. The RMET was included in the screening process for future analysis of associations between RMET and BAPQ scores. To increase variability in the BAP characteristics of the sample, and particularly to have more people who met BAP criteria, Stage 1 participants who scored $\pm$ 1.5 SD from the combined gender normative mean on the BAPQ were invited to complete Stage 2 for additional participant pool credit. If they wanted to participate they completed two additional questionnaires online and arranged an assessment appointment with the researcher at a mutually convenient time. All informed consent forms (see Appendix F) were available on the study website. Informed consent was also obtained at the time of the assessment.

Undergraduate participants who were a parent of child with autism or a disability that was not an ASD were exempt from the screening process and were automatically

able to sign up for the assessment portion (comprised of stage 1 + stage 2) of the study. These participants were given 2.5 bonus marks.

All participants who completed assessments were given the option to complete the questionnaires before their assessment appointment (in order to ensure optimal responding on the questionnaires); if they chose to do this, the researcher obtained informed consent when the questionnaires were given, and also reviewed the requirements of participation at the assessment appointment. Participants were instructed to sign one of the consent forms and turn it in with their questionnaires, and keep the letter of information for their records. All identifying information (informed consent forms, names, phone numbers, and emails) was kept separate from the questionnaires.

Procedure: Sample 2

A brief description of this study was posted on listservs, internet groups, research websites, and social networking sites. Interested participants were directed to a secure website containing on-line versions of the following questionnaires used in this study: Demographics Questionnaire, BAPQ, RMET, BRIEF, & CSFI. They read and electronically signed an informed consent form and completed the questionnaires online. These participants could choose to enter themselves into a draw to win a gift certificate to Toys R Us.

Participants who were parents of a child with autism or a parent of a child with a non-autism spectrum disorder (Other Developmental Disability) were recruited in this manner.

These studies received clearance through the Research Ethics Board at the University of Windsor. All participants in the study were assured of the confidentiality of

their responses, informed of their right to withdraw or choose not to participate, and told that participation in the study was not related to any services they were currently receiving or might receive in the future from any organizations, (local or otherwise, in the case of on-line participants), or from the University of Windsor.

To control for fatigue effects, questionnaires and assessment measures (when applicable) were randomized. All participants will be able to receive feedback about the study through the University of Windsor Research Ethics Board Website. As well, organizations that gave permission to recruit participants will receive feedback about the results of the study.

Results

The results of hypotheses are presented below. First are results from all hypotheses for Sample 1, followed by the results from all hypotheses for Sample 2. Following those results is a comparison of replicable findings (hypotheses using questionnaire data) for both samples.

Sample 1 (Assessment)

Preliminary analyses were conducted for the purpose of data screening, assessing potential correlations between continuous variables, and detecting any relation between group membership on outcome variables. The main analyses for hypothesis testing were then conducted.

Preliminary Analyses

Data screening. Prior to analysis, all variables were examined for accuracy of data entry, missing values, and assumptions of analysis (outliers and skew).

Missing data: Demographic variables. Socioeconomic status (SES) was calculated using the Hollingshead four-factor index (SES = 5(Occupational level) + 3(Educational level); scores range from 8-66, with higher scores indicating higher SES (Hollingshead, 1975; as cited in Yoo, Galabova, Edwin, & Thuluvath, 2002). In cases of two SES values, the higher value was used as this seemed a more accurate representation of SES than the average of the two (Yoo et al., 2002); this method did not result in a negatively skewed distribution. Data for SES were considered missing if Hollingshead SES could not be calculated for both the participant and their significant other, or in the case of undergraduates, for both parents. In this sample (n=147) SES data were missing for 4.76% of cases (n=7); estimation maximization was used to replace missing values (Tabachnick and Fidell, 2005).

Missing data: Assessment measures. One NoDx participant (0.68% of the Assessment sample) did not fill out the BRIEF or the CSFI. Another NoDx participant filled out only the first 6 questions on the CSFI (total missing for CSFI = 1.36% of sample). The first participant was excluded from analyses using these measures as it was not desired to impute data for entire measures. For the second participant who filled out the first half of the CSFI, the responses were counted again for the second half of the questionnaire; as the response items are the same and the measure of interest is one of variability, this seemed to be the best way of estimating the individual's score. Finally, one participant (0.68% of the Assessment sample) was missing data for all the Verbal Fluency measures on the DKEFS; one (different) participant (0.68% of the Assessment sample) was missing data for all the Design Fluency measures on the DKEFS. Both participants' missing data were due to examiner administration error. These two participants were excluded from analyses as it was not desired to impute values for entire measures.

Outliers and skew. Univariate outliers were examined by converting demographic and dependent variables to Z scores. Outliers were defined as Z scores greater than 3.29 (Tabachnick & Fidell, 2001).

The following variables had univariate outliers: Letter Number Sequencing, Design Fluency Filled Dots, Design Fluency Empty Dots, Design Fluency Total; Colour Word Interference Inhibition Switching, Colour Word Interference Switching Error; Tower Total Rule Violations, RMET Total, RMET Average Response Time; BAPQ Pragmatic Language (Total and Average), BAPQ Total Score (Total and Average); and Ratio of Trails B to Trails A. As most of the analyses in this study are regressions, for

variables that were not also skewed (discussed immediately below), outlier transformation was not considered unless these cases were multiviariate outliers (discussed in each regression analysis). In hypotheses for which t-tests or ANOVAs were utilized, examination of appropriate diagnostics dictated changes related to outliers, and are discussed in the context of each analysis as well.

Degree of skew was calculated by dividing the observed skew by the standard error of skew (ses); calculated values greater than 3.33 were considered significantly skewed. One variable, the Reading the Mind in the Eyes Test Response Time (RMET-RT) was highly positively skewed and had outliers on both the average time total and each stimulus item which was not attributable to just a few participants. Examination of these outliers showed that these times were not representative of the reaction times of the sample (for example, several minutes to approximately 83 minutes). Outliers were windsorized for each question before average reaction time was calculated (Field, 2005).

The following variables were significantly positively skewed: RMET Average Response Time (after the windsorization of outliers as discussed above), Ratio of Trails B to Trails A, Colour Word Interference Switching Error, Tower Total Rule Violations, BRIEF Initiate, BRIEF Working Memory, and BRIEF Plan Organize. CSFI Coping Flexibility and Colour Word Interference Inhibition Switching were significantly negatively skewed. Logarithmic transformation reduced skew to acceptable levels for all of the above variables except for Colour Word Interference Inhibition Switching and Colour Word Interference Switching Error. For these two variables, windsorizing outliers (n=4 in both variables) resulted in some improvement in skew (skew = -.781 and -.919 respectively, standard error of skew = .200); log, square root, and reciprocal

transformations did not improve the skew of these variables. The large sample size resulting in the small standard error of skew allows for admission of Colour Word Interference Inhibition Switching in analyses, with skew <.80); however, Switching Error will not be utilized in analyses requiring normal distributions.

Descriptive statistics. Means, standard deviations, and ranges for all variables of interest to this study are presented in Table 5.

Demographic differences between assessment groups. One way ANOVAs (Age, number of children, and SES), and Chi Square analyses (gender, ethnicity, English as a Second Language status, Handedness, and relationship status) were computed to determine if systematic differences between UG, AUT, and ODD groups existed. A *p* of .01 was utilized in this and all following analyses, including hypothesis tests, to correct for Type 1 error.

Participants were similar on SES ($F(2,144)=.840$, $p=.434$), as well as gender, handedness, and (recoded) ethnicity (all X^2 <6.15, all *p*s> .046). However, the NoDx group was significantly younger ($F(2,144)=92.00$, $p<.001$) and had fewer children ($F(2,144)=108.58$, $p<.001$). As well, more NoDx participants reported themselves as not married, cohabiting, or, dating ($X^2(2, N=147)=13.72$, $p=.001$). More of the NoDx group completed the questionnaires online ($X^2(2, N=147)=65.505$, $p<.001$). Finally, more ESL participants were found in the AUT group compared to the UG or ODD group ($X^2(2, N=147)=10.71$, $p=.005$, although caution should be utilized in interpreting this test as 1 cell had fewer than expected counts.

Measurement of dependent variables. T-tests indicated significant differences in RMET average response time between Assessment Sample participants who

Table 5

Means, Standard Deviations, and Ranges for Variables of Interest: Sample 1 (Assessment)

	Mean (SD)	Minimum	Maximum
General Ability[a]			
WAIS-IV Block Design	9.12 (3.05)	3.00	17.00
WAIS-IV Vocabulary	9.11 (2.79)	1.00	14.00
Social Cognition[b]			
Reading the Mind in the Eyes Test (RMET) Total Correct	26.48 (3.87)	12.00	34.00
Reading the Mind in the Eyes Test (RMET) Average Time[c]	2.39 (10.70)	2.39	72.53
Unexpected Outcomes Test (UOT)	13.44 (2.96)	5.00	22.00
Broad Autism Phenotype (BAPQ) Scale Total/Scale Average[b]			
BAPQ Total	102.64 (24.36)/ 2.85 (0.68)	48.00/ 1.33	189.00/ 5.25
BAPQ Pragmatic Language	31.58 (7.75)/ 2.63 (0.65)	12.00/ 1.00	59.00/4.92
BAPQ Aloof	33.17 (11.30)/ 2.76 (0.94)	14.00/ 1.17	65.00/5.42
BAPQ Rigid	37.89 (9.93)/ 3.16 (0.83)	19.00/ 1.58	68.00/5.67
Working Memory[a]			
WAIS-IV Letter Number Sequencing	8.88 (2.45)	4.00	17.00
Verbal Fluency (D-KEFS)[ad]			
Letter Fluency	10.67 (3.19)	2.00	19.00
Category Fluency	11.50 (3.67)	2.00	19.00
Category Switching	10.94 (3.14)	3.00	18.00
Switching Accuracy	11.11 (2.89)	4.00	18.00
Responses in 1st 15 seconds	11.67 (3.16)	5.00	19.00
Responses in 2nd 15 seconds	10.10 (3.04)	3.00	19.00
Responses in 3rd 15 seconds	10.35 (3.12)	1.00	19.00
Responses in 4th 15 seconds	10.39 (3.09)	3.00	18.00
Design Fluency (D-KEFS)[ade]			
Filled Dots	9.11 (2.50)	4.00	19.00

Empty Dots	9.43 (2.49)	4.00	18.00
Switching	10.65 (2.90)	2.00	18.00
Colour Word Interference			
Inhibition Switching	10.55 (2.49)	1.00	15.00
Inhibition Switching[cf]	10.59 (2.37)	4.00	15.00
Switching Error	10.76 (1.57)	5.00	13.00
Switching Error[f]	10.80 (1.45)	7.00	13.00
Sorting Task (D-KEFS)[a]			
Free Sorting Correct Sorts	10.26 (2.08)	5.00	16.00
Free Sorting Correct Descriptions	9.99 (2.20)	4.00	15.00
Sort Recognition Descriptions	8.72 (3.11)	1.00	15.00
Total Description Score	9.29 (2.62)	3.00	16.00
Trails[bd]			
Trails A	30.84 (11.75)	11.00	88.00
Trails B	62.10 (22.94)	26.00	146.00
Trails B/A Ratio[c]	2.12 (0.67)	0.54	5.06
BRIEF[g]			
Inhibition	51.35 (9.77)	36.00	82.00
Shift	55.03 (11.53)	39.00	84.00
Emotional Control	54.08 (11.00)	38.00	86.00
Self Monitor	49.68 (9.95)	37.00	80.00
Initiate[c]	52.43 (12.18)	37.00	87.00
Working Memory[c]	55.71 (12.19)	39.00	94.00
Plan Organize[c]	53.12 (11.58)	38.00	86.00
Task Monitoring	53.72 (11.52)	36.00	83.00
Organization of Materials	51.90 (11.76)	36.00	80.00
Coping Styles Flexibility Inventory			
Problem Solving Total	41.49 (7.33)	22.00	60.00
Reframing Total	40.80 (8.08)	21.00	60.00
Avoid Total	35.19 (7.84)	55.00	55.00
Support Total	39.74 (10.16)	16.00	60.00
Coping Flexibility[c]	5.99 (3.64)	0.43	17.01

[a]Scaled Scores. [b]Raw scores. [c]Logolinear transformation to be used in all analyses. [d]One participant excluded due to injury to dominant hand. [e]One participant excluded due to examiner administration error. [f] Outliers windsorized. [g]T scores.

completed the study online (*n*=96; *M* seconds=14.71, *SD*=6.81) and those who completed the RMET in person (*n*=51; *M* seconds=7.30, *SD*=.50) (*t*(145)=9.24, *p*<.001) [1]. As well, those who completed the study online had higher scores on BRIEF Shift (*M*=56.74, *SD*=11.16) and lower scores on CSFI Social Support (*M*=38.08, *SD*=9.67) than those who completed the study in person (BRIEF Shift *M*=51.59, *SD*=11.58; CSFI Social Support *M*=42.96, *SD*=10.33) (BRIEF Shift: *t*(144)=2.62, *p*=.010; CSFI Social Support: *t*(144)= -2.84, *p*=.005). Online completion was confounded with Child Diagnosis (discussed above), as well as with age; those who completed the questionnaires online were younger (*M* age=29.44, *SD*=10.94) than those who completed the questionnaires in person (*M* age=40.63, *SD*=6.21) (*t*(144.32)= -7.91, *p*<.001).

To determine if these differences were due to the method of measurement, ANOVAs with Online Completion status as the independent variable controlling for age and Child Diagnosis were computed for RMET Average Time, BRIEF Shift, and CSFI Social Support. Results indicated a significant main effect of online completion status even with these control variables on RMET average time score (*F*(1,146)=91.14, *p*<.001) and CSFI Social Support (*F*(1,145)=7.17, *p*=.008). However, no main effect for completion status was observed on BRIEF Shift (*F*(1,145)=4.59, *p*=.034). As such online completion status was entered as a covariate in the hypothesis utilizing these variables.

ESL differences on dependent variables. Significant differences between ESL and non-ESL groups were observed on the BRIEF Organization of Materials (*t*(32.37)= -3.86, *p*=.001), LG10_BRIEF Initiate (*t*(144)=-2.59, *p*=.013), the Unexpected Outcomes Test (*t*(145)= -3.42, *p*=.001). Vocabulary (*t*(18.85)= -5.07, *p*<.001), RMET Total (*t*(145)=

[1] Logolinear RMET Average Response Time was utilized in all analyses. Non-transformed time in seconds is presented for easier comparison.

-3.78, $p<.001$), all Verbal Fluency scores (all t's > |2.95|, all p's <.009), and Sorting Task Total Description score ($t(145)= -2.68$, $p=.008$). A marginally significant difference between ESL/non ESL participants were found on the CSFI Avoidance Total ($t(145)= -2.55$, $p=.012$), which was used in calculating the Coping Flexibility score, but no significant between group differences were observed on the Coping Flexibility score ($t(145) = .981$, $p=.328$).

As ESL status was confounded with Child Diagnosis group membership (Autism, Other Developmental Disability, or No Diagnosis), ANOVAs were computed controlling for Child Diagnosis. A significant main effect of ESL status was observed on all above variables even when child diagnosis was controlled (all Fs >6.195, all ps<.009); as such ESL status will be entered as a covariate in all analyses utilizing the above variables.

Gender differences on dependent variables. Gender differences were observed on the BAPQ total score (males M=115.08 SD=26.91; females M=100.09, SD=23.11) ($t(145)=2.87$, p=.005), as well as the BAPQ subscales of Pragmatic Language (males M=35.76 SD=9.31; females M=30.73, SD=7.15) ($t(144)=3.04$, p=.003) and Aloofness (males M=39.12 SD=11.15; females M=31.95, SD=10.98) ($t(145)=2.97$, p=.004). These gender differences were expected based on past research (Hurley et al., 2007). Gender differences were also observed on LG10_BRIEF Initiate (males M=1.77 SD=.09; females M=1.70, SD=.08) ($t(144)=3.94$, p<.001), LG10_BRIEF Plan Organize (males M= 1.77 SD=.10; females M=1.70, SD=.08) ($t(144)=3.250$, $p=.001$), Block Design (males M=10.60 SD=3.38; females M=8.82, SD=2.90) ($t(145)=2.72$, $p=.007$) , Verbal Fluency Category Switching Total Correct (males M=9.42, SD=3.78; females M=11.25, SD=2.93) ($t(144)= -2.66$, $p=.009$), Verbal Fluency Category Switching Total Switching (males

M=9.67, *SD*=3.38; females *M*=11.39, *SD*=2.71) (*t*(144)= -2.73, *p*=.007), and CSFI Social Support (males *M*=34.00 *SD*=8.80; females *M*=40.98, *SD*=10.02) (*t*(144)= -3.24, *p*=.002).

ANOVAs controlling for ESL status (Verbal Fluency Category Switching Total Correct, Verbal Fluency Category Switching Total Switching, and LG10_BRIEF Initiate), and Online completion status (CSFI Social Support Total) indicated a significant main effect of gender even with control variables (all *F*s $\geq$ 7.65, all *p*s<.006).

As such, gender will be entered as a control variable in all analyses utilizing the above variables.

Hypothesis 1: Prevalence of the Broad Autism Phenotype (BAP). *The BAP will occur more frequently in parents of children with Autism Spectrum Disorders (AUT) than in parents of children who have another developmental disability (ODD).*

Classification into BAP categories (have/do not have) was performed utilizing the gender-specific cutoff scores discussed in Hurley et al. (2007). As such, the significant gender differences observed in the subscales and overall BAPQ score in this sample have already been taken into consideration when formulating BAP have/do not have groups. As expected using this classification method, a Chi Square analysis examining incidence of the BAP across genders was not significant (X^2(1, *N*=147)=.775, *p*=.379).

In the entire sample, 40.14% (n=59) showed the BAP. The incidence rate of the BAPQ across Child Diagnosis groups was as follows: NoDx: Have BAP *n*=36, Not Have BAP *n*=33; AUT: Have BAP *n*=10, Not Have BAP *n*=32; ODD: Have BAP *n*=13, Not Have BAP *n*=23.

A Chi Square Test of Independence was conducted with Child Diagnosis (Child with Autism or Child with Other Developmental Disability) and BAP status (have/do not

have) as variables. NoDx participants were excluded as they were purposefully sampled to have higher BAPQ scores and are not representative of the actual incidence of the BAP in the general population.

The results of the Chi Square analyses were not significant ($X^2(1, N=147)=1.411$, $p=.235$), indicating no difference in incidence of the BAP between parents of children with Autism and parents of children with Other Developmental Disabilities (see Table 6). The hypothesis was not supported. These results could not be attributed to confounding variables such as age, ($t(145)= -1.638$, $p=.103$), SES ($t(145)= -1.695$, $p=.095$), number of children ($t(145)= -1.027$, $p=.306$), having/not having children ($X^2(1, N=147)=3.129$, $p=.077$), ethnicity ($X^2(1, N=147)=.024$, $p=.988$), ESL status ($X^2(1, N=147)=.395$, $p=.530$), or completion method ($X^2(1, N=147)=3.738$, $p=.053$), and were not associated with differences in relationship status ($X^2(1, N=147)=3.669$, $p=.055$), or handedness ($X^2(1, N=147)=.571$, $p=.450$).

Hypothesis 2: Executive Function and the Broad Autism Phenotype

2a. Those individuals with the BAP will have lower executive functioning scores in the areas of problem solving, cognitive flexibility, planning, and verbal fluency.

The operational definitions for the above constructs were as follows: *problem solving*, Sorting Task Free Sorting Correct Sorts; *cognitive flexibility*, Colour Word Interference Inhibition Switching, Verbal Fluency Category Switching Total Switching and Total Correct scores, *planning*, Tower Task overall achievement score, *verbal fluency,* Verbal Fluency Letter and Category total scores, and Verbal Fluency words produced in the first, second, third, and fourth 15-second increment scores.

Table 6

Sample 1 Hypothesis 1: Percent Broad Autism Phenotype Incidence in Parents of Children with Autism or Other Developmental Disabilities

	AUT[1] n=42	ODD[1] n=36
	n(%)	n(%)
BAP[2] Present	10(23.81)	13(36.11)
BAP Not Present	32(76.19)	23(63.89)

[1]AUT=Parent of child with Autism, ODD=Parent of Child with Other Developmental Disability
[2]BAP=Broad Autism Phenotype

In all analyses, BAP present (n=59) and BAP absent (n=88) was used as the grouping variable; the aforementioned scores were dependent variables. T tests were used for all analyses except those involving verbal fluency scores. ANCOVAs were conducted using a Sidak correction to preserve power while controlling for type 1 error when analyzing all verbal fluency measures due to the need to control for ESL status and, for verbal fluency measures involving switching or gender (discussed in detail below).

Correct sorts, inhibition switching, and tower task achievement. For all independent samples t-tests, Levene's test for equality of variances was not significant. Independent samples t-tests showed no significant differences on any of the dependent variables (see Table 7). For Sorting Task Free Sorting Correct Sorts, BAP present M=10.15 (SD=2.20), BAP absent M=10.34 (SD=2.00), (t(145)=.537, p=.592). For LG10_Colour Word Interference Inhibition Switching, BAP present M=1.00 (SD=.17), BAP absent M=1.01 (SD=.14) (t(145)=.263, p=.793). For Tower Task overall achievement score, BAP present M=9.53 (SD=2.98), BAP absent M=9.73, (SD=2.48) (t(145)=.446, p=.656).

Verbal fluency letter, category, and increment scores. In this ANCOVA, Box's Test of Equality of Covariance Matrices was not significant (Box's M=16.75; F=.760, p=.772), as were all Levene's tests of Equality of Error Variances (all Fs$\geq$2.28, all ps$\geq$.133). Finally, the interaction between ESL status and BAP status (assumption of homogeneity of regression slopes) was not significant (all Fs$\geq$10.353, all ps$\geq$.291).

ANCOVAs controlling for ESL status (see Table 8) indicated significant differences between BAP statuses on Verbal Fluency words produced in the second 15-second interval (F(2, 144)=7.228, p=.008). For BAP present, M=10.621 (SD=.310); BAP

Table 7

Sample 1 Hypothesis 2a: T-tests between Broad Autism Phenotype statuses with Sorting, Inhibition Switching, and Tower Achievement Scores.

Variable	*t* value	BAP Present Mean (*SD*)	BAP Not Present Mean (*SD*)
Sorting Task Free Sorting Correct Sorts	.537	10.15 (2.20)	10.34 (2.00)
LG10_Colour Word Interference Inhibition Switching	.263	10.00 (1.48)[1]	10.23 (1.38)
Tower Task Overall Achievement	.446	9.53 (2.98)	9.73 (2.48)

[1]Antilogarithms are presented for this variable for anchoring purposes.

Table 8

Sample 1 Hypothesis 2a: ANCOVAs between Broad Autism Phenotype statuses with Verbal Fluency Scores.

	F value	BAP Present Mean (*SD*)	BAP Absent Mean (*SD*)
Letter Fluency Total Score[1]	3.976*	9.99 (0.40)	11.02 (0.32)
Category Fluency Total Score[1]	1.945	11.00 (0.37)	11.83 (0.46)
1st 15" interval Total[1]	.385	11.48 (0.40)	11.80 (0.32)
2nd 15" interval Total[1]	7.228**	10.62 (0.31)	9.30 (0.38)
3rd 15" interval Total[1]	3.814	9.76 (0.39)	10.62 (0.31)
4th 15" interval Total[1]	3.366	9.83 (0.39)	10.76 (0.32)
Category Switching Total[2] Correct	3.516	10.39 (2.86)	11.31 (3.29)
Category Switching Total[2] Switching	2.562	10.67 (2.69)	11.40 (3.00)

[1]Control Variable: ESL Status.

[2]Control Variables: ESL Status, Gender.

*$p<.05$, **$p<.01$.

absent, *M*=9.299, (*SD*=.381). A marginal difference between BAP statuses on Verbal Fluency Letter Fluency Total score was observed ($F(2, 144)=3.976$, $p=.048$). For BAP present, *M*=11.016 (*SD*=.323); BAP absent, *M*=9.993, (*SD*=.398). Other results (category total correct and 1st, 3rd, and 4th 15-second increment scores) were not significant: all *F*s ≥3.366, all *p*s≥.053. The hypothesis was somewhat supported.

As expected, main effects of the covariate, ESL status were observed on all dependent variables (all *F*s ≥7.563, all *p*s≤.007).

Verbal fluency category switching scores. In this ANCOVA, Box's Test of Equality of Covariance Matrices was not significant (Box's M=1.53; *F*=.542, *p*=.653), as were both Levene's tests of Equality of Error Variances (*F*s≥.674, all *p*s≥.413). Finally, all interactions between ESL status, Gender, and BAP status (assumption of homogeneity of regression slopes) were not significant (all *F*s≥.882, all *p*s≥.416).

ANCOVAs controlling for ESL status and Gender (see Table 8) indicated no significant differences between BAP statuses on Verbal Fluency Category Switching Total Correct ($F(1, 144)=3.516$, $p=.063$) or on Total Switching scores ($F(1,144)=2.562$, $p=.112$). For Verbal Fluency Category Switching Total Correct: BAP present, *M*=10.384 (*SD*=.385); BAP absent, *M*=11.315, (*SD*=.312). For Verbal Fluency Category Switching Total Switching: BAP present, *M*=10.666 (*SD*=.357); BAP absent, *M*=11.402, (*SD*=.289).

As expected, a main effect of both covariates was observed on both dependent variables: for ESL status, both *F*s ≥12.904, both *p*s<.001; for Gender, both *F*s ≥7.194, both *p*s≤.008.

2b. The Broad Autism Phenotype characteristics of problems with pragmatic language and rigidity will be positively predicted by different aspects of executive function. Rigidity will be predicted by problem solving, cognitive flexibility, and planning. Pragmatic Language will be predicted by working memory and verbal fluency.

Prediction of rigidity. The operational definitions for the above constructs were as follows: *problem solving*, Sorting Task Free Sorting Correct Sorts; *cognitive flexibility*, LG10_Colour Word Interference Inhibition Switching and LG10_Ratio of Trails B to A, and *planning*, Tower Task overall achievement score.

Examination of residuals statistics suggested some cases could be influencing the model. Cases with a Mahalanobis Distance above 13.28 (n=3) were excluded. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics (after verbal fluency score deletion) showed the regression model (n=144) met the assumptions of regression analysis. The regression model was not significant (F(4, 143)=.184, p=.946, R^2=.005, see Table 9).

Prediction of pragmatic language. Pragmatic Language was operationalized as BAPQ Pragmatic Language score. Working Memory was operationalized as WAIS-IV Letter Number Sequencing score. Verbal Fluency was operationalized as D-KEFS Verbal Fluency Letter and Category Total Correct scores. Due to significant differences between BAP groups observed in prior analysis, the Verbal Fluency total words produced in the 2nd 15-second interval score was also included in the model. Significant gender differences in BAPQ Pragmatic Language score were observed, and ESL status was uniformly associated with lowered Verbal Fluency scores. As such, the variables in the model were entered in blocks: the first block included Gender, the second block included

Table 9

Sample 1 Hypothesis 2b.1: Regression Predicting BAPQ Rigidity

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1	Overall Model	0.184 (4, 143)	0.005			.946
	Sorting Task Total Correct Sorts			-0.148	-0.031	.739
	Tower Total Achievement			0.239	0.065	.482
	LG10_Colour Word Interference Inhibition Switching			-4.176	-0.45	.620
	LG10_Ratio Trails B/A			-1.389	-0.017	.845

working memory and verbal fluency scores, and the third block included ESL status (see Table 10).

Examination of multicollinarity statistics, in particular the average VIF, indicated that the 2nd 15-second interval verbal fluency score was too highly intercorrelated with the other predictors for the model. As such, the regression was re-run with this predictor deleted. As well, influential cases (Mahalanobis distance>15.09, *n*=4 or standardized residual>3.00, *n*=1) were deleted (see Table 10). Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics (after verbal fluency score deletion) showed the regression model (*n*=141) met the assumptions of regression analysis.

Results indicated that Gender by itself was the best predictor of BAPQ Pragmatic Language score, although this was only marginally significant ($F(1,140)=5.703$, $p=.018$; B value= -3.898, Std. β= -.199, $R^2=.039$). Addition of Verbal Fluency and Letter Number Sequencing scores did not result in improved predictive utility of the model ($F(1,140)=1.520$, $p=.200$, $R^2=.043$). For the Verbal Fluency and Letter Number Sequencing scores, B values ranged from |.020|-|.151|, and Std. βs ranged from |.009|-|.050|. Gender was no longer significant (B=-3.827, Std. β= -.195, p=.022). Addition of ESL status also did not improve the model ($F(1,140)=1.363$, $p=.242$, $R^2=.048$), and was not a significant predictor (B=1.881, Std. β= .079, $p=.389$). For all other predictors, B values ranged from |.020|-|3.812|, and Std. βs ranged from |.009|-|.194|, all *p*s>.023.

Gender and ESL alone in the regression was significant ($R^2=.078$, p=.003). The hypothesis was not supported.

Table 10

Sample 1 Hypothesis 2b.1: Regression Predicting BAPQ Pragmatic Language

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Gender	8.398 (1, 145)	0.055	-4.900	-0.235	.004
	2	Overall Model	1.729 (5, 145)	0.058			.132
		Gender			-4.836	-0.232	.006
		VF Category Total			0.043	0.020	.863
		VF Letter Total			0.017	0.007	.955
		VF 2nd 15" interval			-0.159	-0.063	.668
		Letter Number Sequencing			-0.072	-0.023	.798
	3	Overall Model	2.068 (6, 145)	0.082			.061
		Gender			-4.810	-0.230	.006
		VF Category Total Correct			-0.043	-0.020	.864
		VF Letter Total Correct			-0.006	-0.002	.984
		VF 2nd 15" interval Total			-0.156	-0.425	.671
		Letter Number Sequencing			-0.129	-0.463	.664
		ESL status			3.836	0.163	.060
2[2]	1	Gender	5.703 (1, 140)	0.039	-3.898	-0.199	0.018
	2	Overall Model	1.520 (4, 140)	0.043			0.200
		Gender			-3.827	-0.195	.022

		VF Category Total Correct			-0.096	-0.048	.617
		VF Letter Total Correct			0.020	0.009	.932
		Letter Number Sequencing			0.151	0.050	.591
	3	Overall Model	1.363 (5, 140)	0.048			0.242
		Gender			-3.812	-0.194	.023
		VF Category Total Correct			-0.127	-0.064	.515
		VF Letter Total Correct			0.020	0.009	.932
		Letter Number Sequencing			0.084	0.028	.775
		ESL Status			1.881	0.079	.389
3[3]	1	Gender	9.226 (1, 146)	0.060	-5.035	-0.245	.003
	2	Overall Model	6.086 (1,146)	0.078			.003
		Gender			-5.025	-0.244	.003
		ESL status			3.176	0.135	.095

[1] *n*=146
[2] VF 2nd 15" interval total and influential cases removed, *n*=141.
[3] All non-significant variables removed, *n*=141

Hypothesis 3: Social Cognition and the Broad Autism Phenotype

3a. Those individuals with the Broad Autism Phenotype will have lower social cognition scores in the areas of theory of mind and social inference making.

Theory of mind was operationalized as total score on the RMET. Social inference making was operationalized as score on the Unexpected Outcomes Test. ANCOVAs were conducted using a Sidak correction to preserve power while controlling for type 1 error for both constructs due to the need to control for ESL status and, for RMET average time score, completion method (online versus not online).

RMET and UOT. In this ANCOVA, Box's Test of Equality of Covariance Matrices was not significant (Box's M=5.594; F=1.835, p=.138), as were both Levene's tests of Equality of Error Variances (Fs$\leq$.1.032, all ps$\geq$.311).

The ANCOVAs controlling for ESL status and Gender (see Table 11) indicated no significant differences between BAP statuses on RMET (F(1, 144)=.043, p=.837). For BAP present, M=26.590 (SD=.484); BAP absent, M=26.379, (SD=.396). No significant differences were observed on UOT either (F(1, 144)=1.220, p=.271). For BAP present, M=12.941 (SD=.371); BAP absent, M=13.777, (SD=.304). As expected, a main effect of ESL status was observed for both the RMET (F=15.471, p<.000) and the UOT (F=10.122, p=.002). The hypothesis was not supported.

RMET average response time. For the ANCOVA with RMET average response time as the dependent variable, Completion method was entered as a control variable. In this ANCOVA, Levene's tests of Equality of Error Variances was not significant (F=1.641, p=.202).

Table 11

Sample 1 Hypothesis 3a: ANCOVAs between Broad Autism Phenotype statuses with Social Cognition Scores.

	F value	BAP Present Mean (*SD*)	BAP Absent Mean (*SD*)
RMET Total[1]	0.043	26.59 (0.48)	26.38 (0.40)
UOT[1]	1.220	12.94 (0.37)	13.78 (0.30)
LG10_RMET Average Time[2,3]	0.096	10.23 (1.05)	10.84 (1.05)

[1]Control Variables: ESL Status, Gender.

[2]Control Variables: Completion method, ESL Status.

[3]Antilogarithms presented for anchoring purposes.

The ANCOVA controlling for Completion method (see Table 11) indicated no significant differences between BAP statuses on RMET average time (F(1, 146)=.096, p=.797). For BAP present, M=10.233[2] (SD=1.045); BAP absent, M=10.84, (SD=1.045). As expected, a main effect of ESL status was observed (F=88.060, p<.001). The hypothesis was not supported.

3b. The Broad Autism Phenotype characteristic of problems with pragmatic language will be negatively predicted by social cognition.

Pragmatic Language was operationalized as BAPQ Pragmatic Language score. Social Cognition was operationalized as Unexpected Outcomes Test total and RMET Total. Working Memory was operationalized as WAIS-IV Letter Number Sequencing score. Significant gender differences in BAPQ Pragmatic Language score were observed, and ESL status was associated with lowered scores on both predictor variables. As such, the variables in the model were entered in blocks: the first block included Gender, the second block included working memory and verbal fluency scores, and the third block included ESL status (see Table 12).

Influential cases (Mahalanobis distance>13.28, n=3 or standardized residual>3.00, n=1) were deleted. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics showed the regression model (n=143) met the assumptions of regression analysis. Results again indicated that Gender by itself was a predictor of BAPQ Pragmatic Language score, although this was only marginally significant (F(1,142)=5.075, p=.026; B value= -3.774, Std. β= -.186, R^2=.035). Addition of UOT and RMET scores did not result in improved predictive utility of the model (F(1,142)=2.579, p=.056, R^2=.053). For the UOT, B value= -.366, Std. β= -.140, p=.111.

[2] Antilogs are presented here for anchoring purposes.

Table 12

Sample 1 Hypothesis 3b: Regression Predicting BAPQ Pragmatic Language

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Gender	5.075	.035	-3.774	-0.186	.026
	2	Overall Model	2.579	.053			.056
		Gender			-4.147	-0.205	.016
		UOT Total			-0.366	-0.140	.111
		RMET Total			0.135	0.065	.464
	3	Overall Model	3.337	.088			.012
		Gender			-3.882	-0.192	.022
		UOT Total			-0.427	-0.163	.061
		RMET Total			-0.025	0.012	.895
		ESL status			4.693	0.199	.022
2[2]	1	Gender	5.837 (1, 141)	0.040	-4.206	-0.200	0.17
	2	Overall Model	4.084 (2, 141)	0.056			.019
		Gender			-4.398	-0.209	.012
		UOT Total			-0.324	-0.125	.134
	3	Overall Model	4.438 (3, 141)	0.088			.005
		Gender			-3.916	-0.186	.025
		UOT Total			-0.416	-0.161	.055
		ESL status			4.645	0.186	.028
3[3]	1	Gender	4.772 (1, 127)	0.036	-3.760	-0.191	.031

2	Overall Model	5.792 (2, 127)	0.085			.004
	Gender			-3.970	-0.202	.020
	UOT Total			-0.561	-0.220	.011

[1]Influential cases removed, n=143
[2]RMET removed and influential case removed, *n*=142.
[3]All ESL participants (n=11) removed, influential cases removed, n=128.

For the RMET, B value=.135, Std. β= .012, *p*=.464. Gender was marginally significant (B= -4.147, Std. β= -.205, *p*=.016). Addition of ESL status also did improve the model in that marginal significance was obtained ($F(1,140)=3.337$, $p=.012$, $R^2=.088$), and was a marginally significant predictor (B=4.693, Std. β= .199, *p*=.022). Gender was a marginal predictor as well (B= -3.882, Std. β= .192, p=.022). For the UOT, B value= -.427, Std. β= -.163, p=.061. For the RMET, B value=.025, Std. β= .012, *p*=.895. The hypothesis was not supported.

3c. Social Cognition will be positively predicted by Working Memory

Social cognition was operationalized as score on the RMET and score on the UOT. As such, two simple regression analyses were conducted, with the aforementioned scores as dependent variables, and LNS score as the predictor variables in each.

Social cognition: Prediction of RMET. As significant differences in RMET scores between ESL statuses were observed, ESL status was included as a predictor variable. Variables were entered in blocks: the first block contained ESL status and the second block contained LNS score (see Table 13). Influential cases (Mahalanobis distance>9.21, *n*=4 or standardized residual>|3.00|, *n*=1) were deleted. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics showed the regression model (*n*=142) met the assumptions of regression analysis.

Results again indicated that ESL by itself was a significant predictor of RMET total score, ($F(1,141)=13.385$, $p<.001$; B value= -3.516, Std. β= -.295, $R^2=.087$, see Table 13). However, LNS was also a significant predictor when included in the model ($F(1,141)=13.722$, $p<.001$, $R^2=.153$). In the final model, ESL B value= -2.655, Std. β= -.223, *p*=.006; for LNS, B value=.445, Std. β= .288, *p*<.001.

Table 13

Sample 1 Hypothesis 3c: Regression Predicting Social Cognition (RMET Total Score)

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	ESL	13.385 (1, 141)	0.087	-3.516	-0.295	<.001
	2	Overall Model	13.722 (2, 141)	0.165			<.001
		ESL			-2.655	-0.223	<.001
		Letter Number Sequencing			0.445	0.288	<.001

[1]Influential cases removed, *n*=142

Social cognition: Prediction of UOT. As significant differences in UOT scores between ESL statuses were observed, ESL status was included as a predictor variable. Variables were entered in blocks: the first block contained ESL status and the second block contained LNS score (see Table 14). Influential cases (Mahalanobis distance>9.21 and/or with high leverage values, n=4) were deleted. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics showed the regression model (n=143) met the assumptions of regression analysis.

Results indicated that ESL by itself was a significant predictor of UOT total score, (F(1,142)=7.920, p=.006; B value= -2.236, Std. β= -.231, R^2=.053). LNS was not a significant predictor when included in the model, although the overall model was still significant (F(1,141)=5.286, p=.006, R^2=.070). With the inclusion of LNS (B value= -.040, Std. β= .183, p<.112) the predictive utility of ESL status was marginal (B value= -3.526, Std. β= -.302, p=.020).

Hypothesis 4: Cognitive Function and Coping

4a. Problem focused coping will be positively predicted by executive functioning, specifically, the executive function areas of problem solving, working memory, and planning.

A multiple regression analysis was conducted. The predictor variables were operationalized as follows: *problem solving*, D-KEFS Sorting Task Total Correct Sorts; planning, D-KEFS Tower task total achievement score; working memory, WAIS-IV Letter Number Sequencing score. The dependent variable, problem focused coping, was operationalized as CSFI Problem Focused coping total score. Examination of scatterplots,

Table 14

Sample 1 Hypothesis 3c: Regression Predicting Social Cognition (UOT)

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	ESL	7.920	.053	-3.774	-0.186	.006
	2	Overall Model	5.286	.070			.006
		ESL			-2.236	-0.231	.020
		Letter Number Sequencing			-1.914	0.169	.112
2[2]	1	ESL	13.179	0.085	-2.758	-0.291	<.001
	2	Overall Model	7.833	0.100			.001
		ESL			-2.409	-0.255	.003
		Letter Number Sequencing			0.161	0.128	.127
	3	Overall Model	6.497	0.158			<.001
		ESL			-1.296	-0.137	.170
		Letter Number Sequencing			-0.042	0.033	.702
		Block Design			-0.071	0.073	.400
		Vocabulary			0.296	0.264	.015

[1]Influential cases removed, *n*=143

[2]Exploratory variables Block Design and Vocabulary included, *n*=143.

histograms, and partial plots, as well as multicollinearity statistics showed the regression model (n=146) met the assumptions of regression analysis.

The regression model was not significant ($F(1, 145)=.142$, p=.935, $R^2=.003$, see Table 15). None of the predictors approached significance (all B values$\leq$|.165|, all Std. βs $\leq$|.055|, all *p*s$\geq$.529). The hypothesis was not supported.

Bivariate and partial correlations (when applicable) were run between CSFI Problem Focused Coping and other test scores, including design fluency, verbal fluency, additional sorting task scores, social cognition tasks, and WAIS-IV Block Design and Vocabulary. No significant correlations were found.

4b. Social support seeking as coping will be positively predicted by social cognition.

A multiple regression analyses was conducted. Predictor variables (social cognition) were operationalized as RMET total correct and UOT score. The dependent variable, social support seeking, was CSFI Social Support Seeking total score. Significant gender differences in CSFI social support total score were observed, and completion of the questionnaires online was associated with lowered CSFI Social Support Scores. Finally, ESL status differences in both predictor variables were observed. As such, the variables in the model were entered in blocks: the first block included Gender and Completion Method, the second block included RMET and UOT scores, and the third block included ESL status (see Table 15).

Influential cases (Maholanobis distance>15.09 or high leverage values, *n*=3) were deleted. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics showed the regression model (*n*=146) met the assumptions of regression analysis. The regression model showed that Completion Method (B

Table 15

Sample 1 Hypothesis 4a: Regression Predicting CSFI Problem Focused Coping

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1	Overall Model	0.142 (3, 145)	.003			.935
	D-KEFS Sorting Task Total Correct Sorts			-0.030	-0.008	.927
	D-KEFS Tower Task Total Achievement			-0.050	-0.018	.839
	Letter Number Sequencing			0.165	0.055	.529

Table 16

Sample 1 Hypothesis 4b: Regression Predicting CSFI Social Support

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Overall Model	8.514 (2, 142)	0.108			<.001
		Gender			-6.397	-0.235	.004
		Completion Method			4.469	0.210	.010
	2	Overall Model	5.249 (4, 142)	0.132			.001
		Gender			-7.170	-0.263	.001
		Completion Method			4.320	0.203	.013
		UOT Total			0.521	0.146	.086
		RMET Total			-0.333	-0.116	.172
	3	Overall Model	4.680 (5, 142)	0.146			.001
		Gender			-7.387	-0.271	.001
		Completion Method			4.599	0.216	.008
		UOT Total			0.465	0.130	.127
		RMET Total			-0.431	-0.151	.087
		ESL Status			4.032	0.125	.139

[1]Influential cases removed, n=143

value=4.469, Std. β=.210, *p*=.010) and Gender (B value= -6.397, Std. β= -.235, *p*=.004) significantly predicted Social Support score ($F(1, 142)=8.514.$, $p<.001$, $R^2=.108$). However, the social cognitive variables, RMET total correct (B value= -.333, Std. β= -.116, *p*=.172) and UOT (B value= .521, Std. β=.146, *p*=.086) were not significant predictors in the model (F(1, 142)=5.249, p=.001). However, Gender remained significant (B value= -7.170, Std. β= -.263, *p*=.001), although Completion Method showed marginal significance (B value=4.320, Std. β= .203, *p*=.013). In the final model (F(1, 142)=4.680, p=.001, $R^2=.146$), with the addition of ESL status (B value= 4.032, Std. β= .125, *p*=.139) , it was clear that Gender (B value= -7.387, Std. β= -.271, *p*=.001) and Completion Method (B value=4.599, Std. β=.216, *p*=.008) were by themselves the best predictors of Social Support Score. In the final model, neither RMET total or UOT score were significant (both B values$\leq$|.465|, both Std. βs $\leq$|.151|, both *p*s$\geq$.087).

Hypothesis 5: Coping Flexibility

Broad Autism Phenotype characteristics (problems with pragmatic language, aloof personality characteristics, and rigidity) will be negatively predictive of coping flexibility, and executive functioning (problem solving, planning, and switching) and social cognition will be positively predictive of coping flexibility.

The constructs were operationalized as follows: *BAP characteristics*, BAPQ overall score; *problem solving*, D-KEFS Sorting Task total correct sorts; *planning,* D-KEFS Tower Task Total Achievement Score, *switching*, Trail Making ratio B/A and Colour Word Interference Inhibition Switching, *social cognition*, RMET total and UOT total scores; and *coping flexibility*, CSFI Coping Flexibility score.

A multiple regression analysis was conducted with the aforementioned constructs; CSFI Coping Flexibility Score was the dependent variable. As differences between scores on both social cognition tasks were observed between ESL statuses, ESL was included as a predictor variable as well. Predictor variables were entered in blocks; all cognitive and personality characteristics were entered in the first block, and ESL status was entered in the second block.

The initial regression analysis (see Table 17) was not significant ($F(9, 143)=1.309$, $p=.238$, $R^2=.081$) for the final model. As Coping Flexibility was scored by taking the standard deviation of scores across the four subscales of the CSFI, and the distribution was highly skewed, requiring a logolinear transformation of scores, it was thought that the resultant restriction of range of the CSFI Coping Flexibility score may have been influential in the non-significant finding. Attempts to utilize the variance of CSFI scores resulted in violation of the assumption of normality in the regression analysis (too much skew). As such, the regression was re-run using the CSFI total score.

The regression analysis was significant ($F(9, 143)=3.010$, $p=.003$, $R^2=.168$, see Table 18). The majority of variables did not contribute to the model: for D-KEFS Sorting Task total correct sorts, D-KEFS Tower Task Total Achievement Score, Trails ratio B/A, Colour Word Interference Inhibition Switching, and UOT total scores, all B values $\leq|7.218|$, all Std. $\beta s\leq|.329|$, all $ps\leq.480$. The RMET total score was within range of being marginally significant (B value= -.906, Std. β= -.168, $p=.059$); the high number of variables in the model may have influenced the predictive utility of this variable. However, the BAPQ overall score was a significant predictor (B value = -.282, Std. β= -.329, $p<.001$), and ESL status (B value = -11.864, Std. β= .187, p=.031), was marginally

Table 17

Sample 1 Hypothesis 5: Regression Predicting CSFI Coping Flexibility score (Logarithmic transformation)

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Overall Model	1.329 (8, 143)	.073			.235
		LG10_Ratio Trails B/A			-0.277	-0.129	.148
		DF Switching			-0.007	-0.069	.451
		Tower Total Achievement			-0.011	-0.106	.237
		BAPQ Total			-0.002	-0.137	.108
		LG10_Colour Word Interference Inhibition Switching			-0.224	-0.092	.333
		Sorting Task Free Sorting Correct Sorts			0.002	0.015	.880
		UOT Total			-0.002	-0.020	.823
		RMET Total			0.011	0.149	.103
	2	Overall Model	1.309 (9, 143)	.081			.238
		LG10_Ratio Trails B/A			-0.268	-0.125	.162
		DF Switching			-0.006	-0.063	.492
		Tower Total Achievement			-0.012	-0.111	.216
		BAPQ Total			-0.001	-0.124	.151
		LG10_Colour Word Interference Inhibition Switching			-0.215	-0.088	.355
		Sorting Task Free			0.002	0.018	.853

Sorting Correct Sorts			
UOT Total	7.53^{E-5}	0.001	.993
RMET Total	0.012	.169	.071
ESL Status	-0.084	-0.097	.287

Table 18

Sample 1 Hypothesis 5: Regression Predicting CSFI Coping Total score

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Overall Model	2.718 (8, 143)	0.139			.008
		LG10_Ratio Trails B/A			8.502	0.054	.527
		DF Switching			0.241	0.033	.704
		Tower Total Achievement			-0.547	-0.070	.418
		BAPQ Total			-0.260	-0.303	<.001
		LG10_Colour Word Interference Inhibition Switching			-0.971	-0.005	.952
		Sorting Task Free Sorting Correct Sorts			-0.337	-0.033	.721
		UOT Total			0.687	-0.097	.268
		RMET Total			-0.703	-0.130	.139
	2	Overall Model	3.010 (9, 143)	0.168			.003
		LG10_Ratio Trails B/A			7.218	0.046	.587
		DF Switching			0.156	0.022	.804
		Tower Total Achievement			-0.471	-0.060	.480
		BAPQ Total			-0.282	-0.329	<.001
		LG10_Colour Word Interference Inhibition Switching			-2.356	-0.013	.883
		Sorting Task Free			-0.403	-0.040	.666

		Sorting Correct Sorts					
		UOT Total			0.397	0.056	.525
		RMET Total			-0.906	-0.168	.059
		ESL Status			11.864	0.187	.031
2	1	Overall Model	15.123 (2, 136)	0.184			<.001
		BAPQ Total			-0.346	-0.411	<.001
		RMET Total			-0.523	-0.093	.237
	2	Overall Model	15.595 (3, 136)	0.260			<.001
		BAPQ Total			-0.393	-0.467	<.001
		RMET Total			-0.950	-0.169	.031
		ESL Status			20.041	0.293	<.001

[1]Influential case removed, *n*=144.

[2] Non-significant predictors and influential cases removed, *n*=137.

predictive of CSFI total score. The hypothesis was partially supported in that BAP characteristics predicted coping, indicating that BAP characteristics, but not cognitive abilities, predict coping strategy use.

Although unlikely to have significantly impacted the results of the above regression, BAPQ overall score and CSFI total score p-plot showed a slight indication of heteroskedasticity and non-linearity. As BAPQ overall score was highly correlated with BAPQ subscale scores, it was thought that substituting the BAPQ subscale scores would provide more specific predictor variables, improve reliability of the model, and possibly eradicate the problems with assumptions observed with the CSFI and BAPQ overall scores.

Prediction of CSFI using BAPQ subscales and RMET. As significant gender differences in BAPQ Aloof and Pragmatic Language scores were observed, and ESL status differences on Pragmatic Language and RMET total were observed, Gender and ESL status was entered into the model in addition to the three BAPQ subscales (pragmatic language, rigidity, and aloof) and RMET (see Table 19). Variables were entered in blocks; the BAPQ subscales were entered in the first block, Gender was entered in the second block, and ESL status was entered in the third block. Influential cases were removed (n=5). The regression model was significant ($F(4, 98)=7.541$, $p<.001$, $R^2=.243$) for the final model. The only significant predictor in the model, however, was BAPQ Aloof (B value= -.745, Std. β= -.411, p=.001). For all other predictors, all B values$\leq$11.749, all Std. βs$\leq$.171, and all ps$\geq$.067. When BAPQ Aloof was entered into a regression with Gender in the second block to predict the CSFI Total score, the initial regression was significant ($F(1, 98)=24.807$, $p<.001$, $R^2=.204$, B value=

Table 19

Sample 1 Hypothesis 5: Regression Predicting CSFI Coping Total score Using BAPQ Subscales

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Overall Model	9.837 (4, 132)	0.235			<.001
		BAPQ Pragmatic Language			-0.100	-0.128	.692
		BAPQ Aloof Total			-0.792	-0.460	<.001
		BAPQ Rigid Total			0.105	0.053	.614
		RMET Total			-0.659	-0.039	.110
	2	Overall Model	7.840 (5, 132)	0.236			<.001
		BAPQ Pragmatic Language			-0.109	-0.043	.667
		BAPQ Aloof Total			-0.802	-0.466	<.001
		BAPQ Rigid Total			0.112	0.056	.594
		RMET Total			-0.637	-0.124	.128
		Gender			-1.410	-0.028	.725
	3	Overall Model	7.600 (6, 132)	0.266			<.001
		BAPQ Pragmatic Language			-0.182	-0.072	.469
		BAPQ Aloof Total			-0.793	-0.461	<.001
		BAPQ Rigid Total			0.047	0.023	.823
		RMET Total			-0.893	-0.174	.037
		Gender			-0.806	-0.016	.839
		ESL Status			12.389	0.189	.025

2[2]	1	BAPQ Aloof Total	36.805 (1, 132)	.219	-0.806	-0.468	<.001
	2	Overall Model	20.223 (2, 132)	.237			<.001
		BAPQ Aloof Total			-0.853	-0.496	<.001
		ESL Status			8.982	0.137	.083
3		BAPQ Aloof Total	32.183 (1, 120)	.213	-0.821	-0.461	<.001

[1]Influential cases removed, *n*=133.

[2] Non-significant predictors (Pragmatic Language, Rigidity, Gender) removed, *n*=133.

[3]Non-significant predictors and influential cases (which contained all ESL participants) removed, *n*=121.

-.819, Std. β= -4.51, p<.001). The second predictor, Gender was not significant (B value= 12.009, Std. β= .174, p=.057), although the overall model remained significant (F(2, 98)=14.601, p<.001, R^2=.233). These results indicate that in particular the BAP characteristic of Aloofness predicted coping.

Summary of Results: Sample 1

Hypotheses were partially supported. No differences in the incidence of the BAP were observed between AUT and ODD groups. No differences in social cognition measures, including response latency to RMET stimuli, were observed between BAP groups. Measures of concept formation, planning, shifting, verbal fluency, and social cognition were not predictive of BAPQ characteristics. However, working memory as measured by Letter Number Sequencing (LNS) was a significant predictor of Reading the Mind in the Eyes (RMET) score. Measures of concept formation, planning, switching, and working memory were not predictive of coping strategy use on the Coping Styles Flexibility Inventory (CSFI) problem focused/social support seeking/total score, but BAPQ characteristics, in particular the BAPQ Aloof subscale, was predictive of CSFI total score.

Results: Sample 2

Preliminary Analyses

Data screening. Prior to analysis, all variables were examined for accuracy of data entry, missing values, and assumptions of analysis (outliers and skew).

Calculation of SES. Socioeconomic status (SES) was calculated using the Hollingshead four-factor index (SES = 5(Occupational level) + 3(Educational level); scores range from 8-66, with higher scores indicating higher SES (Hollingshead, 1975; as

cited in Yoo, Galabova, Edwin, & Thuluvath, 2002). In cases of two SES values, the higher value was used as this seemed a more accurate representation of SES than the average of the two (Yoo et al., 2002); this method did not result in a negatively skewed distribution. Data for SES were considered missing if Hollingshead SES was unable to be calculated for both the participant and their significant other.

No demographic information was missing in this sample. See above for information related to response rate and incomplete questionnaire sets. Only complete questionnaire sets (Demographics questionnaire, RMET, BRIEF, CSFI, and BAPQ) were included in the analyses. No missing answers were observed on any questionnaires.

Outliers and skew. Univariate outliers were examined by converting demographic and dependent variables to Z scores. Outliers were defined as Z scores greater than 3.29 (Tabachnick & Fidell, 2001).

The following variables had univariate outliers: BAPQ Pragmatic Language, BAPQ Total score, and RMET total. As the primary analyses in this study are regressions, for variables that were not also skewed (discussed below), outlier transformation was not considered unless these cases were multiviariate outliers (discussed below).

Degree of skew was calculated by dividing the observed skew by the standard error of skew (ses); calculated values greater than 3.33 were considered significantly skewed. The following variables were significantly positively skewed: BRIEF Shift, BRIEF Self Monitor, and BAPQ Total. RMET Total was significantly negatively skewed. Logarithmic transformation reduced skew to acceptable levels for all of the above variables, and eliminated outliers (BAPQ total), except in the case of the RMET Total score, in which

both the significant outlier and skew remained unchanged. The outlier was windsorized and skew was reduced to acceptable levels.

Multivariate outliers (for regression analyses) were evaluated using Mahalanobis distance. Cutoff values varied depending on the number of variables in the regression, and are discussed before each analysis.

Demographic differences between assessment groups. Means, standard deviations, and ranges for demographic variables of interest were presented in Tables 3 and 4. Independent samples t-tests (Age, number of children, and SES), and Chi Square analyses (gender, ethnicity, and relationship status) were computed to determine if systematic differences between On-AUT and On-ODD groups existed. Participants were similar on SES, Age, and number of children (all ts(102)$\leq$1.266, ps$\geq$.208), as well as gender, (recoded) ethnicity and relationship status (all $X^2 \leq$.902, all ps$\geq$ .539).

Gender differences on dependent variables. Means, standard deviations, and ranges for dependent variables of interest are presented in Table 20. Gender differences were observed on the BAPQ Aloof score (males M=115.08 SD=26.91; females M=100.09, SD=23.11) (t(15.332)=3.360, p=.004). This gender difference was expected based on past research (Hurley et al., 2007); likely the relatively small n of males in this sample precluded differences on other BAPQ scales. Gender differences were also observed on CSFI Social Support (males M=34.00 SD=8.80; females M=40.98, SD=10.02) (t(102)= -3.649, p<.001). As such, gender will be entered as a control variable in all analyses utilizing the BAPQ Aloof score and the CSFI Social Support score.

Table 20

Means, Standard Deviations, and Ranges for Variables of Interest: Sample 2

	Mean (SD) (n=104)	Minimum (n=104)	Maximum (n=104)
Social Cognition[a]			
Reading the Mind in the Eyes Test (RMET) Total Correct	26.19 (4.57)	3.00	36.00
Reading the Mind in the Eyes Test (RMET) Total Correct[b]	26.28 (4.20)	12.00	36.00
Reading the Mind in the Eyes Test (RMET) Average Time[c]	2.39 (10.70)	2.39	72.53
Broad Autism Phenotype (BAPQ) Scale Total/Scale Average[a]			
BAPQ Total[c]	102.64 (24.36)/ 2.85 (0.68)	48.00/ 1.33	189.00/ 5.25
BAPQ Pragmatic Language	31.58 (7.75)/ 2.63 (0.65)	12.00/ 1.00	1.00/4.92
BAPQ Aloof	33.17 (11.30)/ 2.76 (0.94)	14.00/ 1.17	1.17/5.42
BAPQ Rigid	37.89 (9.93)/ 3.16 (0.83)	19.00/ 1.58	1.58/5.67
BRIEF[d]			
Inhibition	51.35 (9.77)	36.00	82.00
Shift[c]	55.03 (11.53)	39.00	84.00
Emotional Control	54.08 (11.00)	38.00	86.00
Self Monitor[c]	49.68 (9.95)	37.00	80.00
Initiate	52.43 (12.18)	37.00	87.00
Working Memory	55.71 (12.19)	39.00	94.00
Plan Organize	53.12 (11.58)	38.00	86.00
Task Monitoring	53.72 (11.52)	36.00	83.00
Organization of Materials	51.90 (11.76)	36.00	80.00
Coping Styles Flexibility Inventory			
Problem Solving Total	41.49 (7.33)	22.00	60.00
Reframing Total	40.80 (8.08)	21.00	60.00
Avoid Total	35.19 (7.84)	55.00	55.00
Support Total	39.74 (10.16)	16.00	60.00
Standard Deviation	5.99 (3.64)	0.43	17.01

[a]Raw scores. [b]Windsorized outlier. [c]Logolinear transformation to be used in all analyses [d]T scores.

Hypotheses

Hypothesis 1: Prevalence of the Broad Autism Phenotype (BAP). *The BAP will occur more frequently in parents of children with Autism Spectrum Disorders (ASD) than in parents of children without ASD.*

As in the sample 1, classification into BAP categories (have/do not have) was performed utilizing the gender-specific cutoff scores discussed in Hurley et al. (2007). As such, the significant gender differences observed in the subscales and overall BAPQ score in this sample have already been taken into consideration when formulating BAP have/do not have groups. As expected using this classification method, a Chi Square analysis examining incidence of the BAP across genders was not significant ($X^2(1, N=104)=.073$, $p=.787$).

A Chi Square Test of Independence was conducted with Child Diagnosis (Child with Autism or Child with Other Developmental Disability) and BAP status (have/do not have) as variables. The incidence rate of the BAPQ across Child Diagnosis groups was as follows: AUT: Have BAP $n=22$, Not Have BAP $n=30$; ODD: Have BAP $n=17$, Not Have BAP $n=35$. The results of the Chi Square were not significant ($X^2(1, N=104)=1.026$, $p=.311$, see Table 21), indicating no difference in incidence of the BAP between parents of children with Autism and parents of children with Other Developmental Disabilities. The hypothesis was not supported.

These results could not be attributed to confounding variables such as age ($t(102)= -1.351$, $p=.180$), SES ($t(102)= -1.167$, $p=.246$), number of children ($t(102)= -2.247$, $p=.027$) or ethnicity ($X^2(1, N=104)=1.647$, $p=.439$), and were not associated with differences in relationship status ($X^2(1, N=104)=2.512$, $p=.113$).

Table 21

Sample 2 Hypothesis 1: Percent Broad Autism Phenotype Incidence in Parents of Children with Autism or Other Developmental Disabilities

	AUT[1] n=52	ODD[1] n=52
	n(%)	n(%)
BAP[2] Present	22(42.31)	17(32.69)
BAP Not Present	30(57.69)	35(63.31)

[1]AUT=Parent of child with Autism, ODD=Parent of Child with Other Developmental Disability
[2]BAP=Broad Autism Phenotype

Hypothesis 2: Executive Function and the Broad Autism Phenotype

2a. Those individuals with the BAP will have lower executive functioning scores in the areas of problem solving, planning, and cognitive flexibility.

Four independent samples t-tests were conducted, with "BAP have/not have" as the grouping variable. Operational definitions were as follows: problem solving: BRIEF-A Task Monitoring; planning BRIEF-A Plan/Organize, and cognitive flexibility BRIEF-A scales of Inhibition. It was also decided to include BRIEF-A Shift as a measure of cognitive flexibility, as inhibition loads on the Behavioural Regulation Index and Shift loads on the Meta-Cognitive Index, potentially providing a better measure of academic problem solving. For all t-tests, Levene's test for equality of variances was not significant.

Results indicated significant differences between those with and without the BAP on all four variables (see Table 22). For BRIEF Task Monitoring: $t(102)= -3.858$, $p<.001$; BAP present $M=62.641$ ($SD=13.423$), BAP absent $M=53.769$, ($SD=9.923$). For BRIEF Plan/Organize: $t(102)= -3.816$, $p<.001$; BAP present $M=62.769$ ($SD=14.999$), BAP absent $M=52.862$ ($SD=11.32$). In terms of cognitive flexibility, for BRIEF Inhibition: $t(102)= -5.990$, $p<.001$; BAP present $M=60.0769$ ($SD=11.113$), BAP absent $M=48.549$ ($SD=8.415$). For BRIEF-A Shift, $t(102)= -7.045$, $p<.001$; BAP present $M=63.709$[3] ($SD=1.216$), BAP absent $M=49.363$ ($SD=1.183$). The hypothesis was supported.

2b. The Broad Autism Phenotype characteristics of problems with rigidity and pragmatic language will be positively predicted by different aspects of executive function, specifically the domains of problem solving, cognitive flexibility, planning, and working memory.

[3] Antilogarithms of calculated means and standard deviations are presented for anchoring purposes.

Table 22

Sample 2 Hypothesis 2a: T-tests between Broad Autism Phenotype statuses with BRIEF Inhibit, Plan/Organize, Task Monitoring Scores, and Shift Scores

Variable	*t* value	BAP Present Mean (*SD*)	BAP Not Present Mean (*SD*)
BRIEF Inhibit T	-5.550	60.08 (11.11)	48.54 (8.42)
BRIEF Plan Organize T	-3.816	62.76 (15.00)	52.86 (8.42)
BRIEF Task Monitoring T	-3.858	62.64 (13.42)	53.77 (9.92)
LG10_BRIEF Shift T[1]	-7.045	63.71 (1.216)	49.36 (1.183)

[1]Antilogarithms are presented for this variable for anchoring purposes.

Prediction of rigidity. The above constructs were measured as follows: *ridigity*: BAPQ Rigidity score (dependent variable); problem solving, BRIEF-A Task Monitor; *cognitive flexibility*, BRIEF-A Inhibition and LG10_Shift; and *planning*, BRIEF-A Plan/Organize.

Influential cases (Mahalanobis distance>15.09, n=1) were deleted, as were the variables with high multicollinearity to BRIEF Plan/Organize (see Table 23). The regression was run again with only BRIEF Plan Organize and LG10_BRIEF Shift. This regression was significant (F(2, 103)=68.804, p<.001, R^2=.579), although LG10_BRIEF Shift showed evidence of non-linearity; as the variable had already been transformed, it was decided to remove the variable from the analysis. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics showed the regression model (n=103) met the assumptions of regression analysis.

As such, the best model (F(1, 103)=17.437, p<.001, R^2=.147) included only BRIEF-A Plan Organize, B value=.311, Std. β= .384, p<.001. Due to the high multicollinearity between the variables in the analysis, it appears that BRIEF Plan Organize encompasses many different executive function processes, and as such the hypothesis was at least partially supported.

Prediction of pragmatic language. The constructs were operationalized as follows: *pragmatic language*, BAPQ Pragmatic Language score (dependent variable); *working memory*, BRIEF-A Working Memory. Influential cases (Mahalanobis distance>6.63, n=1 and those with standardized residuals >3.00, n=1) were deleted. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity

Table 23

Sample 2 Hypothesis 2b: Regression Predicting BAPQ Rigidity

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1	Overall Model	31.808 (5, 103)	.619			<.001
	BRIEF Inhibit T			0.174	0.179	.069
	LG10_BRIEF Initiate T			21.147	0.174	.095
	BRIEF Plan Organize T			-0.381	-0.485	<.001
	LG10_BRIEF Shift T			92.301	0.814	<.001
	LG10_BRIEF Self Monitoring T			7.577	0.067	.510
2[1]	Overall Model	68.804 (2, 102)	.579			<.001
	BRIEF Plan Organize T			-0.198	-0.25	.007
	LG10_BRIEF Shift T			103.287	0.921	<.001
3[2]	BRIEF Plan Organize T	17.437 (1, 102)	.147	.311	.384	<.001

[1]All non-significant predictors and influential case removed, n=103.
[2]LG10_BRIEF Shift Deleted due to violation of assumptions.

statistics showed the regression model (n=102) met the assumptions of regression analysis.

The regression model was significant (F(1, 101)=88.079, p<.001, R^2=.468) (see Table 24). For the only predictor, B value=.402, Std. β= .684, p<.001. The hypothesis was supported.

Hypothesis 3: Social Cognition and the Broad Autism Phenotype

3a. Those individuals with the Broad Autism Phenotype will have lower social cognition scores in the areas of theory of mind and social inference making.

Two independent samples t-tests were conducted with BAP status the grouping variable, and the RMET Total and LG10_RMET time to respond as the dependent variables. For both independent samples t-tests, Levene's test for equality of variances was not significant.

Results indicated no significant differences between those with and without the BAP on the RMET Total (t(102)=1.007, p=.316, see Table 25). For BAP present M=25.74 (SD=5.07), BAP absent M=26.60, (SD=3.59). However, significant differences between BAP statuses were observed on the LG10_RMET time to respond (t(102)=2.984, p=.004). For BAP present M=11.607[4] (SD=1.44), BAP absent M=14.29, (SD=1.39).

3b. The Broad Autism Phenotype characteristic of problems with pragmatic language will be negatively predicted by social cognition.

A multiple regression analysis was conducted. BAPQ Pragmatic Language score (dependent variable) was used as a measure of problems with pragmatic language. Social

[4] Antilogarithms of calculated means and standard deviations are presented for anchoring purposes.

Table 24

Sample 2 Hypothesis 2b: Regression Predicting BAPQ Pragmatic Language

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	BRIEF Working Memory T	88.079	.468	0.402	0.684	<.001

[1]Influential cases deleted, *n*=102.

Table 25

Sample 2 Hypothesis 3a: T-tests between Broad Autism Phenotype statuses with Social Cognition Scores.

	t value	BAP Present Mean (*SD*)	BAP Absent Mean (*SD*)
RMET Total	1.007	25.74 (5.07)	26.60 (3.59)
LG10_RMET Average Time[1]	2.984**	11.61 (1.44)	14.29 (1.39)

[1]Antilogarithms presented for anchoring purposes.

**$p<.01$

cognition (predictor variables) were operationalized as RMET overall score and RMET average time to respond.

Cases with Mahalanobis distance> 9.21 (n=3) or a standardized residual of >3.00 (n=1) were deleted. The model was not significant (F(2, 99)=.838, p=.436, R^2=.017, see Table 26). For RMET total, B value= -.136, Std. β= -.061, p=.552. For RMET average time to respond, B value= -7.330, Std. β= -.123, p=.229. The hypothesis was not supported.

3c. Social Cognition will be positively predicted by Working Memory

Working memory was defined as BRIEF-A Working Memory Score. Social Cognition was defined as RMET total score. A simple regression analysis was conducted, with BRIEF-A Working Memory scores as the predictor variable and score on the RMET as the dependent variable. Influential cases (Mahalanobis distance>6.28, n=1; standardized residual>3.00, n=2). The regression analysis (n=101) met the assumptions of analysis. The regression was not significant (F(1, 99)=0.997, p=.320, R^2=.010, see Table 27). For Working Memory, the only predictor, B value=.025, Std. β=.100, p=.320. This hypothesis was not supported.

Hypothesis 4: Cognitive Function and Coping

4a. Problem Focused Coping will be positively predicted by executive functioning, specifically, the executive function areas of problem solving, working memory, and planning.

A multiple regression analyses was conducted, with CSFI Problem Focused Coping score as the measure of problem focused coping (dependent variable). The predictor variables were operationalized as follows: *problem solving*: BRIEF-A Task

Table 26

Sample 2 Hypothesis 3b: Regression Predicting BAPQ Pragmatic Language

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	Overall Model	.838 (2, 99)	.017			.436
	LG10_RMET Average Time			-7.330	-.123	.229
	RMET Total			-0.136	-.061	.552

[1]Influential cases deleted, *n*=100.

Table 27

Sample 2 Hypothesis 3c: Regression Predicting RMET Total Score

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	BRIEF Working Memory	0.997	.010	0.025	0.100	.320

[1]Influential cases deleted, *n*=101.

Monitoring, *planning*: BRIEF-A Plan Organize and BRIEF-A Organization of Materials, and *working memory*, BRIEF-A Working Memory. Shift was also included in the model, as it was believed that being able to disengage from emotional involvement could assist problem focused coping (Ganesalingham, Yeates, Sanson, & Anderson, 2007).

Influential cases (Mahalanobis distance>16.81, n=1 and those with standardized residuals >3.00, n=1) were deleted, as well as variables highly intercorrelated with Plan Organize (see Table 28). The model was then closer to significance, but the discrepancy between the p value of the overall model and those of the predictors suggested multicollinearity. As such the regression was re-run twice, using each of the variables to identify which, if any, had better predictive utility. For Plan Organize, the regression model was significant (F(1, 101)=8.931, p=.004, R^2=.082, B value= -.171, Std. β=-.286). The regression model with LG10_BRIEF Shift was significant as well (F(1, 101)=7.993, p=.006, R^2=.065, B value= -22.746, Std. β= -.-8.046).

The hypothesis was at least partially supported due to the high multicollinearity between the variables utilized in this analysis.

4b. Social support seeking as coping will be positively predicted by social cognition.

A simple regression analyses was conducted. Social cognition was defined as RMET score (predictor variable); seeking social support was operationalized as CSFI Social Support score (dependent variable). As significant gender differences were observed on the dependent variable, Gender was entered into the model as well. Variables were entered in blocks, with Gender in the first block and RMET score in the second block.

Table 28

Sample 2 Hypothesis 4a: Regression Predicting CSFI Problem Focused Coping

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1	Overall Model	1.397 (5, 103)	.067			.232
	BRIEF Plan Organize			-0.042	-0.076	.728
	LG10_BRIEF Shift			-10.528	-0.131	.354
	BRIEF Task Monitoring			.011	0.018	.929
	BRIEF Organize Materials			-0.083	-0.138	.334
	BRIEF Working Memory			0.015	0.029	.880
2[1]	Overall Model	3.046 (2, 103)	.057			.052
	BRIEF Plan Organize			-0.077	-0.138	.300
	LG10_BRIEF Shift			-9.878	-0.122	.356
3[2]	BRIEF Plan Organize	8.931 (1, 101)	.082	-0.171	-0.286	.004
4[3]	LG10_BRIEF Shift	7.993 (1, 101)	.065	-22.746	8.046	.006

[1]Variables highly intercorrelated with Plan Organize deleted.

[2]Influential cases and LG10_BRIEF Shift deleted, *n*=102.

[3]Influential cases and Plan Organize deleted, *n*=102.

Attempts to preserve male participants in the analysis by using a less conservative Mahalanobis Distance value resulted in increased leverage values; although the model was significant (see Table 29), the assumptions of the model may have been violated. Elimination of influential cases by using the most conservative Mahalanobis Distance (>9.21) resulted in elimination of all the males (*n*=9) in the sample. The identification of all of the males as outliers was likely due to the small number of males in the sample. As such, the regression was run with only females, and gender was eliminated from the model. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics showed the regression model (n=94) met the assumptions of regression analysis. The regression model was not significant ($F(1, 93)=3.732$, $p=.056$, $R^2=.039$). For RMET, the only predictor, $B= -.532$, Std. $\beta= -1.932$, $p=.056$). The hypothesis was not supported.

Hypothesis 5: Coping Flexibility

*Broad Autism Phenotype characteristics (problems with pragmatic language, aloof personality characteristics, and rigidity) will be negatively predictive of coping flexibility, and executive functioning (problem solving, planning, and switching) and social cognition will be positively predictive of coping flexibility***.**

The constructs were operationalized as follows: *BAP characteristics*, BAPQ overall score; *problem solving*, BRIEF Task Monitoring; *planning,* BRIEF Plan/Organize, *switching*, LG10_BRIEF Shift, *social cognition*, RMET total; and *coping flexibility*, CSFI Coping Flexibility score. A multiple regression analysis was conducted with the aforementioned constructs; CSFI Coping Flexibility Score was the dependent variable

Table 29

Sample 2 Hypothesis 4b: Regression Predicting CSFI Social Support

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Gender	15.112 (1, 101)	.131	-14.505	-0.362	<.001
	2	Overall Model	9.651 (2, 101)	.163			<.001
		Gender			-15.032	-0.375	<.001
		RMET Total			-0.520	-0.179	.055
2[2]		RMET Total	3.732 (1, 93)	.039	-0.532	-0.197	.056

[1]Regression using less conservative Mahalanobis Distance value, *n*=102.

[2]Regression with influential cases deleted regardless of gender, *n*=94, all female participants.

The initial regression analysis was not significant ($F(6, 103)=.346$, p=.911, $R^2=.081$, see Table 30). As Coping Flexibility was scored by taking the standard deviation of scores across the four subscales of the CSFI, and the distribution was highly skewed, requiring a logolinear transformation of scores, it was thought that the resultant restriction of range of the CSFI Coping Flexibility score may have been influential in the non-significant finding. As in the previous study, attempts to utilize the variance of CSFI scores resulted in violation of the assumption of normality in the regression analysis (too much skew). As such, the regression was re-run using the CSFI total score.

The regression analysis was significant ($F(6, 103)=4.285$, $p<.001$, $R^2=.235$, see Table 31). The majority of variables did not contribute to the model: for BRIEF Shift, BRIEF Task Monitoring, and RMET total, all B values $\leq$|38.306|, all Std. βs$\leq$|.181|, all ps$\geq$.158. The LG10_BAPQ overall score was a significant predictor, however (B value = -116.907, Std. β= -.627, p<.001), but the model showed a high level of multicollinearity, particularly with BRIEF Task Monitoring (B value=.155, Std. β=.094, p=.557), so non-significant predictors were deleted and influential cases were eliminated (Mahalanobis Distance>16.81, Standardized Residual>3.00, n=4). When the regression was run again using only BRIEF Plan Organize and BAPQ total as predictors, the regression was again significant ($F(5, 103)=13.741$, $p<.001$, $R^2=.221$). However, only LG10_BAPQ Total was a significant predictor (B value = -98.971, Std. β= -.519, $p<.001$), BRIEF Plan Organize was not significant (B value = -116.907, Std. β= -.627, $p<.001$). These findings support the idea that BAPQ characteristics, but not cognitive variables, predict coping strategy use, partially supporting the hypothesis.

Table 30

Sample 2 Hypothesis 5: Regression Predicting CSFI Coping Flexibility score (Logarithmic transformation)

Run	Variables Entered	*F* value (*dfb*,*dfw*)	R^2	B Value	Std. β	*p* value
1	Overall Model	.342 (5, 103)	.017			.886
	BRIEF Plan Organize			-0.017	-.060	.732
	LG10_BRIEF Shift			2.778	.068	.690
	BRIEF Task Monitoring			-0.037	-.117	.528
	RMET Total			-0.015	-0.017	.872
	LG10_BAPQ Total			.791	0.020	.885
2[1]	Overall Model	.598	.012			.552
	BRIEF Plan Organize			-0.035	-.124	.286
	LG10_BAPQ Total			1.713	0.044	.706

[1]Variables with multicollinearity to Plan Organize deleted.

Table 31

Sample 2 Hypothesis 5: Regression Predicting CSFI Coping Total Score

Run	Variables Entered	*F* value (*dfb*,*dfw*)	R^2	B Value	Std. β	*p* value
1	Overall Model	4.285 (2, 103)	.179			.001
	BRIEF Plan Organize			-0.062	-0.043	.803
	LG10_BRIEF Shift			38.306	0.181	.242
	BRIEF Task Monitoring			0.155	0.094	.557
	RMET Total			-0.636	-0.134	.158
	LG10_BAPQ Total			-106.176	-0.531	<.001
2[1]	Overall Model	13.741 (2, 99)	.221			<.001
	BRIEF Plan Organize			.173	.117	.262
	LG10_BAPQ Total			-98.971	-.519	<.001

[1]Influential cases and variables with multicollinearity to Plan Organize and lowest correlations with predictor deleted, *n*=100.

No problems with homoskedasticity and non-linearity were observed in the BAPQ overall score and CSFI total score in this regression. However, as BAPQ overall score was highly correlated with BAPQ subscale scores, it was thought that substituting the BAPQ subscale scores would provide more specific predictor variables.

Prediction of CSFI using BAPQ subscales. As significant gender differences in BAPQ Aloof scores were observed, Gender was entered into the model in addition to the three BAPQ subscales (pragmatic language, rigidity, and aloof). Variables were entered in blocks; the BAPQ subscales were entered in the first block and gender was entered in the second block. Influential cases were removed (n=5). The regression model was significant (F(4, 98)=7.541, p<.001, R^2=.243, see Table 32) for the final model. The only significant predictor in the model, however, was BAPQ Aloof (B value= -.745, Std. β= -.411, p=.001). For all other predictors, B values≤11.749, all Std. βs≤.171, all ps≥.067). When BAPQ Aloof was entered into a regression with Gender in the second block to predict the CSFI Total score, the initial regression was significant (F(1, 98)=24.807, p<.001, R^2=.204, B value= -.819, Std. β= -4.51, p<.000). The second predictor, Gender was not significant (B value= 12.009, Std. β= .174, p=.057), although the overall model remained significant (F(2, 98)=14.601, p<.001, R^2=.233). As such, although the overall hypothesis that BAPQ characteristics predict coping was supported, it is more precise to state that BAPQ Aloof characteristics predict coping.

Summary of Results: Sample 2

In Sample 2, the results of the hypotheses were partially supported as well. No differences in the incidence of the BAP were observed between AUT and ODD groups. Self report of EF difficulties (Inhibition, Planning, Task Monitoring, and Shifting) were

Table 32

Sample 2 Hypothesis 5: Regression Predicting CSFI Coping Total Score Using BAPQ Subscales

Run		Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Overall Model	8.686 (3, 98)	.215			<.001
		BAPQ Pragmatic Language Total			-0.229	-.107	.328
		BAPQ Rigid Total			0.176	.103	.386
		BAPQ Aloof Total			-0.833	-.459	<.001
	2	Overall Model	7.541 (4, 98)	.243			<.001
		BAPQ Pragmatic Language Total			-0.235	-0.110	.307
		BAPQ Rigid Total			.123	0.072	.542
		BAPQ Aloof Total			-0.745	-0.411	<.001
		Gender			11.749	0.171	.067
2[1]	1	BAPQ Aloof Total	24.807 (1, 98)	.204	-0.819	-.451	<.001
	2	Overall Model	14.601 (2, 98)	.233			<.001
		BAPQ Aloof Total			-0.767	-.423	<.001
		Gender			12.009	.174	.057

[1]Influential cases deleted, *n*=99.
[2]Non-significant variables deleted, *n*=99.

significantly higher in the BAP Present group compared to BAP Absent group. Self-report of Planning and Organizing ability was the best predictor of BAPQ rigidity score. Interestingly, although no significant differences between BAP groups were observed on RMET total score, significantly shorter response latencies to RMET stimuli were observed in the BAP Present group. Self-report of working memory was not associated with RMET total score. No social cognitive variables were significant predictors of BAP characteristics or coping (social support seeking). Self report of planning ability and shifting ability were significant predictors of problem focused coping on the CSFI. CSFI total score was not predicted by BRIEF-A EF or RMET, but by BAPQ characteristics, specifically the Aloof subscale being the best predictor.

Results: Replication of Findings Observed in Sample 2

Hypothesis 2: Executive Function and the Broad Autism Phenotype

2a. Those individuals with the BAP will have lower executive functioning scores in the areas of problem solving, planning, and cognitive flexibility.

Three independent samples t-tests and on ANCOVA (controlling for gender) were conducted, with "BAP have/not have" as the grouping variable. Operational definitions were as follows: *problem solving*: BRIEF-A Task Monitoring; *planning*: BRIEF-A Plan/Organize, and *cognitive flexibility:* BRIEF-A Inhibition. As in Sample 2, BRIEF-A Shift was included as a measure of problem solving. Levene's test of equality of error variances was significant for BRIEF Task Monitoring and BRIEF Shift.

Results indicated significant differences between those with and without the BAP on all four variables (see Tables 33 and 34). For BRIEF Task Monitoring: $t(144)= -4.713$, $p<.001$; BAP present $M=58.97$ ($SD=12.97$), BAP absent $M=49.84$ ($SD=8.84$). For BRIEF

Table 33

Sample 1 Hypothesis 2a.1: T-tests between Broad Autism Phenotype statuses with BRIEF Inhibit, Task Monitoring Scores, and Shift Scores

Variable	*t* value	BAP Present Mean (*SD*)	BAP Not Present Mean (*SD*)
BRIEF Inhibit T	-3.316***	54.53 (10.09)	49.20 (9.13)
BRIEF Task Monitoring T	-4.713***	58.97 (12.97)	49.84 (8.84)
BRIEF Shift T	-7.414***	62.58 (11.34)	49.76 (8.38)

***$p \leq .001$

Table 34

Study 1 Hypothesis 2a.1: ANCOVA between Broad Autism Phenotype statuses with BRIEF Plan Organize Score

Variable	*F* value	BAP Present Mean (*SD*)	BAP Not Present Mean (*SD*)
LG10_BRIEF Plan Organize[1]	27.13***	57.02[2] (1.03)	48.52 (1.02)

[1]Control variable: Gender

[2]Antilogarithms are presented for anchoring purposes.

***$p<.001$

Plan/Organize: F(1, 143)= 27.125, p<.001; BAP present *M*=57.02 (*SD*=1.02), BAP absent *M*=48.53 (*SD*=1.02). In terms of cognitive flexibility, for BRIEF Inhibition: *t*(144)= -3.316, *p*=.001; BAP present *M*=54.53 (*SD*=10.09), BAP absent *M*=49.195 (*SD*=9.13). For BRIEF-A Shift, *t*(144)= -7.414, *p*<.001; BAP present *M*=62.58 (*SD*=11.35), BAP absent *M*=49.76 (*SD*=8.38). The hypothesis was supported.

2b. The Broad Autism Phenotype characteristics of problems with rigidity and pragmatic language will be positively predicted by different aspects of executive function, specifically the domains of problem solving, cognitive flexibility, planning, and working memory.

Prediction of rigidity. The above constructs were measured as follows: *ridigity*: BAPQ Rigidity score (dependent variable); problem solving, BRIEF-A Task Monitor; *cognitive flexibility*, BRIEF-A Inhibition and Shift; and *planning*, BRIEF-A Plan/Organize.

Influential cases (*n*=3) were deleted. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics showed the regression model (*n*=103) met the assumptions of regression analysis. The regression was significant (*F*(4, 142)=32.440, *p*<.001, R^2=.486) (see Table 35). However, LG10_BRIEF Plan Organize and BRIEF Inhibit were non significant (both *ps*≥.132), and BRIEF Self Monitoring was closer to significance (p=.066). The regression was run again with only BRIEF Shift and Self Monitoring. This regression was also significant (*F*(2, 142)=60.159, *p*<.001, R^2=.464). For BRIEF Shift, B value=.564, Std. β= .640, *p*<.001. For BRIEF Plan Organize, B value=.066, Std. β= .066, *p*<.393. With BRIEF Self Monitoring deleted, the best model (*F*(1, 142)=119.810, *p*<.001, R^2=.461) included only BRIEF-A Shift, B

Table 35

Sample 1 Hypothesis 2b.1.1: Regression Predicting BAPQ Rigidity

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Gender	1.926 (1, 141)	.014	-3.109	-.116	.167
	2	Overall Model	21.460 (6, 141)	.488			<.001
		Gender			0.046	.002	.979
		LG10_BRIEF Plan Organize T			-20.196	-.176	.124
		LG10_BRIEF Initiate T			8.314	.073	.505
		BRIEF Inhibit T			-0.140	-.130	.126
		BRIEF Shift T			0.644	.731	<.001
		BRIEF Self Monitoring T			0.151	.151	.087
2[2]	---	Overall Model	32.440 (4, 141)	.486			<.001
		LG10_BRIEF Plan Organize T			-14.738	-.128	.147
		BRIEF Inhibit T			-0.134	-.125	.132
		BRIEF Shift T			0.648	.735	<.001
		BRIEF Self Monitoring T			0.159	.159	.066
3[3]	---	Overall Model	60.159 (2, 141)	.464			<.001
		BRIEF Shift T			.564	.640	<.001
		BRIEF Self Monitoring T			.066	.066	.393

4[4]	---	BRIEF Shift T	119.810 (1, 141)	.461	0.598	.679	<.001
5[5]	---	LG10_BRIEF Plan Organize T	22.994 (1, 141)	.141	43.080	.376	<.001

[1]Influential cases removed, *n*=142.
[2]Gender and BRIEF Initiate removed, *n*=142
[3]Non-significant variables removed, *n*=142.
[4]Non-significant variable removed, *n*=142.
[5]Exploratory replication conducted, *n*=142.

value=.490, Std. β= .659, p<.001. The hypothesis was at least partially supported, as there was at least moderate collinearity between all BRIEF subscales.

For specific purposes of replication, BRIEF Plan Organize was put into a regression alone. Influential cases (n=1) was deleted. This regression was also significant (F(1, 141)=23.131, p<.001, R^2=.143). As such the results from Sample 2 were replicated, although these results suggest lack of specificity of BRIEF predictor variables.

Prediction of pragmatic language: The constructs were operationalized as follows: *pragmatic language*, BAPQ Pragmatic Language score (dependent variable); *working memory*, LG10_BRIEF-A Working Memory. Influential cases (Mahalanobis distance>6.63 and/or standardized residuals >3.00, n=2) were deleted. Examination of scatterplots, histograms, and partial plots, as well as multicollinearity statistics showed the regression model (n=144) met the assumptions of regression analysis.

The regression model was significant (F(1, 143)=77.927, p<.001, R^2=.350) (see Table 36). For the only predictor, B value=46.687, Std. β= .595, p<.001. The hypothesis was supported and the results of Sample 2 were replicated.

Hypothesis 3: Social Cognition and the Broad Autism Phenotype

3c. Social Cognition will be positively predicted by Working Memory

Working memory was defined as BRIEF-A Working Memory Score. Social Cognition was defined as RMET total score. A simple regression analysis was conducted, with BRIEF-A Working Memory score as the predictor variable and score on the RMET as the dependent variable. Influential cases (Mahalanobis distance>6.28 and/or standardized residual>3.00, n=2) were deleted. The regression (n=144) met the assumptions of analysis. The regression was not significant (F(1, 144)=1.290, p=.258,

Table 36

Sample 1 Hypothesis 2b.2.1: Regression Predicting BAPQ Pragmatic Language

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	Overall Model	24.337 (4, 143)	.412			<.001
	BRIEF Working Memory			0.169	.287	.013
	LG10_BRIEF Plan Organize			22.038	.272	.025
	BRIEF Task Monitoring			0.046	.074	.510
	BRIEF Inhibit			0.059	.081	.382
2[2]	Overall Model	48.021 (2, 143)	.405			<.001
	BRIEF Working Memory			0.207	.352	.001
	LG10_BRIEF Plan Organize			26.450	.327	.001
3[3]	LG10_BRIEF Plan Organize	77.537 (1, 143)	.353	48.107	.594	<.001
4[4]	BRIEF Working Memory	79.963 (1, 143)	.360	.354	.600	<.001

[1]Influential cases deleted, *n*=144.

[2]Non-significant variables deleted, *n*=144

R^2=.009, see Table 37). For Working Memory, the only predictor, B value=3.694, Std. β=.095, *p*=.258. As in Sample 2, this hypothesis was not supported.

Hypothesis 4: Cognitive Function and Coping

4a. Problem Focused Coping will be positively predicted by executive functioning, specifically, the executive function areas of problem solving, working memory, and planning.

A multiple regression analyses was conducted, with CSFI Problem Focused Coping score as the measure of problem focused coping (dependent variable). The predictor variables were operationalized as follows: *problem solving*: BRIEF-A Task Monitoring, *planning*: LG10_BRIEF-A Plan Organize and BRIEF-A Organization of Materials, and *working memory*, LG_10 BRIEF-A Working Memory. Shift was also included in the model, as it was believed that being able to disengage from emotional involvement could assist problem focused coping (Ganesalingam et al., 2007).

As significant gender differences were observed on LG10_ BRIEF A Plan Organize, variables were entered in blocks; in the first block all BRIEF variables were entered, and the second block included the above variables and gender. The initial regression was significant (see Table 38); for block 1, $F(5, 145)=4.390$, $p=.001$, $R^2=.136$. For the second block, F(6, 145)=4.176, p=.001, $R^2=.153$. However, multicollinearity of variables was evident. With problematic variables removed the regression included only BRIEF Plan Organize and Task Monitoring in the first block, and Gender in the second block. The regression was significant; for block 1, $F(2, 145)=10.029$, $p<.001$, $R^2=.123$. For the second block, $F(3, 145)=7.729$, p<.001, $R^2=.140$. However, none of the variables were significant.

Table 37

Sample 1 Hypothesis 3c.1: Regression Predicting RMET Total Using BRIEF WM

Run	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	LG10_BRIEF Working Memory	1.290 (1, 143)	.001	3.694	.095	.258

[1]Influential cases removed, *n*=144.

Table 38

Sample 1 Hypothesis 4a.1: Regression Predicting CSFI Problem Focused Coping

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1	1	Overall Model	4.390 (5, 145)	.136			.001
		LG10_BRIEF Plan Organize			-6.004	-.073	.629
		BRIEF Shift			-0.058	-.091	.420
		BRIEF Task Monitoring			-0.077	-.121	.381
		BRIEF Organize Materials			-0.024	-.038	.723
		LG10_BRIEF Working Memory			-8.370	-.105	-.105
	2	Overall Model	4.176 (6, 145)	.153			.001
		BRIEF Plan Organize			-9.619	-.117	.443
		LG10_BRIEF Shift			-0.059	-.093	.402
		BRIEF Task Monitoring			-0.075	-.118	.391
		BRIEF Organize Materials			-0.017	-.027	.799
		BRIEF Working Memory			-8.281	-.104	.418
		Gender			-2.640	-.136	.095
2[1]	1	Overall Model	10.029 (2, 145)	.123			<.001
		LG10_BRIEF Plan Organize			-15.138	-.185	.148

		BRIEF Task Monitoring			-0.118	-.186	.144
	2	Overall Model	7.729 (3, 145)	.140			<.001
		LG10_BRIEF Plan Organize			-18.488	-.226	.081
		BRIEF Task Monitoring			-0.114	-.180	.156
		Gender			-2.648	-.137	.093
3[2]	1	LG10_BRIEF Plan Organize	15.919 (1, 133)	.108	-28.375	-.328	<.001
	2	Overall Model	9.618 (2, 133)	.128			<.001
		LG10_BRIEF Plan Organize			-31.507	-.364	<.001
		Gender			-3.296	-.147	.082
4[3]	1	BRIEF Task Monitoring	17.967 (1, 143)	.112	-.210	-.335	<.001

[1]Variables with high multicollinearity with Plan Organize and influential cases deleted, *n*=144.
[2]Regression run with only Plan Organize and Gender, influential cases deleted, *n*=134
[3]Regression run with only Task Monitoring, *n*=144, no influential cases required to be deleted.

Each BRIEF variable was then entered into a separate regression. For BRIEF Plan Organize, Gender was entered into the second block. With influential cases (n=12) deleted, the regression met assumptions of analysis. The regression was significant: for block 1, $F(1, 133)=15.919$, $p<.001$, $R^2=.108$. For BRIEF Plan Organize, B value= -28.375, Std. β= -.328, $p<.001$. For the second block, $F(2, 133)=9.618$, $p<.001$, $R^2=.128$. For Plan Organize, B value= -31.507, Std. β= -.364, p<.001. For Gender, B value= -3.296, Std. β= -.147, $p<.082$.

The regression with BRIEF Task Monitoring was also significant: $F(1, 143)=17.967$, $p<.001$, $R^2=.112$; B value= -.210, Std. β= -.335). The hypothesis was supported and the results of Sample 2 were replicated in that Plan Organize was a significant predictor.

Hypothesis 5: Coping Flexibility

*Broad Autism Phenotype characteristics (problems with pragmatic language, aloof personality characteristics, and rigidity) will be negatively predictive of coping flexibility, and executive functioning (problem solving, planning, and switching) and social cognition will be positively predictive of coping flexibility***.**

The constructs were operationalized as follows: *BAP characteristics*, BAPQ overall score; *problem solving*, BRIEF Task Monitoring; *planning,* BRIEF Plan/Organize, *switching*, LG10_BRIEF Shift, *social cognition*, RMET total; and *coping flexibility*, CSFI Coping Flexibility score. A multiple regression analysis was conducted with the aforementioned constructs. Due to the restriction of range observed previously, CSFI Coping Total was entered as the dependent variable. Gender was entered into the

regression in a second block due to differences observed between genders on Plan Organize.

The regression analysis, with influential cases deleted (n=2) was significant (see Table 39). For block 1: (F(5, 141)=5.235, p<.001, R^2=.161). For block 2: (F(6, 141)=4.333, p<.001, R^2=.161). As in Sample 2, only BAPQ total was a significant predictor (block 1: B value= -.322, Std. β= -.379, p<.001; block 2: B value= -.321, Std. β= -.377, p=.001). For all other variables, B values≤|26.687|, Std. βs≤|.152|, ps≥.231. These results are similar to that in Sample 2, with BAPQ total being the best predictor in the context of other BRIEF variables. The analyses regarding BAPQ subscales have already been conducted as a result of a similar finding with neuropsychological test measures in Sample 1.

Summary of Replication Analyses: Sample 1

Replication of analyses including BRIEF-A subscales in Sample 2 with Sample 1 showed similar results between the two studies. Those with the BAP had significantly higher scores on the BRIEF-A scales of Inhibition, Plan Organize, Task Monitoring, and Shift. Plan Organize was the best predictor variable for BAPQ Rigidity, and self-report of working memory predicted pragmatic language on the BAPQ but not the RMET. However, in replication of the regression for problem focused coping, Task Monitoring and Plan Organize were the best predictors of problem focused coping, not Shift as observed in Sample 2 (although Shift was a significant predictor when entered by itself). However, again, BRIEF-A scores and social cognition scores were non-significant predictors of CSFI total, resulting in BAPQ Aloof being the best predictor of CSFI total.

Table 39

Sample 1 Hypothesis 5.1: Regression Predicting CSFI Coping Total Score

Run	Block	Variables Entered	*F* value (*dfb,dfw*)	R^2	B Value	Std. β	*p* value
1[1]	1	Overall Model	5.235 (5, 141)	.161			<.001
		LG10_BRIEF Plan Organize			-26.687	-.120	.393
		BRIEF Shift			0.265	.152	.213
		BRIEF Task Monitoring			-0.053	-.031	.813
		RMET Total			-0.522	-.096	.231
		BAPQ Total			-0.322	-.379	<.001
	2	Overall Model	4.333 (6, 141)	.161			<.001
		LG10_BRIEF Plan Organize			25.814	-.116	.421
		BRIEF Shift			0.262	.150	.222
		BRIEF Task Monitoring			-0.055	-0.032	.807
		RMET Total			-0.053	-0.098	.231
		BAPQ Total			-0.321	-0.377	.001
		Gender			.565	-0.010	.901
2[2]	1	Overall Model	11.589 (2, 141)	.131			<.001
		LG10_BRIEF Plan Organize			-13.888	-0.062	.504
		BAPQ Total			-0.290	-0.341	<.001

[1]Variables with high multic[1]Influential variables deleted, n=142.

[2]Variables with high multicollinearity to Plan Organize deleted, n=142.

See Appendices H (Sample 1) and G (Sample 2) for a summary of the results of this study.

DISCUSSION

Overview

The purpose of the study was to examine if BAP characteristics were related to EF difficulties that could make coping with a child with a disability difficult. It also examined relations between BAP characteristics and Executive Function (EF) and how EF would relate to coping strategies, particularly coping flexibility. As well, the current study assessed the incidence of the Broad Autism Phenotype (BAP) in parents of children with Autism Spectrum Disorders (ASDs) and Other Developmental Disabilities (ODDs).

Results are discussed in detail below. Implications of the findings, and strengths and limitations of the current study are presented. Last to be discussed is suggestions for future research in this area, as well as possible clinical applications of this work.

Hypothesis 1: Prevalence of the Broad Autism Phenotype.

It was hypothesized that the incidence of the BAP would be higher in parents of children with ASDs than in parents of children with ODDs. This hypothesis was not supported in either Sample 1 or Sample 2.

It was of interest that in Sample 1, 30.56% of the AUT parents were ESL, and thus had diverse cultural backgrounds. It is possible that the BAPQ cutoff scores as developed by North American culture were inappropriate for those of different cultural backgrounds. However, this argument becomes less plausible when the results of Sample 2 are considered—Sample 2 was primarily comprised of participants living in the USA where the BAPQ was developed (Hurley et al., 2007). However, as ESL status was not assessed in this sample, it is unknown as to how many of the Sample 2 participants were ESL. As such, it is difficult to draw a firm conclusion on the matter of BAPQ validity in persons for

whom English is not their first language or those who have minority culture backgrounds. Future research will be required to address this issue. As well, it is possible that the higher educational level observed in this sample compensated for whatever difficulties those with ESL might have.

Another explanation for this lack of incidence difference is the possibility of sampling bias. Participants in most samples were primarily women, in whom social interest and verbal ability are often higher in general, who generally outperform males on measures of social inference making (Lanting, Haugrud, & Crossley, 2009; Hurley et al., 2007; Zhao et al., 2007). This study required one-on-one interaction with the examiner, and participants were recruited primarily from community events. It is possible that, particularly for Sample 1 (assessment), those higher on the BAP may have not had the opportunity to find out about the study due to not attending community events. Sampling bias may also apply to Sample 2 (online data), as those who are highest on the BAP may be less likely to be a part of online groups. However, it is also possible that sampling bias does not adequately explain the lack of differences observed in Sample 2.

Another explanation could be that the BAPQ does not adequately address the BAP. For example, the BAPQ does not assess restrictive interests or stereotyped behaviours, (Hurley et al., 2001; Dawson et al., 2007), heightened anxiety (Austin, 2005), or visual strengths such as attention to detail (Scheeren & Stauder, 2008; Hill, 2004; Hughes et al., 1999; Bolte & Poutska, 2006; Pisula, 2003), which may be observed in the BAP. As well, Perhaps the BAP looks different in parents of children with ASD versus those with ODD—for example, perhaps problems with rigidity and/or ToM are observed in ASD samples, but more problems with EF are observed in ODD samples.

Finally, it is possible that the incidence of the BAP is *not* higher in parents of children with ASDs when compared to parents of children with Other Developmental Disabilities. Past research has attested to differences between control parents and ASDs—it is possible that the BAP (which the endophenotype of poor ToM, poor planning, or weak central coherence) is observed at a higher incidence in parents of children with learning disabilities as well, particularly in light of the research implicating EF weaknesses in the BAP and in parents of children with ODDs, and the research indicating poor social skills in children with learning disabilities (Diamantopoulou et al., 2007; Delorme et al., 2007; Friedman et al., 2008; Glasse & Ramstam, 2009).

Hypothesis 2: Executive Function and the Broad Autism Phenotype

Hypothesis 2a. It was expected that individuals with the Broad Autism Phenotype would have lower executive functioning scores in the areas of problem solving, cognitive flexibility, planning, and verbal fluency. This hypothesis was partially supported. In Sample 1, those with the BAP did show lower scores on Letter Fluency as well as Total Words Generated in the 2nd 15" interval. It is possible that the structure of the tasks masked difficulties that those with the BAP would have in terms of generating words (Ponnet, Busse, Roeyers, & Clercq, 2008). However, it is of interest to note that Letter Fluency was, in accordance with standardized procedures, the first of the VF tasks presented (Delis et al., 2001). It is possible that Category fluency and Category Switching performance were increased compared to Letter Fluency performance due to the benefit of practice from the Letter Fluency. This argument is strengthened when considering the second difference—that of fewer words generated in the 2nd 15" interval across Letter and Category Fluency tasks. Total Words Generated in the 2nd 15" interval is thought to be

related to purposive generative executive function strategies whereas the First 15" is thought to be more of an automatic response (Hurks et al., 2006). Thus it appears that automatic responses to language cues (letters, categories) across BAP status are similar, but those with the BAP might benefit more from practice than those without when generation of a strategy is required.

Given that the research implicating planning difficulties is particularly robust (Piven & Palmer, 1997; Hughes et al., 1997; Hughes et al., 1999; Goussé & Rastan, 2010), the lack of differences between BAP Status on a measure of planning (the Tower Task) was unexpected. It is possible that the lack of difference was due to the lower complexity of the particular tower task (the Tower of California)—past research utilizes the Tower of London frequently, which may allow for less compensation for planning deficits (Gokcen et al., 2009; Delis et al., 2001).

Hypothesis 2a using BRIEF scores. Differences in executive function by BAP Status were observed when the BRIEF-A subscales were utilized as dependent variables. These findings were observed in both Sample 1 and Sample 2. As expected in a non-clinical sample, the mean scores of both groups (BAP Present/Absent) were below the clinical range ($T \geq 65$). However, a difference of approximately 10 points (1 standard deviation) was consistently observed between groups (Roth et al., 2005). Although differences in (self-report) EF between groups was expected for planning and possibly shifting, the differences between groups on Inhibition was not expected based on research (Hill, 2004; Klienhans et al., 2008; South et al., 2007; Tager-Flusberg, 2007). Task Monitoring had yet to be assessed in research. These results suggest more widespread difficulties with EF in the BAP than just planning (Goussé & Rastan, 2010). It is possible

that the more real-world applicability of the BRIEF-A was a more sensitive measure compared to neuropsychological tests, in which the structure and one-on-one administration can be unlike the demands of the natural environment (Gouldern & Silver, 2009). Alternatively, method variance (both were self report measures) or an increased attention to perceived cognitive difficulties could explain the association between BRIEF-A and BAP scores. Finally, "parents of children with ASDs" and "persons showing the BAP" are often used interchangeably in research (Losh et al., 2009)—it is this ASD and/or BAP group for whom the planning deficit was supported in research. It is possible that lack of separation of groups into BAP present/Absent, which included people who both had a child with an ASD and did not have a child with an ASD created a confound in previous research.

Hypothesis 2b: Rigidity. For Sample 1, it was expected that VF scores would be predictive of Pragmatic Language. However, while Gender was a significant predictor, no VF scores were. One reason for these findings may be related to the structure of the VF task (one-on-one "testing") compared to real-world social settings in which (as reflected in the BAPQ PL questions) more self-monitoring may be required, it would be easier to get sidetracked from the conversational goal, and turn taking is not prefaced by explicit instructions as to when the examinee should begin and end speaking (Goulden & Silver, 2009; Hurley et al., 2001; Delis et al., 2001; Ponnet et al., 2008). Lack of predictive value may also be related to the scoring of the VF task. Pauses in VF while the person thinks about what to say, or how they say it (intonation) are not counted either for or against their score (although pauses, lengthy or not may result in fewer overall words produced), while the Pragmatic Language scale on the BAPQ does assess these conversational difficulties

(Hurley et al., 2001; Delis et al., 2001). As well, the Pragmatic Language scale also assesses a difficult to quantify "in tune" (Hurley, 2001, p. 1689) quality of interaction (interest of the other person, changing behaviour which is interpersonal in nature (how it is said) and would appear to be relatively independent of the content (what was said) (Griffiths, 2007).

Hypothesis 2b with BRIEF-A Scores. In Sample 2, Plan Organize was a significant predictor of BAPQ Rigidity such that having more problems with planning and organization was predictive of more rigidity. Interestingly, in Sample 1's replication of the Rigidity regression, shifting, self-monitoring, and planning and organizing behaviour were all predictive of Rigidity. In both samples, planning and organizing behaviour showed high multicollinearity with all other BRIEF scores in the model (but less multicollinearity between the other variables was observed). While the replication of findings (planning being a significant, if not the best, predictor of rigidity) supports the idea of difficulties in planning in those with the BAP, the fact that many BRIEF Scores were significant predictors of rigidity precludes a definitive interpretation of these findings without further research. The findings also suggest that planning and organization might be a skill requiring multiple executive functions; weaknesses in any of these areas could result in the planning weakness observed in parents of children with ASDs (Goussé & Rastan, 2010). As such, the grounding research for the study may have been non-specific in nature. Future research could further elucidate the interrelation of planning and other EF domains, particularly in the context of non-testing situations (Peterson et al., 2009).

Hypothesis 2b: Pragmatic Language. It was expected that working memory would be negatively predictive of problems with pragmatic language (that is, better WM

would predict a lower "problems with pragmatic language score". This hypothesis was supported. Working memory association with pragmatic language is robust in research related to schizophrenia patients (Lysaker et al., 2005), and recent research suggests that some research in the schizophrenia population can be generalized to the ASD populations (Couture et al., 2010). Working memory is important in many non-social tasks (Alloway, 2009; Noel, 2009), but is thought to be particularly important for learning new information, and keeping up with an ever-changing, multi-dimensional task such that would be encountered in social situations (Griffiths, 2007).

Hypothesis 3: Social Cognition and the Broad Autism Phenotype

Hypothesis 3a. It was expected that those presenting with the BAP would have lower scores on social cognitive measures (UOT for Sample 1 only; RMET for both Samples 1 and 2) compared to those without the BAP. As well, it was thought that due to weaknesses in ToM, those with the BAP would show longer response latency when responding to RMET stimuli.

Both the UOT (Camodeca, 2009) and the RMET (Baron-Cohen, 2001) have normative data with which to compare scores. The UOT average score for both BAPQ groups in Sample 1 (approximately 13 points) was similar to normative data (Camodeca, 2009). For both Sample 1 and Sample 2, the RMET score for both BAPQ groups (26 points for females and 22 points for males) was similar to normative data (Baron-Cohen, 2001).

Interestingly, a difference in response latency on the RMET was observed in Sample 2 (online data collection). Although these differences in response latency were not observed in Sample 1, the results of Sample 2 seem more compelling as everyone in

Sample 2 was administered the RMET in the same way (online). However, the difference was not in the expected direction; as research indicates children with ASD perform more accurately when facial information is presented more slowly (Tardif et al., 2007), and those with the BAPQ actually responded more quickly than those without. As there were no significant differences in correct responses, it does not appear that those with the BAP responded without considering the options or that their quickness in responding was detrimental to performance (Clark, Winkielman, & McIntosh, 2008). This finding could mean that their ToM skills are more automated than those without the BAP (Rule, Ambady, & Hallet, 2009; Rawson & Milldleton, 2009). Or, as anxiety is often observed in parents of children with ASD (and thus, as is currently conceptualized in research, the BAP; Austin, 2005), it is possible that the same hyperviligance to negative emotions in others as observed in anxious persons is also observed in those with the BAP (Puleo & Kendall, 2010); error analysis could elucidate if response time differed across target items. Finally, it is possible that although weaknesses in ToM were not evident, abnormal visual tracking of the picture was (Chawarska, Volkmar, & Klin, 2010; Itier & Batty, 2009). It could be that those with the BAP looked at the eyes quickly and then looked away, showing the avoidance of eye region that is observed in those with ASDs, decreasing their response latencies but not showing a speed/accuracy tradeoff (Rommelse, Van der Stigchil, & Sergeant, 2008; Clark et al., 2008). Although replication is necessary, any of these explanations could be investigated through future research.

Regardless of the difference in response latency, the lack of difference between correct answers between BAP status groups as well as the “average” mean score obtained by both groups suggests that the RMET requirements were within the abilities of both

groups. Interestingly, however, the RMET response latency was negatively skewed for participants in both Sample 1 and Sample 2, indicating that overall, people responded quickly; those with the BAP just responded more quickly. Taken together, these observations suggest that ToM as measured by the RMET is a very basic skill (Clark et al., 2008). As such, it may not be that those with the BAP have current deficits in basic social or ToM skills, but experience difficulties with more complex social skills not assessed by the social cognitive tasks utilized in this study (Peterson, Garnett, Kelly, & Attwood, 2009)

One way to address this issue is to utilize more complex Theory of Mind (ToM) tasks, which would require more working memory, higher level ToM skills, or different ToM skills, such as self-perspective inhibition (Corcoran, Mercer, & Frith, 1995; Gokcen et al., 2009; Janssen Krabbendam, Jolles, & van Os, 2003; Sabbagh, 2004; Samson, 2009).

Hypothesis 3b. In Sample 1, the hypothesis that social cognition would predict Pragmatic Language was partially supported as the UOT was a marginal (p=.011) predictor in the context of other variables (gender and ESL). This finding makes sense in that both the Pragmatic Language scale and UOT require verbal output and the understanding of others' emotions (Hurley et al., 2001; Dyck et al., 2001). Further, it is probable that the UOT is a more complex ToM task—the examinee must keep multiple pieces of information in mind, make an inference, and generate a response (Dyck et al., 2001; Gokcen et al., 2008).

Neither RMET total or RMET Response latency predicted pragmatic language in either Sample 1 or Sample 2. It was unexpected that the RMET would not emerge as a significant predictor, particularly due to the idea that an understanding of other's emotions

would facilitate the pragmatics of language (Dyck et al., 2001; Lysaker et al., 2005). However, research suggests that there is a distinction between the skills required for Pragmatic Language (verbal output and verbal comprehension during conversations) and visual inference making about emotions that is required for the RMET, which may explain what was observed here (Hassenstab, Dziobek, Rogers, Wolf, & Convit, 2007). As well, given the association between working memory and RMET score in Sample 1, it is possible that working memory serves as a mediator for pragmatic language (Yaghoub, Imbolter, & Cohen, 2007).

Hypothesis 3c: Predicting RMET total score from LNS. This hypothesis was supported. In Sample 1, LNS was a significant predictor of RMET score. This finding was expected given the past research relating working memory to social cognition. However, research suggests that working memory is predictive of more than just social cognition (Alloway, 2009; Noel, 2009). As such, LNS may not be a specific predictor although it did predict RMET score in Sample 1. However, this finding that WM predicts RMET score provides support for the idea discussed above—that RMET is a basic skill—as such it is more of a working memory task in a non-clinical (non-ASD) sample than it is a task of ToM (Leitman et al, 2010).

Hypothesis 3c: predicting UOT with working memory. The idea that working memory would predict the score on the UOT was not supported; in fact, Vocabulary from the WAIS-IV was the best predictor. One explanation for these findings could be that association with working memory could have been attenuated because the item could be repeated as many times as requested. Another explanation is that LNS test was not sensitive to working memory difficulties—for comparison, one study investigating the

BAP used a measure of verbal working memory, the Auditory Consonant Trigrams (ACT; Lezak, 2004), which does not allow for rehearsal and requires divided attention (Gokcen, 2007).

That Vocabulary was the best predictor of UOT score coupled with the differences observed on both the UOT and Vocabulary tests in the ESL participants could be interpreted to mean that the UOT is similar in content to the Vocabulary subtest. Vocabulary draws upon previously learned and memorized verbal material that has to be accessed, with more precise responses being given higher scores (Weschler, 2007). As vocabulary is the basis for language understanding (Braze, Tabor, Shankweiler, & Mencl, 2007; Yeatman, Shachar, Glover, & Feldman, 2010), it is possible that the UOT taps something that is a basis for social understanding. The implication of which is that this task is not assessing social inference making (comprehension level) as is believed (Dyck et al., 2007), but assesses the ability to recall a previous experience in which that unexpected outcome might have occurred. Future research could investigate this idea.

Hypothesis 3c: BRIEF-A scores in Sample 1 and Sample 2. In both studies, self-report of working memory was not predictive of score on the RMET. Given the vast amount of research implicating working memory in social cognition (e.g., Lysaker, 2005), it is possible that a) the same relation is not observed in non-clinical populations (Leitman et al., 2010), or b) the ecological validity of the RMET and the BRIEF-A Working Memory subscale are not comparable (Silver, 2000). As well, the veracity of working memory self-reports may be questionable.

Hypothesis 4: Cognitive Function and Coping

Hypothesis 4a. The hypothesis that problem solving tasks, including variables such as planning, concept formation, and working memory would be predictive of problem focused coping (CSFI Problem Focused Coping score) was not supported. This finding could support a discrepancy between social (and emotional) cognition, as has been observed in research (Allen, Strauss, Donohue, & van Kammen, 2007; Chawarska et al., 2010; McPartlan, Webb, Keehn, & Dawson, 2010; Prothmann, Ettrich, & Prothmann). However, in both Sample 1 and Sample 2, the BRIEF scores that predicted problem focused coping loaded on the Meta-Cognitive index (not the Behavioural Regulation Index) (Roth et al., 2005) which could suggest that at some level task-oriented EF is related to coping, as observed in clinical populations (Lysaker et al., 2005). The relation between EF and coping could be different in this non-clinical population however (Eack et al., 2008). Also, as mentioned previously, the structure of the neuropsychological tasks could contribute to poor ecological validity (Silver, 2000).

Hypothesis 4b. The hypothesis that social cognitive factors (RMET total correct, RMET response latency, and/or UOT total) would predict social support as coping was not supported in these non-clinical samples with overall average scores on social cognitive measures. It is possible that a curvilinear relationship best describes the relation between social cognition and coping, or that group differences in coping would be observed if persons were classified into “at least average” and “below average” groups. As well, these participants were, for the most part married or cohabiting; it is likely that their partner was a source of social support for them regardless of their BAP characteristics (Pollman, Finkenauer, & Beeger, 2010).

Hypothesis 5: Coping Flexibility

The idea that coping flexibility would be predicted by social cognition, EF, and BAP characteristics was partially supported in that BAP characteristics (specifically Aloofness) were predictive of coping strategy use. This finding is not entirely unexpected given the findings of hypothesis 4a in Sample 1 (no predictive utility of neuropsychological tasks), but it is surprising given the findings related to the BRIEF and problem focused coping (did show predictive utility). These findings suggest that a preference for being alone was related to decreased use of different coping strategies across different situations (Cheung & Cheung, 2005); as Aloofness was shown to be the best predictor in both studies, it appears that Aloofness is the variable most likely responsible for decreases in varied different coping strategy use.

Future research will need to be conducted to further elucidate this relation. It is possible that this Aloofness selectively decreases the seeking social support score (Pollman et al., 2010). As no differences in RMET and UOT scores were observed across BAP Status, it could be that Aloofness is a mediator for coping strategy use that is related to motivation for social contact. It is also possible that Aloofness decreases two or more scores on the CSFI.

Overall Conclusions

These findings suggest that there is a distinction between social reasoning and non-social reasoning, at least at basic levels (Allen, Strauss, Donahue, & van Kammen, 2007). However, as social interaction/coping/academic tasks become more complex, more executive functions may be required. Planning ability may be a particularly complex executive function. These executive functions may not be adequately tapped by

neuropsychological tests, which are highly structured, and might be better assessed through either more complex tasks or questionnaires (Goulden & Silver, 2009).

The correlations between the self-report (BRIEF-A) and measures of coping, and the differences between the BAP statuses on the BRIEF-A measures supports the idea that it is more complicated, higher order difficulties that are observed in the BAP. This brings up the idea that the BAPQ (at least for some) is less of a deficit in basic social reasoning compared to higher order social reasoning. Whether the higher order social reasoning overlaps with higher order academic reasoning is unknown and was not assessed in this study. However, these findings do present the *idea* that the BAPQ is a deficit of (social) executive function as opposed to basic social skills, and that it is this basic skill deficit that is associated with clinically diagnosable ASD (Lindgren, Folstein, Tomblin, & Tager-Flusberg, 2009). Alternatively, given the research implicating attention to social cues in parents of children with ASDs, there may be a deficit at an attention level to social cues level that was not adequately assessed in this study (optimal attention to highly structured, mostly academic tasks was obtained in the one-on-one testing situation). A final (likely) possibility is that attention and executive function mediate each other in real world situations in ways that were not captured by this methodology; as such both attention (basic skill) and executive function (higher level skill) are implicated in the BAP.

These findings also suggests that in terms of the coping deficits observed in clinical populations (i.e., schizophrenia), it may be a different mechanism than academic problem solving or social cognition that leads to poor coping. It could also be that these variables (EF, social cognition, personality characteristics, and coping) are differentially related in clinical populations (Leitman et al., 2010; Ojeda et al., 2010).

Strengths of the Current Study

This study examined characteristics of the BAP regardless of the type of disability in the child, which avoids a potential confound in which some parents of children with ASDs do not have the BAP. This study is one of the few that examined the relation between social cognition and non-social cognition. Both self-report and task measures were utilized in this research.

Limitations of the Current Study

Measurement of variables. The social cognitive tasks utilized in this study were relatively basic, as evidenced by the correlations between RMET and LNS (the task was essentially a working memory task for this sample) and the generally quick response latency (highly negatively skewed distribution). As well, the fact that Vocabulary predicted the UOT score best could mean that it requires similar skill—verbal output of learned material. Thus essentially no "complex" social inference measures were utilized in the study, making the mundane realism of the tasks low. As well, only two measures of social reasoning were utilized in this study, limiting the social cognitive variables that could be assessed, especially compared to the number of EF measures utilized. The Tower Task on the D-KEFS as well as the LNS task from the WAIS-IV may also have been easier than other tasks tapping the same skills.

Sampling and sample characteristics. Particularly for Sample 1, it is possible that sampling bias played a role in the results. This study required one-on-one interaction with the examiner. Community sample participants were recruited primarily from community events for parents and their child with disabilities. It is possible that those higher on the BAP may have opted out or not even been at the event to be approached by

the researcher or receive a flyer about the study. Additionally, less than one-third of the eligible participants from the participant pool ultimately completed the study; it is possible that those with better EF and/or lower BAP scores were non-consenters to Stage 2 or non-completers of Stage 2.

As is true for many research studies, the majority of participants were female, mostly college educated or better, and of generally high SES (Lim, Tsai, Bender, Chee, & Im, 2006; Longeneck et al., 2010). While the current study is internally valid in terms of the categorization of the BAP due to use of gender-normed cutoff scores (Hurley et al., 2007), the external validity of this study is in question, particularly because of the gender imbalance in terms of learning disabilities (more males) (Donfrancesco et al., 2010). More difficulties with EF might have been observed in a sample that contained more males; as well, perhaps different relations between the BAP and EF would be observed in males. In terms of education, the majority of participants in this study were college or University educated, which may be associated with lack of difficulty in EF. Educational attainment is highly associated with SES (Carozza et al., 2010). As such, as might be true for gender, perhaps more difficulties with EF or different relations between the BAP and EF would be observed in a sample of lower educational attainment/lower SES (Hackman & Farah, 2009; Weibe et al., 2010). Future research could elucidate these ideas.

As well, given the research on de novo mutations and sporadic autism, perhaps it would have been more informative to examine siblings of children with ASDs (Liu et al., 2009). Interactions between having multiple incidences of ASD vs. only one child with ASD, or having multiple children with ODD including a child with ASD and the BAP characteristics were also not assessed.

Suggestions for Future Research.

ToM tasks. In terms of ToM, more subtle differences could be examined, such as attentional biases and/or eye movements on the RMET, differential response patterns to emotion subtypes, free-recall as opposed to non-multiple choice methods of emotion naming. As well, more complex measures of social inferencing could be used, like the Hinting Task (Corcoran, Mercer, & Frith, 2005), which requires a person to understand a subintelligitur from an orally presented scenario.

BAP characteristics. Future research could examine the factor structure of the BAPQ questionnaire in ODD and ASD samples, as well as identify profiles in different samples. The BAPQ and the Broader Phenotype Autism Symptom Scale (BPASS; Dawson et al., 2007) could also be compared for their efficacy in identifying the BAP. As ASDs are social disorders, the BAP inherently suggests difficulties in social reasoning, yet research is equivocal and difficulties in EF (a secondary ASD characteristic) have been observed. Given the heterogeneity of ASDs, and that some with ASD can pass ToM tasks (McParland, Webb, Keehn, & Dawson, 2010; Peterson et al., 2009), future research could work to elucidate how many/how much (severity) of multiple criteria a person could meet to "have" the BAP as opposed to identifying "the" endophenotype of the BAP.

Sampling. Future studies could utilize more random sampling methods; as well it might be more informative to utilize siblings as opposed to parents when researching the BAP. Furthermore, the research could benefit from separating those who have the BAP and are parents of children with ASDs vs. those who are not parents of children with ASDs. As well, although the BAP present/not present was accomplished using gender adjusted norms, the fact remains that BAP characteristics are stronger in males, which

were underrepresented in this research. Future research could include recruitment strategies that would increase the likelihood that males would participate, and also investigate the impact of gender on expression of executive function weaknesses in the BAP.

Reciprocal relations and coping. Research could examine what optimal coping strategies are in families with children with ASDs, and identify similarities and differences between coping strategies and outcomes in families that do not have to deal with disability. One area of research could examine the relation of child social reciprocity and coping in parents (Ruble, McDuffie, King, & Lorenz, 2008). Finally, research consistently indicates that some skills, such as reading, are consistently learned/mastered the same way, even across cultures and with different languages (Furnes & Samuelsson, 2010). As coping is a skill, it is possible that everyone learns to cope effectively in the same way. As such, social support may be necessary for everyone, even those with autism characteristics, although this support may look different for those with the BAP. For example, someone with the BAP may have one or two confidants, whereas someone who is less aloof or better at pragmatic language may have several confidants. Alternatively, those with the BAP might rely less on face-to-face contact and might prefer contacting friends through email or on-line groups. Future research could investigate this idea as well.

The purpose of this study was to elucidate executive function and social cognitive weaknesses in the Broad Autism Phenotype population and identify how weaknesses in either of these areas could influence coping repertoire and coping flexibility. The current study suggests that, at least in non-clinical samples, there is a distinction between social-emotional functioning and more academic (task based reasoning) such that executive

function as assessed by neuropsychological tasks, social cognition, and coping are mostly not related. This study does support the idea that more ecologically valid measures should be used in assessing the relation between social-emotional functioning and executive function. This study also provided evidence for global weaknesses in executive functioning in the Broad Autism Phenotype as assessed by self-report, although the importance of planning as a marker for the Broad Autism Phenotype was also supported. Finally, these results showed that the Broad Autism Phenotype characteristic of Aloofness was very important in coping strategy use.

Implications for Practice

For those with the Broad Autism Phenotype, it is possible that one individual will exhibit *all* the BAP characteristics observed in this study at equal levels of severity; however, it is more likely that heterogeneity in specific BAP characteristics will occur. Nonetheless, the findings of this study provide a template from which to work with individuals showing the BAP to remediate or compensate for weaknesses.

The attention and working memory continuum is an important factor for inhibition, planning and organizing, task monitoring, and shifting, as well as in social situations with high pragmatic language demands (Cicerone et al., 2005). Strategies that allow for improved working memory performance relate to breaking information into smaller pieces, automatizing skills and incorporation of routines, taking breaks from difficult tasks that require more focused attention, and providing visual supports. With regard to the specific areas of weakness noted, specific targeted teaching of strategies would be beneficial, along with frequent and directed practice (Cicerone et al., 2005; Fish et al., 2007). The specific strategies employed, however, would be dependent on the situations

and executive areas in which there is difficulty (Bade, 2009; Ruble, McGrew, Dalrymple, & Jung, 2010; Wolf, 2010). For example, for a parent who is experiencing difficulty with being on time for his or her child's many appointments with different intervention specialists (i.e., speech, occupational therapy, tutors, etc.), strategies such as the use of an electronic or paper agenda with clear visuals such as colour coding blocks of time, viewing a week at a time, and identification of required "preparation and travel" periods before appointments and at the end of each day might be beneficial (Cicerone et al., 2005; de Joode, van Heugten, Verhey, & Boxtel, 2010; Gentry, Wallace, Kvarfordt, & Lynch, 2010). However, for a parent who, during meetings with their child's teacher about undesirable behaviours in the classroom, talks at length about their own current marital problems instead of problem solving with their child's teacher regarding the behaviours, external structure such as cues ("we need to talk about ____") and ignoring comments about the parent's own problems could be beneficial, as could referral to a counsellor for an appropriate outlet for their difficulties. Another idea could be a pre-meeting routine that involves the parent reminding him or herself of the topics on which to focus for the meeting to prevent becoming derailed by conversation that would best be directed toward another professional or a friend (Cicerone et al., 2005; Fish et al., 2007; Hayes, Hirano, Marcu, Monibi, Nguyen, & Yeganyan, 2010).

In terms of coping, planning and organizing problems were consistently predictive of less problem focused coping use. As such, teaching planning and organization strategies with regard to coping would likely be beneficial, particularly as problem focused coping is consistently associated with improved psychological adjustment (Cheung & Cheung, 2005). Identifying specific situations which prove difficult to employ problem focused

coping strategies, identifying specific strategies to employ in each situation, and providing as much practice as possible with these situations to make the responses more automatic and habitual would likely be beneficial (Cicerone et al., 2005; Drahota, Wood, Sze, & Van Dyke, 2010; Zamarian, Ischebeck, & Delazer, 2009). The techniques associated with various cognitive behavioural therapies for particular situations and feelings, such as social skills, anger management, anxiety, depression, or procrastination would seem particularly suited to these parents with these difficulties (Kennard et al., 2009; Lang, Regester, Lauderdaule, Ashbaugh, & Haring, 2010; Puleo & Kendall, 2010; Poggi et al., 2009; Reaven, 2009; Sitdhisanguan, Chotikakamthorn, Dechaboon, & Out, 2008; Steel, 2010; Willner & Tomlinson, 2007).

Although the impact of the BAP on the interaction in the therapeutic relationship was not addressed in this study, the impact of the aloof characteristic may be particularly important in determining who seeks out face-to-face treatment as a coping strategy. Those with the BAP may be less likely to initiate therapy or return for subsequent appointments. As well, rigidity or pragmatic language difficulties in addition to aloofness may impact how they interact in treatment, which may differ from the "typical" client and may be misinterpreted by therapists unfamiliar with autism-like characteristics. As such some of those with the BAP may prefer online message groups or self-help books that give specific recommendations that can be implemented without consulting others. In addition, there may exist a bias by mental health professionals that face-to-face therapy is the best way to address coping difficulties, whereas currently no research exists with regard to aloofness and optimal coping. All of these hypothesess could be addressed in future research.

In summary, as determined by this community sample, persons with the BAP are likely to be encountered when dealing with persons with or without children with autism spectrum disorders. While this study generally shows that persons with the BAP have no difficulties with thinking ahead, stopping or starting behaviours, and being goal-directed on specific neuropsychological tests, there is evidence that those with the BAP may require a practice trial to perform their best. As well, when demands increase, particularly with regard to performance of tasks that require considering many things at one time, or when a lot of thinking ahead is needed, those with the BAP may perform worse than one might expect. Finally, those with the BAP may require more external assistance with regard to engaging in a variety of coping strategies.

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Appendix A

Hypotheses and Test Descriptions

Hypothesis	Sample	Groups	Test(s)	Independent Variable(s)	Dependent Variable(s)
1. The Broad Autism Phenotype will occur more frequently in parents of children with autism spectrum disorders than control parents.	1	AUT ODD NoDx	Chi Square Test of Independence	Autism Parent/Parent of Child without autism	BAP[3] Have/BAP Not Have
	2	AUT ODD[2]			
2a. Those individuals with the Broad Autism Phenotype will have lower executive functioning scores in the areas of problem solving, cognitive flexibility, planning, and verbal fluency.	1	AUT ODD NoDx	Independent Samples T tests	BAP Have/BAP Not Have	D-KEFS[4] Colour Word Interference D-KEFS Sorting Task D-KEFS Tower Task D-KEFS Verbal Fluency Trail Making Test B/A ratio
	2	AUT ODD[2]	Independent Samples T tests	BAP Have/BAP Not Have	BRIEF-A[5] Inhibition BRIEF-A Plan/Organize BRIEF-A Task Monitoring
2b. The Broad Autism Phenotype characteristics of problems with pragmatic language and rigidity will be negatively predicted by executive function, specifically the domains of problem solving, cognitive flexibility, planning, working memory, and verbal fluency.	1	AUT ODD NoDx	Multiple Regression	D-KEFS Sorting Task D-KEFS Tower Task Trail Making Test B/A ratio	BAPQ Rigidity
			Multiple Regression	WAIS-IV LNS[7] D-KEFS Verbal Fluency	BAPQ Pragmatic Language

	2	AUT ODD[2]	Multiple Regression	BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Inhibition BRIEF-A Switching	BAPQ Rigidity
			Simple Regression	BRIEF-A Working Memory	BAPQ Pragmatic Language
3a. Those individuals with the Broad Autism Phenotype will have deficits in social cognition.	1	AUT ODD NoDx	Independent Samples T tests	BAP Have/BAP Not Have	RMET[8] Total Correct RMET Response Latency UOT[9] Score
	2	AUT ODD[2]	Independent Samples T tests	BAP Have/BAP Not Have	RMET Total Correct RMET Response Latency
3b. The Broad Autism Phenotype characteristic of problems with pragmatic language will be negatively predicted by social cognition.	1	AUT ODD NoDx	Multiple Regression	RMET Total Correct RMET Response Latency UOT Score	BAPQ Pragmatic Language
	2	AUT ODD[2]	Multiple Regression	RMET Total Correct RMET Response Latency	BAPQ Pragmatic Language
3c. Social Cognition will be positively predicted by Working Memory	1	AUT ODD NoDx	Simple Regression	WAIS-IV LNS	RMET Total Correct
			Simple Regression	WAIS-III LNS	UOT Score
	2		Simple Regression	BRIEF-A Working Memory	RMET Total Correct

4a. Problem Focused Coping will be positively predicted by executive functioning, specifically the executive function areas of problem solving, working memory, and planning.	1	AUT ODD NoDx	Multiple Regression	D-KEFS Sorting Task D-KEFS Tower Task WAIS-III LNS	CSFI[10] Problem Focused Coping
	2	AUT ODD[2]	Multiple Regression	BRIEF-A Working Memory BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Switching BRIEF-A Organization of Materials	CSFI Problem Focused Coping
4b. Social Support Seeking will be positively predicted by social cognition.	1	AUT ODD NoDx	Multiple Regression	RMET Total Correct RMET Response Latency UOT Score	CSFI Social Support Seeking
	2	AUT ODD	Multiple Regression	RMET Total Correct RMET Response Latency	CSFI Social Support Seeking
5. The Broad Autism Phenotype characteristics (problems with pragmatic language, aloof personality characteristics, and rigidity) will be negatively predictive of coping flexibility, and executive functioning (problem solving, planning, and switching) and social cognition will be positively predictive of coping flexibility.	1	AUT ODD NoDx	Multiple Regression	D-KEFS Sorting Task D-KEFS Tower Task Trail Making Test B/A ratio RMET Total Correct UOT Score BAPQ Overall Score	CSFI Coping Flexibility Score

2	AUT ODD	Multiple Regression	BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Switching BAPQ Overall Score RMET Total Correct	CSFI Coping Flexibility Score

[1] Assessment-Autism Parent, Assessment-Other Developmental Disability Parent, Assessment-Undergraduates
[2]Online Questionnaires-Autism Parent, Online Questionnaires-Other Developmental Disability Parent.
[3]Broad Autism Phenotype
[4]Delis-Kaplan Executive Functioning Scales (Delis et al., 2001)
[5]Behaviour Rating Inventory of Executive Functioning-Adult Version (Roth et al., 2005)
Broad Autism Phenotype Questionnaire (Hurley et al., 2007)
[7]Weschler Adult Intelligence Scale-III Letter Number Sequencing (Weschler, 1997)
[8]Reading the Mind in the Eyes Test (Baron-Cohen et al., 1997)
[9]Unexpected Outcomes Test (Dyck et al., 2001)
[10]Coping Styles Flexibility Inventory (Williams et al., 2002).

Appendix B

Demographics Sheet (For Community Sample Assessment Group)

Please answer the following questions by checking the appropriate box or filling in the blank.

1. How did you hear about this study?
   - ☐ University of Windsor Participant Pool
   - ☐ Summit Centre for Preschool Children with Autism
   - ☐ Windsor Community Event (which one:_____)
   - ☐ Website (name of website or web address:_____)
   - ☐ Other (please specify:_____)

2. Age: _____

3. Gender:
   - ☐ Male
   - ☐ Female
   - ☐ Other: _____

4. Ethnic Background:
   - ☐ African American/African Canadian
   - ☐ Canadian
   - ☐ Chinese
   - ☐ French
   - ☐ German
   - ☐ Indian
   - ☐ Irish
   - ☐ Italian
   - ☐ Native American/First Nations
   - ☐ Pacific Islander
   - ☐ Scottish
   - ☐ Other: _____

5. Please select the category below that best matches the highest level of education obtained by you and (if applicable) your significant other (S.O.) by checking 1 box in each column.

You		S.O.
☐	…….Less than Grade 7……..……..…	☐
☐	….……Junior high school (Grade 9)……..	☐
☐	……..Partial high school (Grade 10 or 11)…..…….	☐
☐	...……..…...High school graduate or GED…..……	☐
☐	At least 1 year of college/university or completed ……..……..…..specialized training……..……	☐
☐	……..…..College or university graduate…..……..	☐
☐	...Graduate or professional training (graduate degree)…	☐
	I do not have a significant other.	☐

6. Please select the category below that best matches your and (if applicable) your significant other's (S.O.) current job by checking 1 box in each column.

You		S.O.
☐	….Farm labour, emergency services, or housekeeping…	☐
☐	……..Construction apprentice, attendant, driving……..	☐
☐	..……..Machine operator or semiskilled worker…….	☐
☐	..……..…..…..…..Skilled craftsman…..…..…..……	☐
☐	……..…..Clerical, sales, or administration…..……	☐
☐	……..…..Technician or paraprofessional…..……..	☐
☐	……..…..Managerial, small business owner…..……	☐
☐	……..…..Administrator or medium business owner…….	☐
☐	.Executive, large business owner, or major professional.	☐
☐	*I do not work.* *I do not have a significant other.*	☐

7. Indicate your current job title/position: _____

8. Current relationship status:
   - ☐ Married
   - ☐ Dating significant other
   - ☐ Cohabitation
   - ☐ Divorced
   - ☐ Widowed
   - ☐ Single

9. Check the best classification of your major in college/University:

- ☐ Biological Sciences
- ☐ Business Administration
- ☐ Chemistry and Biochemistry
- ☐ Communication Studies
- ☐ Computer Science
- ☐ Dramatic Art
- ☐ Earth Sciences
- ☐ Economics
- ☐ Education
- ☐ Engineering
- ☐ English Language and Literature
- ☐ Environmental Studies
- ☐ Forensic Science
- ☐ History
- ☐ Human Kinetics
- ☐ Kinesiology
- ☐ Labour Studies
- ☐ Languages, Literatures, and Cultures
- ☐ Law
- ☐ Liberal and Professional Studies
- ☐ Mathematics and Statistics
- ☐ Mechanical, Automotive, and Materials Engineering
- ☐ Music
- ☐ Nursing
- ☐ Philosophy
- ☐ Physics
- ☐ Political Science
- ☐ Psychology
- ☐ Social work
- ☐ Sociology and Anthropology
- ☐ Visual Arts
- ☐ Women's Studies
- ☐ Other (state) _____

10. Think about yourself and your immediate family. Indicate if *you* (1st column) or *your parents or siblings* (2nd column) have a history of any of the following diagnoses. (Check as many as apply).

	You	Your parents or siblings
Autism	☐	☐
Asperger's Disorder	☐	☐
Anxiety Disorder	☐	☐
Depression	☐	☐
History of Speech Delay	☐	☐
Learning Disability in reading, math, spelling, or writing.	☐	☐
Non Verbal Learning Disability	☐	☐
Obsessive-Compulsive Disorder	☐	☐
Pervasive Developmental Disorder NOS	☐	☐
Tourette's Syndrome	☐	☐
Other (please write in):	☐	☐

11. Do you have any **biological** children?
    - ☐ Yes (go to question 12)
    - ☐ No (The remainder of the questions on this surveys ask about **biological** children. Please go on to the next survey.)

12. Indicate the gender of each **biological** child by checking the appropriate box.

Child 1	Child 2	Child 3	Child 4
☐Male ☐Female	☐Male ☐Female	☐Male ☐Female	☐Male ☐Female

13. For the diagnoses that follow, check the box if the diagnosis applies to your **biological** child. Consider each **biological** child separately and check as many diagnoses as apply.

	Child 1	Child 2	Child 3	Child 4
Autism/High functioning autism	☐	☐	☐	☐
Asperger's Disorder	☐	☐	☐	☐
Anxiety Disorder	☐	☐	☐	☐
Depression	☐	☐	☐	☐
History of Speech Delay	☐	☐	☐	☐
Learning Disability in reading, math, spelling, or writing.	☐	☐	☐	☐
Non Verbal Learning Disability	☐	☐	☐	☐
Obsessive-Compulsive Disorder	☐	☐	☐	☐
Pervasive Developmental Disorder NOS	☐	☐	☐	☐
Tourette's Syndrome	☐	☐	☐	☐
Other (please write in):	☐	☐	☐	☐

14. (Biological Mothers will get this question)
Think about your child's biological father and the immediate family (parents and siblings) of your child's biological father. Is there a history of any of the following diagnoses in the **biological** father OR the parents or siblings of the **biological** father of your child or children? If your children have different **biological** fathers, please consider each **biological** father separately. Check as many diagnoses as apply.

	Biological Father		Parents or siblings of Biological Father	
Circle which child/children this person is the biological father of:	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Check here if you do not know this information:	☐	☐	☐	☐
Autism	☐	☐	☐	☐
Asperger's Disorder	☐	☐	☐	☐
Anxiety Disorder	☐	☐	☐	☐
Depression	☐	☐	☐	☐
History of Speech Delay	☐	☐	☐	☐
Learning Disability in reading, math, spelling, or writing.	☐	☐	☐	☐
Non Verbal Learning Disability	☐	☐	☐	☐
Obsessive-Compulsive Disorder	☐	☐	☐	☐
Pervasive Developmental Disorder NOS	☐	☐	☐	☐
Tourette's Syndrome	☐	☐	☐	☐
Other (please write in):	☐	☐	☐	☐

14. (Biological fathers will get this question.)
Think about your child's biological mother and immediate family (parents and siblings) of your child's biological mother. Is there a history of any of the following diagnoses in the the **biologica** mother OR parents or siblings of the **biological** mother of your child or children? If your children have different **biological** mothers, please consider each **biological** mother separately. Check as many diagnoses as apply.

	Biological Mother		Parents or siblings of Biological Mother	
Circle which child/children this person is the biological mother of:	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Check here if you do not know this information:	☐	☐	☐	☐
Autism	☐	☐	☐	☐
Asperger's Disorder	☐	☐	☐	☐
Anxiety Disorder	☐	☐	☐	☐
Depression	☐	☐	☐	☐
History of Speech Delay	☐	☐	☐	☐
Learning Disability in reading, math, spelling, or writing.	☐	☐	☐	☐
Non Verbal Learning Disability	☐	☐	☐	☐
Obsessive-Compulsive Disorder	☐	☐	☐	☐
Pervasive Developmental Disorder NOS	☐	☐	☐	☐
Tourette's Syndrome	☐	☐	☐	☐
Other (please write in):	☐	☐	☐	☐

Appendix C

Unexpected Outcomes Task (Dyck et al., 2001); revised for use with adults

Examiner Instructions:

Discontinue after three consecutive failures.

Read each story to the participant. You may repeat the story if asked or if the person does not respond after 10-15 seconds.

If the participant responds with "I don't know", to the first two questions, you may prompt the participant as indicated.

Sample Story: I'm going to tell you a story. In this story, something happens to a little boy called Tommy. Tommy suddenly feels something or someone push him very hard from behind so that he falls flat on the ground. What would you do if that happened to you? Would you be angry? Or scared? Would you cry? Well, Tommy laughed. Why would Tommy laugh instead of being angry or scared?

Well, maybe Tommy knew who pushed him over because it was his dog Spike, and Tommy and Spike were playing together. Spike always pushed Tommy on the ground and then they would roll over and over.

1-02. Now I'm going to tell you another story. In this story, a little boy called Johnny gets a new bicycle for Christmas. What do you think Johnny would feel? Happy? Well, Johnny didn't feel happy. He started to cry. Why would Johnny cry?

Prompt: What if it wasn't what he wanted? What if it was a "girl's bike? What if he wanted something else?

2-07. Here's another story. In this story, Sean has an ice-cream cone, but he drops it on the ground. How do you think Sean would feel? Sad? Angry? What Sean did was laugh. Why would Sean laugh when he dropped his ice-cream on the ground?

Prompt: Do you think that Sean liked ice-cream? How do you think the ice-cream looked on the ground? What makes you throw food away?

3-03. This story is about a girl named Lisa. Lisa wants a job very much, and one day she gets a letter telling her that she can have just the job she wants. She starts to cry. Why would Lisa be crying?

4-04. Peter is a man who has committed a crime and had to go to court. In the court, the judge tells Peter that Peter will have to go to jail for 15 years. When Peter hears this, he starts to smile a very big smile. Why would Peter be smiling?

5-06. Joan is a woman who, one day, has a very healthy baby. Joan starts to cry. Why would Joan be crying?

6-01. In this story, John likes a girl called Susan, and he wants her to go to the movies

with him. When he asks her, she says yes. At first, he is happy, but when they are on their way to the movies, he is very angry. Why would John be angry?

7-20. Joyce is sitting with some other people. All these people are looking at Joyce as though they are mad at her. Then Joyce yawns. Why would Joyce yawn?

8-12. Mary and June were in a meeting together. The meeting was very uncomfortable; everyone was getting very tense. Then Mary said: "Okay June, I was wrong, I'm sorry." June burst into tears. Why would June start crying?

9-16. John went fishing with his father. Together they a lot of big fish. John bowed his head. Why would John bow his head?

10-10. Ian wants a girlfriend. One day, he meets a girl who he likes more than he has ever liked another girl. And this girl seems to like Ian just as much – and maybe more – as he likes her. Ian laughs and laughs and laughs. Why would Ian laugh?

11-17. Mary was very tired. All of her muscles were tired. So she took a shower and could feel the lovely feeling of the steaming hot water helping her to relax. Then Mary smashed her fist into the wall. Why would Mary smash her fist into the wall?

12-22. Mary was bored. She talked and talked and talked about what a boring day she had just had. And while Mary was talking, her friend June started to cry, just a little bit. What did Mary do? Mary just kept talking. Why would Mary just keep talking?

Appendix D

BAP Questionnaire (Hurley et al., 2007)

Instructions:

You are about to fill out a series of statements related to personality and lifestyle. For each question, circle the answer that best describes how often that statement applies to you. Many of these questions ask about your interactions with other people. Please think about the way you are with most people, rather than special relationships you may have with spouses or significant others, children, siblings, and parents. Everyone changes over time, which can make it hard to fill out questions about personality. Think about the way you have been the majority of your adult life, rather than the way you were as a teenager, or time you may have felt different than normal. You must answer each question, and give only one answer per question. If you are confused, please give it your best guess.

	Very rarely	Rarely	Occasionally	Somewhat often	Often	Very often
1.I like being around other people.	1	2	3	4	5	6
2.I find it hard to get my words out smoothly.	1	2	3	4	5	6
3.I am comfortable with unexpected changes in plans.	1	2	3	4	5	6
4.It's hard for me to avoid getting sidetracked in conversation.	1	2	3	4	5	6
5.I would rather talk to people to get information than to socialize.	1	2	3	4	5	6
6.People have to talk me into trying something new.	1	2	3	4	5	6
7.I am "in tune" with the other person during conversation.***	1	2	3	4	5	6
8.I have to warm myself up to the idea of visiting an unfamiliar place.	1	2	3	4	5	6
9.I enjoy being in social situations.	1	2	3	4	5	6
10. My voice has a flat or monotone sound to it.	1	2	3	4	5	6
11. I feel disconnected or "out of sync" in conversations with others. ***	1	2	3	4	5	6

12. People find it easy to approach me.***	1	2	3	4	5	6
13. I feel a strong need for sameness from day to day.	1	2	3	4	5	6
14. People ask me to repeat things I've said because they don't understand.	1	2	3	4	5	6
15. I am flexible about how things should be done.	1	2	3	4	5	6
16. I look forward to situations where I can meet new people.	1	2	3	4	5	6
17. I have been told that I talk too much about certain topics.	1	2	3	4	5	6
18. When I make conversation it is just to be polite.***	1	2	3	4	5	6
19. I look forward to trying new things.	1	2	3	4	5	6
20. I speak too loudly or softly.	1	2	3	4	5	6
21. I can tell when someone is not interested in what I am saying. ***	1	2	3	4	5	6
22. I have a hard time dealing with changes in my routine.	1	2	3	4	5	6
23. I am good at making small talk.***	1	2	3	4	5	6
24. I act very set in my ways.	1	2	3	4	5	6
25. I feel like I am really connecting with other people.	1	2	3	4	5	6
26. People get frustrated with my unwillingness to bend.	1	2	3	4	5	6
27. Conversation bores me.***	1	2	3	4	5	6
28. I am warm and friendly in my interactions with others.***	1	2	3	4	5	6
29. I leave long pauses in conversation.	1	2	3	4	5	6
30. I alter my daily routine by trying something different.	1	2	3	4	5	6

31. I prefer to be alone rather than with others.	1	2	3	4	5	6
32. I lose track of my original point when talking to people.	1	2	3	4	5	6
33. I like to closely follow a routine while working.	1	2	3	4	5	6
34. I can tell when it is time to change topics in conversation.***	1	2	3	4	5	6
35. I keep doing things the way I know, even if another way might be better.	1	2	3	4	5	6
36. I enjoy chatting with people.***	1	2	3	4	5	6

***Casual interactions with acquaintances rather than special relationships such as with close friends and family members.

Appendix E

CSFI (Williams, 2002)

Think about the ways in which you would normally try to cope with each experience or emotion. Rate each of the four coping responses for how frequently you use it in dealing with each experience or emotion on the following scale. Treat each experience or emotion as separate and respond with how you would normally cope, rather than with how "most people" might cope. There are no right or wrong answers.

		Never	Seldom	Sometime	Often	Always
1.	When I get really angry					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
2.	When I feel guilty					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
3.	When I feel ashamed					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
4.	When my feelings are hurt					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
5.	When I doubt my ability to succeed					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
6.	When I'm about to receive bad news					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5

7.	When I receive negative feedback from others					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
8.	When I regret a decision					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
9.	When I'm afraid of something					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
10.	When I begin to think about past failures or mistakes					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
11.	When I feel depressed					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5
12.	When I feel anxious					
	a. I try to control or take action to change the thought, feeling or situation	1	2	3	4	5
	b. I try to think about the thought, feeling, or situation in a more positive way.	1	2	3	4	5
	c. I try to avoid or escape from the thought, feeling, or situation.	1	2	3	4	5
	d. I seek support from others (e.g., talk about it with someone else).	1	2	3	4	5

Appendix F

University of Windsor

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: **Thinking, Socializing, and Coping: Participant Pool (Stage 1)**

You are asked to participate in a research study conducted by Amy Camodeca, M.A., Student, and Sylvia Voelker, Ph.D., faculty, from the Psychology Department at the University of Windsor. The results of this study will contribute to a doctoral dissertation.

If you have any questions or concerns about the research, please contact Amy Camodeca at x4705 or Dr. Voelker at x2249.

PURPOSE OF THE STUDY
This study will examine the relations between cognitive and social skills and coping abilities.

PROCEDURES
If you volunteer to participate in this study, we would ask you to do the following things:

- Complete two online questionnaires about your characteristics and behaviours.

This will take approximately 30 minutes.

After completing this questionnaire, you may be asked to participate in a follow up assessment for additional participant pool credit.

POTENTIAL RISKS AND DISCOMFORTS
We do not anticipate any risks associated with this part of the study.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY
Participation in this study will further the understanding of how cognitive and social abilities contribute to coping strategy use.

PAYMENT FOR PARTICIPATION
You will receive .5 mark to be allocated to an eligible psychology course of your choosing.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Participants will be identified by number only, and informed consent materials will be

kept separate from the questionnaire data. Data will be stored in a locked area to which only the researchers have access. Data will be retained for 7 years after publication.

PARTICIPATION AND WITHDRAWAL
You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if your answers to the questionnaires or assessment measures indicate random responding.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE SUBJECTS
The results of this study will be posted on the University of Windsor's Research Ethics Board website (www.uwindsor.ca/reb) after January 2010.

SUBSEQUENT USE OF DATA
These data may be used in subsequent studies.

RIGHTS OF RESEARCH SUBJECTS
You may withdraw your consent at any time and discontinue participation without penalty. If you have questions regarding your rights as a research subject, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF RESEARCH SUBJECT/LEGAL REPRESENTATIVE
I understand the information provided for the study **Thinking, Socializing, and Coping** as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

_____
Name of Subject

_____ _____
Signature of Subject Date

SIGNATURE OF INVESTIGATOR
These are the terms under which I will conduct research.

_____ _____
Signature of Investigator Date

University of Windsor

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: **Thinking, Socializing, and Coping: Participant Pool (Stage 2)**

You are asked to participate in a research study conducted by Amy Camodeca, M.A., Student, and Sylvia Voelker, Ph.D., faculty, from the Psychology Department at the University of Windsor. The results of this study will contribute to a doctoral dissertation.

If you have any questions or concerns about the research, please contact Amy Camodeca at x4705 or Dr. Voelker at x2249.

PURPOSE OF THE STUDY
This study will examine the relations between cognitive and social skills and coping abilities.

PROCEDURES
If you volunteer to participate in this study, we would ask you to do the following things:
- Complete questionnaires about your characteristics and behaviours.
- Participate in an assessment of cognitive and social skill areas.

This will take approximately 120 minutes.

POTENTIAL RISKS AND DISCOMFORTS
Some participants may be concerned about their performance on the assessment measures. A summary statement with the phone number of the Student Counselling Centre will be provided for all participants.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY
Participation in this study will further the understanding of how cognitive and social abilities contribute to coping strategy use.

PAYMENT FOR PARTICIPATION
You will receive 2 marks to be allocated to an eligible psychology course of your choosing.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Participants will be identified by number only, and informed consent materials will be kept separate from the questionnaire data. Data will be stored in a locked area to which only the researchers have access. Data will be retained for 7 years after publication.

PARTICIPATION AND WITHDRAWAL
You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if your answers to the questionnaires or assessment measures indicate random responding.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE SUBJECTS
The results of this study will be posted on the University of Windsor's Research Ethics Board website (www.uwindsor.ca/reb) after January 2010.

SUBSEQUENT USE OF DATA
These data may be used in subsequent studies.

RIGHTS OF RESEARCH SUBJECTS
You may withdraw your consent at any time and discontinue participation without penalty. If you have questions regarding your rights as a research subject, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF RESEARCH SUBJECT/LEGAL REPRESENTATIVE
I understand the information provided for the study **Thinking, Socializing, and Coping** as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

_____
Name of Subject

_____ _____
Signature of Subject Date

SIGNATURE OF INVESTIGATOR
These are the terms under which I will conduct research.

_____ _____
Signature of Investigator Date

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: **Thinking, Socializing, and Coping: Participant Pool Parents of Children with Autism Spectrum Disorders or Other Developmental Disabilities**

You are asked to participate in a research study conducted by Amy Camodeca, M.A., Student, and Sylvia Voelker, Ph.D., faculty, from the Psychology Department at the University of Windsor. The results of this study will contribute to a doctoral dissertation.

If you have any questions or concerns about the research, please contact Amy Camodeca at x4705 or Dr. Voelker at x2249.

PURPOSE OF THE STUDY
This study will examine the relations between cognitive and social skills and coping abilities.

PROCEDURES
If you volunteer to participate in this study, we would ask you to do the following things:
- Complete questionnaires about your characteristics and behaviours.
- Participate in an assessment of cognitive and social skill areas.

This will take approximately 2.5 hours.

POTENTIAL RISKS AND DISCOMFORTS
Some participants may be concerned about their performance on the assessment measures. A summary statement with the phone number of the Student Counselling Centre will be provided for all participants.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY
Participation in this study will further the understanding of how cognitive and social abilities contribute to coping strategy use.

PAYMENT FOR PARTICIPATION
You will receive 2.5 marks to be allocated to an eligible psychology course of your choosing.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Participants will be identified by number only, and informed consent materials will be

kept separate from the questionnaire data. Data will be stored in a locked area to which only the researchers have access. Data will be retained for 7 years after publication.

PARTICIPATION AND WITHDRAWAL
You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if your answers to the questionnaires or assessment measures indicate random responding.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE SUBJECTS
The results of this study will be posted on the University of Windsor's Research Ethics Board website (www.uwindsor.ca/reb) after January 2010.

SUBSEQUENT USE OF DATA
These data may be used in subsequent studies.

RIGHTS OF RESEARCH SUBJECTS
You may withdraw your consent at any time and discontinue participation without penalty. If you have questions regarding your rights as a research subject, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF RESEARCH SUBJECT/LEGAL REPRESENTATIVE
I understand the information provided for the study **Thinking, Socializing, and Coping** as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

_____
Name of Subject

_____ _____
Signature of Subject Date

SIGNATURE OF INVESTIGATOR
These are the terms under which I will conduct research.

_____ _____
Signature of Investigator Date

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: **Thinking, Socializing, and Coping: Community Sample**

You are asked to participate in a research study conducted by Amy Camodeca, M.A., Student, and Sylvia Voelker, Ph.D., faculty, from the Psychology Department at the University of Windsor. The results of this study will contribute to a doctoral dissertation.

If you have any questions or concerns about the research, please contact Amy Camodeca at x4705 or Dr. Voelker at x2249.

PURPOSE OF THE STUDY
This study will examine the relations between cognitive and social skills and coping abilities.

PROCEDURES
If you volunteer to participate in this study, we would ask you to do the following things:
- Complete questionnaires about your characteristics and behaviours.
- Participate in an assessment of cognitive and social skill areas.

This will take approximately 2 hours.

POTENTIAL RISKS AND DISCOMFORTS
Some participants may be concerned about their performance on the assessment measures. A summary statement with counselling resources in Windsor/Essex County will be provided to all participants.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY
Participation in this study will further the understanding of how cognitive and social abilities contribute to coping strategy use.

PAYMENT FOR PARTICIPATION
You will receive a $__gift certificate to Toys R Us for participating.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Participating in this study will have no impact on any services you have or may receive in the future. Participants will be identified by number only, and informed consent materials will be kept separate from the questionnaire data. Data will be stored in a

locked area to which only the researchers have access. Data will be retained for 7 years after publication.

PARTICIPATION AND WITHDRAWAL
You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if your answers to the questionnaires or assessment measures indicate random responding.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE SUBJECTS
The results of this study will be posted on the University of Windsor's Research Ethics Board website (www.uwindsor.ca/reb) after January 2010.

SUBSEQUENT USE OF DATA
These data may be used in subsequent studies.

RIGHTS OF RESEARCH SUBJECTS
You may withdraw your consent at any time and discontinue participation without penalty. If you have questions regarding your rights as a research subject, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF RESEARCH SUBJECT/LEGAL REPRESENTATIVE
I understand the information provided for the study **Thinking, Socializing, and Coping** as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

_____
Name of Subject

_____ _____
Signature of Subject Date

SIGNATURE OF INVESTIGATOR
These are the terms under which I will conduct research.

_____ _____
Signature of Investigator Date

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study: **Thinking, Socializing, and Coping: On-line Data Collection**

You are asked to participate in a research study conducted by Amy Camodeca, M.A., Student, and Sylvia Voelker, Ph.D., faculty, from the Psychology Department at the University of Windsor. The results of this study will contribute to a doctoral dissertation.

If you have any questions or concerns about the research, please contact Amy Camodeca at x4705 or Dr. Voelker at x2249.

PURPOSE OF THE STUDY
This study will examine the relations between cognitive and social skills and coping abilities.

PROCEDURES
If you volunteer to participate in this study, we would ask you to complete questionnaires about your characteristics and behaviours and complete an emotion recognition task. This will take approximately 20 minutes.

POTENTIAL RISKS AND DISCOMFORTS
The researchers do not anticipate any risks associated with this study.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY
Participation in this study will further the understanding of how cognitive and social abilities contribute to coping strategy use.

PAYMENT FOR PARTICIPATION
You will not receive payment for participating. If you would like, you may email the researcher to be entered into a draw for a $50 gift certificate to Toys R Us.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Participating in this study will have no impact on any services you have or may receive in the future. Participants will be identified by number only, and informed consent materials will be kept separate from the questionnaire data. Online data is collected via a secure server to which only the researchers have access. Data will be retained for 7 years after publication.

PARTICIPATION AND WITHDRAWAL
You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences. You may also refuse to answer any questions you don't want to answer and still remain in the study.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE SUBJECTS
The results of this study will be posted on the University of Windsor's Research Ethics Board website (www.uwindsor.ca/reb) after January 2010.

SUBSEQUENT USE OF DATA
These data may be used in subsequent studies.

RIGHTS OF RESEARCH SUBJECTS
You may withdraw your consent at any time and discontinue participation without penalty. If you have questions regarding your rights as a research subject, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF RESEARCH SUBJECT/LEGAL REPRESENTATIVE
I understand the information provided for the study **Thinking, Socializing, and Coping** as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

_____
Name of Subject

_____ _____
Signature of Subject Date

SIGNATURE OF INVESTIGATOR
These are the terms under which I will conduct research.

_____ _____
Signature of Investigator Date

Appendix G

Hypothesis		Independent Variable(s)	Dependent Variable(s)	Hypothesis Outcome
1. The Broad Autism Phenotype will occur more frequently in parents of children with autism spectrum disorders than control parents.	Original	Autism Parent/Parent of Child without autism	BAP[3] Have/BAP Not Have	Not supported
2a. Those individuals with the Broad Autism Phenotype will have lower executive functioning scores in the areas of problem solving, cognitive flexibility, planning, and verbal fluency.	Original	BAP Have/BAP Not Have	D-KEFS[4] Colour Word Interference D-KEFS Sorting Task D-KEFS Tower Task D-KEFS Verbal Fluency Trail Making Test B/A ratio	Not supported
	Replication	BAP Have/BAP Not Have	BRIEF-A[5] Inhibition BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Shift	Supported: all variables
2b. The Broad Autism Phenotype characteristics of problems with pragmatic language and rigidity will be negatively predicted by executive function, specifically the domains of problem solving, cognitive flexibility, planning, working memory, and verbal fluency.	Original	D-KEFS Sorting Task D-KEFS Tower Task Trail Making Test B/A ratio	BAPQ Rigidity	Not Supported

	Original	WAIS-IV LNS[7] D-KEFS Verbal Fluency	BAPQ Pragmatic Language	Not supported
	Replication	BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Inhibition BRIEF-A Shift	BAPQ Rigidity	Partially supported; Plan Organize = best predictor variable
	Replication	BRIEF-A Working Memory	BAPQ Pragmatic Language	Supported
3a. Those individuals with the Broad Autism Phenotype will have deficits in social cognition.	Original	BAP Have/BAP Not Have	RMET[8] Total Correct RMET Response Latency UOT[9] Score	Not supported
3b. The Broad Autism Phenotype characteristic of problems with pragmatic language will be negatively predicted by social cognition.	Original	RMET Total Correct RMET Response Latency UOT Score	BAPQ Pragmatic Language	Not supported
3c. Social Cognition will be positively predicted by Working Memory	Original	WAIS-IV LNS	RMET Total Correct	Supported

	Original	WAIS-IV LNS	UOT Score	Not supported ; Vocabulary was best predictor
	Replication	BRIEF-A Working Memory	RMET Total Correct	Not supported
4a. Problem Focused Coping will be positively predicted by executive functioning, specifically the executive function areas of problem solving, working memory, and planning.	Original	D-KEFS Sorting Task D-KEFS Tower Task WAIS-IV LNS	CSFI[10] Problem Focused Coping	Not supported
	Replication	BRIEF-A Working Memory BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Shift BRIEF-A Organization of Materials	CSFI Problem Focused Coping	Partially supported; Task Monitoring and Plan Organize = significant predictors.
4b. Social Support Seeking will be positively predicted by social cognition.	Original	RMET Total Correct RMET Response Latency UOT Score	CSFI Social Support Seeking	Not supported

5. The Broad Autism Phenotype characteristics (problems with pragmatic language, aloof personality characteristics, and rigidity) will be negatively predictive of coping flexibility, and executive functioning (problem solving, planning, and switching) and social cognition will be positively predictive of coping flexibility.	Original	D-KEFS Sorting Task	CSFI Coping Flexibility Score	Partially supported; BAPQ Aloof was best predictor
		D-KEFS Tower Task		
		Trail Making Test B/A ratio		
		RMET Total Correct		
		UOT Score		
		BAPQ Overall Score		
	Replication	BRIEF-A Plan/Organize	CSFI Coping Flexibility Score	Partially supported; BAPQ Aloof was best predictor
		BRIEF-A Task Monitoring		
		BRIEF-A Switching		
		BAPQ Overall Score		
		RMET Total Correct		

[1] Assessment-Autism Parent, Assessment-Other Developmental Disability Parent, Assessment-Undergraduates
[2]Online Questionnaires-Autism Parent, Online Questionnaires-Other Developmental Disability Parent.
[3]Broad Autism Phenotype
[4]Delis-Kaplan Executive Functioning Scales (Delis et al., 2001)
[5]Behaviour Rating Inventory of Executive Functioning-Adult Version (Roth et al., 2005)
Broad Autism Phenotype Questionnaire (Hurley et al., 2007)
[7]Weschler Adult Intelligence Scale-III Letter Number Sequencing (Weschler, 1997)
[8]Reading the Mind in the Eyes Test (Baron-Cohen et al., 1997)
[9]Unexpected Outcomes Test (Dyck et al., 2001)
[10]Coping Styles Flexibility Inventory (Williams et al., 2002).

Appendix H

Hypothesis	Independent Variable(s)	Dependent Variable(s)	Hypothesis Outcome
1. The Broad Autism Phenotype will occur more frequently in parents of children with autism spectrum disorders than control parents.	Autism Parent/Parent of Child without autism	BAP[3] Have/BAP Not Have	Not supported
2a. Those individuals with the Broad Autism Phenotype will have lower executive functioning scores in the areas of problem solving, cognitive flexibility, planning, and verbal fluency.	BAP Have/BAP Not Have	BRIEF-A[5] Inhibition BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Shift	Supported
2b. The Broad Autism Phenotype characteristics of problems with pragmatic language and rigidity will be negatively predicted by executive function, specifically the domains of problem solving, cognitive flexibility, planning, working memory, and verbal fluency.	BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Inhibition BRIEF-A Switching	BAPQ Rigidity	Partially supported; Plan Organize = best predictor variable
	BRIEF-A Working Memory	BAPQ Pragmatic Language	Supported
3a. Those individuals with the Broad Autism Phenotype will have deficits in social cognition.	BAP Have/BAP Not Have	RMET Total Correct RMET Response Latency	Partially supported ; RMET Response Latency differences found
3b. The Broad Autism Phenotype characteristic of problems with pragmatic language will be negatively predicted by social cognition.	RMET Total Correct RMET Response Latency	BAPQ Pragmatic Language	Not supported
3c. Social Cognition will be positively	BRIEF-A Working Memory	RMET Total Correct	Not Supported

predicted by Working Memory			
4a. Problem Focused Coping will be positively predicted by executive functioning, specifically the executive function areas of problem solving, working memory, and planning.	BRIEF-A Working Memory BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Switching BRIEF-A Organization of Materials	CSFI Problem Focused Coping	Partially supported; Plan Organize and Shift were significant predictors.
4b. Social Support Seeking will be positively predicted by social cognition.	RMET Total Correct RMET Response Latency	CSFI Social Support Seeking	Not supported
5. The Broad Autism Phenotype characteristics (problems with pragmatic language, aloof personality characteristics, and rigidity) will be negatively predictive of coping flexibility, and executive functioning (problem solving, planning, and switching) and social cognition will be positively predictive of coping flexibility.	BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Switching BAPQ Overall Score RMET Total Correct	CSFI Coping Flexibility Score	Partially supported; BAPQ Aloof was best predictor

Appendix I

Hypothesis	Independent Variable(s)	Dependent Variable(s)	Outcome Sample 1	Outcome Sample 2
1. The Broad Autism Phenotype will occur more frequently in parents of children with autism spectrum disorders than control parents.	Autism Parent/Parent of Child without autism	BAP[3] Have/BAP Not Have	Not supported	Not supported
2a. Those individuals with the Broad Autism Phenotype will have lower executive functioning scores in the areas of problem solving, cognitive flexibility, planning, and verbal fluency.	BAP Have/BAP Not Have	BRIEF-A[5] Inhibition BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Shift	Supported; all variables	Supported; all variables
2b. The Broad Autism Phenotype characteristics of problems with pragmatic language and rigidity will be negatively predicted by executive function, specifically the domains of problem solving, cognitive flexibility, planning, working memory, and verbal fluency.	BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Inhibition BRIEF-A Shift	BAPQ Rigidity	Partially supported; Plan Organize = best predictor variable	Partially supported; Plan Organize = best predictor variable
	BRIEF-A Working Memory	BAPQ Pragmatic Language	Supported	Supported
3a. Those individuals with the Broad Autism Phenotype will have deficits in social cognition.	BAP Have/BAP Not Have	RMET Total Correct RMET Response Latency	Not supported	Partially supported ; RMET Response Latency differences found
3b. The Broad Autism Phenotype characteristic of problems with pragmatic language will be negatively predicted by social cognition.	RMET Total Correct RMET Response Latency	BAPQ Pragmatic Language	Not supported	Not supported
3c. Social Cognition will be positively	BRIEF-A Working Memory	RMET Total Correct	Not Supported	Not Supported

predicted by Working Memory				
4a. Problem Focused Coping will be positively predicted by executive functioning, specifically the executive function areas of problem solving, working memory, and planning.	BRIEF-A Working Memory BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Shift BRIEF-A Organization of Materials	CSFI Problem Focused Coping	Partially supported; Plan Organize and Task Monitoring were significant predictors	Partially supported; Plan Organize and Shift were significant predictors.
4b. Social Support Seeking will be positively predicted by social cognition.	RMET Total Correct RMET Response Latency	CSFI Social Support Seeking	Not supported	Not supported
5. The Broad Autism Phenotype characteristics (problems with pragmatic language, aloof personality characteristics, and rigidity) will be negatively predictive of coping flexibility, and executive functioning (problem solving, planning, and switching) and social cognition will be positively predictive of coping flexibility.	BRIEF-A Plan/Organize BRIEF-A Task Monitoring BRIEF-A Shift BAPQ Overall Score RMET Total Correct	CSFI Coping Flexibility Score	Partially supported; BAPQ Aloof was best predictor	Partially supported; BAPQ Aloof was best predictor

VITA AUCTORIS

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