SOCIAL INTERACTION IN AUTISM SPECTRUM PRESENTATION: THE DEVELOPMENT OF THE SOCIAL SITUATION STORIES QUESTIONNAIRE (SSSQ)

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ABSTRACT

Autism spectrum presentations are considered 'lifelong developmental disabilities' affecting the way individuals communicate and relate to others, thus significantly impacting on social interaction resulting in various social disadvantages.

To date, the key psychological theory accepted, as an explanation for difficulties observed in autism presentations is the lack of 'Theory of Mind' (ToM), which is considered a facet of social cognition required in understanding how to interact socially with others, through the ability to recognise others as alike but also independent. Despite its popularity there are several limitations of this proposed theory. Furthermore many individuals with autism presentations can pass ToM tests at an older age or in adulthood. This has resulted in more sophisticated ToM tests being developed.

This study aims to develop a more sensitive ToM test, which aims to operationalise a more subtle aspect of ToM that adults with autism presentations may have difficulty understanding. The concept of social overtures which are often present in normative social interaction is used in the current study to develop items to discriminate between individuals with and without autism presentations in a questionnaire format. This new test called the Social Situation Stories Questionnaire (SSSQ) was administered to 12 adults with autism presentation and 16 adults without this diagnosis in a matched cohort study. The SSSQ is a two part instrument consisting of general ToM skills and more subtle ToM skills (social overture detection). Findings show no difference between the two groups on the general part of the SSSQ, however individuals with autism presentations were less able to detect the social overtures, thus scoring less well on the more stringent ToM component of the SSSQ.

This novel social cognition test will be used to further understand social interaction differences between adults with and without autism presentation.
Taking a critical realistic epistemological approach *differences* observed are critically discussed.

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INTRODUCTION

1.1 The Autism Spectrum Disorders

The Autism Spectrum Disorders (ASD) includes three categories: Autistic Disorder (Autism), Asperger Syndrome and Pervasive Developmental Disorder (not otherwise specified) (APA, 1994). The remainder of this thesis will refer to individuals with ASD for brevity; however, it is acknowledged that ASD is a diagnostic label which has evolved over time. Individuals with a diagnosis of ASD are characterised as having difficulties in three key areas, referred to as the 'triad of impairment': i) difficulties in social interaction, ii) impaired communication/language, and iii) unusual patterns of restricted/repetitive behaviour, all which range in severity (APA, 1994). ASD is a lifelong developmental disorder. Approximately 1% of the adult population in England are estimated to have ASD; this has been reported to be higher in males (Brugha et al., 2011). Adults living in the community tend to be unrecognised and socially disadvantaged (Brugha et al., 2011).

1.1.2 'Autistic Disorder' (Autism)

The term 'Autism' was originally coined by psychiatrist Bleuler (1911) to describe observations of social withdrawal seen in his patients. This was believed at the time to be a key symptom of schizophrenia. The term was later used independently by both Kanner (1943) and Asperger (1944), to describe specific behaviours observed in some children. The term 'autism' first appeared within the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM) (APA, 1980). It has been categorised as a pervasive developmental disorder (PDD), thus removing the distinction between child and adult presentations. Following further investigations of the classification and epidemiology of the 'triad of impairments' the singular category known as 'Classic' or 'Kanner's Autism' (Bogdashina, 2005) was later developed to reflect a spectrum of 'disorder' (comprising levels of impairment) hence the new term 'Autism Spectrum Disorder' (Wing & Gould, 1979).

There are three criteria described by the DSM-IV (APA, 1994) and the International Classification of Diseases, Tenth Edition (ICD-10, 1992) which must be met for a diagnosis of autism and are expected to be expressed before three years of age. These criteria are considered a more expansive

description than Kanner's 'autism' and are based on classification set out by Wing and Gould (1979) and their subsequent work defining the core aspects of the triad (Wing, 1991, 1993; Wing & Gould, 1979).

- **Social Interaction** - impairment in reciprocal social interaction; typified by reduced eye contact; lack of relationships and 'social inappropriateness'.

- **Communication** - impairment in verbal and non-verbal methods of communication; typified by lack of, or delayed speech and lack of 'symbolic play'.

- **Restricted Interests** - a restricted repertoire of interests; typified by repetitive gestures and body movements; and activities which are overly focused, with lack of variation.

1.1.3 High Functioning Autism and Asperger's Syndrome

Despite heterogeneity in levels of impairment, individuals have been reduced clinically to a dichotomy of low versus high functioning autism (HFA) (Bogdashina, 2005). This is largely based on intelligence quotient (IQ) scores; however, the validity of this distinction is debated (Attwood, 2007). The most obvious difference clinically is that those with HFA have greater language ability, thus permitting better interaction and test participation.

Asperger's Syndrome (AS) became a distinct diagnostic category in 1992 (ICD-10, 1992). Individuals with AS are characterised by the same diagnostic criteria, but show greater ability to interact with others and have no language delay (APA, 1994). Because of the similarities in achieving average/above average IQ scores, the terms HFA and AS are often used interchangeably.

1.1.4 Diagnostic Changes

As described above, the terms 'autism' and 'AS' have only existed as medical terms in the last thirty years, since their inclusion in the DSM in the 1980s. These terms have since undergone great scrutiny. As the DSM has been revised the

terms have seen a number of re-constructions and most recently in the DSM 5th edition (APA, 2013), the terms have been collapsed into the umbrella term of ASD, with the removal of terms such as AS. It is important to acknowledge this recent change as many adults will continue to be described as having AS if previously diagnosed as such. Following the new changes, the number of ASD diagnoses was predicted to decrease by a third (Kulage, Smaldone, & Cohn, 2014). What was previously described as three areas of deficit has also now been collapsed into two key areas: 'social communication and interaction' and 'restricted, repetitive patterns of behaviour, interests, or activities' (National Autism Society, 2014).

1.1.5 Aetiology

The search for the root biological cause for ASD has proven to be elusive. Although research has focused on biological and genetic causes (Baron-Cohen & Hammer, 1997; Rutter, 2005) and more recently on metabolic (James et al., 2006) and allergic causes (Mostafa, Hamza, & El-Shahawi, 2008), there appears to be no one cause that can account for the occurrence of impairments.

1.1.6 Epidemiology

The number of children and adults diagnosed with ASD and other PPDs is increasing (Fombonne, 2003). These surveys which are mainly conducted in western cultures report prevalence estimates of nine in every ten thousand births in 1987, to eleven in every ten thousand births by 2003; a rise of 22% and considered a dramatic increase by some (Fombonne, 2003). This may suggest that 'autistic' behaviours are more prevalent in the population. However, these prevalence estimates are based on diagnoses which may be the result of broadening the diagnostic criteria and increased social awareness (Bogdashina, 2005; Fombonne, 2003). The incidence of ASD diagnoses also appears to be increasing (Hertz-Picciotto & Delwiche, 2009); however, inadequate data collection techniques are likely impacting on this (Fombonne, 2001).

1.1.6.1 Western Cultural Assumptions

ASD is considered by academics and clinicians to be a worldwide phenomenon (Autism Society of America, 2000). However, despite these assertions little

research has actually looked at global understandings of ASD; with some arguing, this very lack of cross-cultural studies as a key factor in maintaining this view (Fombonne, 2003). In western cultures, the best funded research area in ASD is symptomology (Charman & Clare, 2004). For example a key symptom of ASD has been poor eye-contact. In other communities however direct eye-contact to peers and/or elders could be regarded as disrespectful, as such it has been argued that western diagnoses are grounded in cultural prejudice (Wheeler, 2011). Other researchers have also learnt a 'western' diagnosis alleviated parents' concerns about spiritual possession in South Africa (Grinker et al., 2012) but consequently confirmed it was the child and not the social network that was 'sick'; alternatively traditional healers would carry out cleansing rituals to appease ancestral spirits thought to be expressing, through the child, displeasure at a deficit in society. Whilst these ideas may seem far from western ideology, they are not necessarily so. The social model of disability evolved from the expansion of advocacy groups for people positioned as having a deficit; instead situating the deficits within society and not the individual (Molloy & Vasil, 2002). This model makes key distinctions between impairment and disability, defining the latter as a disadvantage produced by society (Molloy & Vasil, 2002). For example identifying systemic barriers, negative attitudes and exclusion by society (purposely or inadvertently) provides the alternative conceptualisation of society as the main contributory factor in disabling people (Wheeler, 2011).

There have been challenges to the claim that ASD is considered the same in non-western cultures (Sanua, 1984). More positive attitudes towards difference and a lower incidence rate have been reported (Dyches, Wilder, Sudweeks, Obiakor, & Algozzine, 2004). This suggests that the concept of observable differences in behaviour (described as ASD) as caused by a diagnosable 'illness', could be viewed as a construct of ethnocentric thinking about difference (Sanua, 1984).

1.1.7 Beyond the Medical Model and Discourse of Deficits
Implicit within the medical metaphor, is an emphasis on lifelong problematic illness and disability (O'Neal, 2013). This invites us to understand ASD as an abnormal impairment (Molloy & Vasil, 2002). Consequently the medical conceptualisation is problem saturated and does not account for complexity (Wheeler, 2011), and

could prevent people from claiming their unique experience of ASD as a part of their collective and personal identity. The difficulties which people with ASD experience are naturalised, and not seen as a product of society, but wholly individualistic (Nelson & Prilleltensky, 2010).

In her 'Bring the Family Address' at the 25th Association for Psychological Science Annual Convention, Gernsbacher (2013) discussed how interpreting research findings in terms of *deficits* rather than *differences* reinforces negative stereotypes. Historically there have been examples of differences that were once described as deficits but are no longer seen as a deficit. For example the once-held belief that the physical differences between male and female brains (women's brains on average weigh less) arose from women's intellectual inferiority. Neuroscientists no longer believe this about women (Gernsbacher, 2013). Similarly for much of the 20th century sexual orientation was a difference very much treated by mental health professional as a deficit. A paradigm shift was witnessed in the 1970s when the APA removed homosexuality from the DSM and mental health professionals were called to remove the stigma historically associated with homosexuality (Herek, 2010).

Of course, women and sexual minorities continue to face discrimination and inequality (Wilkinson & Pickett, 2009); however their differences are no longer labeled as deficit in diagnostic manuals. Brain differences in other groups continue to be interpreted by scientists as deficits. Gernsbacher (2013) illustrates this for ASD. Following an exhaustive analysis of autism-related neuroimaging studies she reported very few consistent patterns of results across studies for any region of the brain:

> ...whenever a difference was reported, even if the direction of the difference conflicted with the finding of another study, the difference was always interpreted as an autistic deficit (Gersbacher, 2013).

The challenge to the deficit model has coincided with growing acceptance of clinical and personal accounts from those with a diagnosis of ASD (Smukler, 2005). These describe how they are able to achieve high level academic

qualifications and complex and demanding jobs, but still describe social functioning difficulties. These personal accounts rarely describe deficit, but rather relate to perceived differences with those around them (Frith, 2003; Lawson, 1998). Despite this however, ASD remains very much a brain difference conceptualised as a deficit within the medical model.

1.1.8 Current National Policy and Research Context

The Autism Act (2009) England was the first piece of autism-specific legislation in the UK, which came into force following campaigns by the National Autistic Society. The Act applies only to Adults in England only.

This resulted in the first ever strategy for adults with autism in England: 'Fulfilling and Rewarding Lives Strategy' 2010. Feedback from adults with autism, parents, carers and professionals resulted in a further new strategy - Think Autism; published in April 2014 (National Autism Society, 2014).

The main focus of the strategy was to:

- Increase awareness of autism
- Improve access and consistency of diagnosis for adults
- Develop pathways and services to meet their needs including employment opportunities

1.1.9 Current Key Concerns in ASD

As it stands a key issue in the field of ASD, which is highlighted in the current national policy are the need for increased awareness around ASD and the need for improved assessment and diagnostic services particularly for adults.

1.2 Psychological Theories

Baron-Cohen (2000) describes difficulties with social interaction as the "pathognomonic" symptom of autism. It is no surprise then, that psychological models have had a propensity to focus on particular behavioural 'abnormalities' that impact on social abilities. In order to contextualise the psychological models it is important to go back further to understanding social cognition as a wider construct.

1.2.1 Cognition

1.2.1.1 General Cognition

During the 1920s psychologists became interested in individual differences and social interaction. At the time the psychometric approach claimed to be successful in classifying individual differences in general cognition. Social cognition had been described as the ability to understand other people and engage in adaptive interactions with them. It is thought to comprise separate skills to those measured as general cognition (Thorndike, 1920). Discriminating between these two facets of cognition however proved difficult. The first attempt at this would be the George Washington Social Intelligence Test (Moss & Hunt, 1927) where social cognition was operationalised through facets including: judgement; memory for names/faces and recognition of mental states. However, the test items failed to distinguish between general and social cognition.

1.2.1.2 Social Cognition

Marlowe (1986) gathered findings from psychometric research and found that five facets of social cognition were constant: interest in and concern for other people; social performance skills; empathetic ability; emotional expressiveness and sensitivity to others emotions; social anxiety, self-efficacy and self-esteem. Gardner (1983, 1993) described this within an individual-difference construct, proposing that people would possess different abilities in these domains. He believed these developed over the lifespan through interactions with others.

Advocates of social cognition continued to search for a method which would explain the skills of social cognition by mapping the relationship of social abilities

to brain functioning. This was primarily motivated by brain injury study findings that appeared to show several brain areas were associated with abilities related to social cognition, including the temporo-parietal junction in mental state representations (Saxe, 2006); the amygdala in emotional awareness (Adolphs, 2001); the ventro-medial prefrontal cortices in emotional reasoning (Adolphs, 1999); the somatosensory cortices in social motivation and anxiety (Sutton et al., 2005).

Early research demonstrated the representation of an innate drive for socialisation through an infant's preference within the first year of life for, human faces; imitation of emotions and acts observed in others; shared attention and gaze direction and biological motion (Frith & Blakemore, 2004). However more recent social cognition models have moved away from a solely innate perspective to consider these preferences as learnt experience between the infant and caregiver. They describe social abilities as integrating different functional aspects of the brain to make up an early social cognition network, through perception, motor and somatosensory routes rather than domain-specific (Klin, Jones, Schultz, & Volkmar, 2003; McKinnon & Moscovitch, 2007; Meltzoff, 2007). This theory aims to account for how brain domains and social behaviour develop together whereby, personality and cultural learning shape the way social cognition is represented in the brain. Meltzoff (2007) proposed that the infant learns through perceptual and motor acts that others are 'like me' and this drives the motivation to attend to others. Meltzoff (2007) further demonstrated that infants would not respond in a 'like me' way until they had firsthand experience of the action therefore suggesting that the infant actively learns the preference for human interaction through personal experience. This relational dynamic has also been demonstrated to shown how infants require recognition from others that they are understood, through mirroring of their emotional and physical acts by others (Rochat, 2009). In the absence of this an infant would become distressed and withdraw.

Interaction with others can transpose personal declarative knowledge into procedural knowledge about the world through rules, skills and strategies drawn from interactions, therefore suggesting social cognition as something that can develop over the lifespan at different rates for different people (Cantor & Kihlstrom,

1989). The expansion of social knowledge in relation to self and others is continued throughout development and evolves in complexity as the brain changes to accommodate and provide a basis for newly developing complex skills (Casey, Galvan, & Hare, 2005). Whether this process is absent or significantly delayed in people with ASD appears to be an area of research that is neglected creating a potential blind spot in the existing literature.

1.2.2 Psychological Models of ASD

These models propose that deficits in cognitive abilities account for the underlying processes that result in 'inadequate' social interaction.

1.2.2.1 Executive Function

Deficits in executive functioning were proposed to account for the repetitive and restricted behaviours (Ozonoff, Rogers, & Pennington, 1991; Shallice, 1988). It is proposed that the typical processes which govern abilities to: switch from one task to another; to remember and monitor; adapt and inhibit behaviour, have been disrupted. This disruption results in the preference for routine, particular toys, or confining movement to self-controllable, predictable factors, i.e. finger flickering. Clinical accounts describe how diversions from routines or repetitive behaviours are difficult to manage, as it challenges their ability to maintain control in their environment (Frith, 2003). The need for consistency, and difficulties with adaptation and inhibition, can potentially impact on social interaction abilities, as interaction with others is ever changing and often fast paced (Bennetto, Pennington, & Rogers, 1996). Enquiry into differences in frontal lobe activation to support executive functioning theory has been the focus of numerous neuroimaging studies. Whilst there have been some support of this, this is by no means a consistent finding and variability has been found (Happe, Ronald, & Plomin, 2006; Hill & Bird, 2006; Saxe, 2006; Sutton et al., 2005).

1.2.2.2 Central Coherence

A weakness in central coherence was proposed following evidence of individuals appearing to do very well on cognitive tasks requiring the de-integration of a whole pattern; such as in block design and embedded

figures tasks (Shah & Frith, 1993), thus interpreted by some as a deficit in the ability to pay attention to the context (Klin et al., 2003). This apparent 'preference' for focusing on the parts rather than the whole has been described by some as a potential asset (Baron-Cohen, Wheelwright, Lawson, Griffin, & Hill, 2002; Happe, 1999), but by others as a deficit, as individuals do not appear to pay attention to the context, finding contextually bound tasks difficult (Klin et al., 2003). It is easy to see why some may view this to impact on social abilities as they propose that this 'restricted world view' creates difficulties in understanding and generalising between social situations (Happe, 1999). In support of this theory, the parvocelluar system (which examines fine detail) was found to be more dominant than the magnocellular system (which examines overall patterns) in those with an ASD diagnosis compared to controls (Milne et al., 2002). Similar differences have also shown within the auditory system (Mottron, Dawson, Soulieres, Hubert, & Burack, 2006).

1.2.2.3 The Theory of Mind Model

The current accepted theory is of deficits in Theory of Mind (ToM). The ToM model is *the* dominant psychological model explaining the capacity of humans to interact. It has become difficult to talk about human interaction without referring to ToM (Reddy & Morris, 2009). ToM is considered a facet of social cognition required in understanding how to coordinate socially with others, through the ability to recognise others as alike but also independent. Some argue this is an innate specific domain, which activates at around age four (Leslie, Friedman, & German, 2004). The concept of ToM was incorporated in ASD by (Baron-Cohen, Leslie, & Frith, 1985). Those subscribing to this model propose that children develop in their ability to make predictions about the behaviour of others by using a range of intentional heuristic concepts which enable them to infer mental state phenomena (i.e. "beliefs", "desires", "emotions" and "intentions") as being causal of behaviour (Baron-Cohen, 2000). This theoretical model proposes that people with a diagnosis of ASD have impaired ToM ability and thus view others as 'objects' with no special interest in their human agency. This has been supported in clinical accounts where no desire for physical contact or communication with others has been described (Frith, 2003; Park, 1972). This theory further proposes that lacking ToM also results in the failure to adequately identify personal affective states.

ToM ability is underpinned by a diverse range of component behaviours and skills. Baron-Cohen (2000) details 20 of these abilities and tests to measure them. Typically this includes the ability to infer mental states, first-order false belief tasks, this refers to what one person thinks about real events (i.e. "Michael thinks that Sophie is angry") and second-order belief tasks that pertain to what a person thinks about other people's thoughts (i.e. "Michael thinks that Sophie thinks that he's angry with her"). Others include; for example, emotion detection, humour, sarcasm and internality. The collection of tests provides convergent evidence for an innate ToM functional module.

Some argue that processes by which these abilities occur are innate and that these mechanisms are linked to specific brain areas, suggesting that abnormalities within these areas lead to social impairments (Baron-Cohen et al., 1985; Leslie, 1991). Neuropsychological support for ToM has been shown by differences in brain activation to ToM stimuli for those with a diagnosis of ASD (Gallagher & Frith, 2003). Recent evidence also suggests a role for mirror neurones in mapping others' behaviour to our own (Allison, Puce, & McCarthy, 2000; Gallese & Goldman, 1998). These are visuomotor neurons (detected in humans and primates) activated when either performing or observing goal directed activity. This line of research has been explicitly linked with ASD and ToM. It is suggested that insults to these neurons render it difficult to simulate the mental states of others (Perkins, Stokes, McGillivray, & Bittar, 2010; Williams, Whiten, Suddendorf, & Perrett, 2001).

1.2.2.4 Beyond ToM

Despite its popularity, many have criticised this dominant model. ToM has become a taken-for-granted construct (Reddy & Morris, 2009) which has entered everyday language. It is difficult to find any literature on ASD that does not discuss or even devote an entire section to ToM (Attwood, 2007). This is particularly significant given how recently the relationship between ToM construct and ASD came about. Leuda and Costall (2009) critically discuss the concept of ToM and suggest the model is favoured because it has been able to integrate a number of different cognitive, behavioural and linguistic functions into one overarching concept. Consequently there has been a larger experimental evidence base used to confirm

the utility of the construct. The very nature of this evidence base however is arguably flawed given 'lack of ToM' and the characteristics which represent this are often assessed in laboratory settings, using formal tests, where the complexity of the "social environment" is reduced (Leudar & Costall, 2009).

A key concern is that this body of evidence allows researchers to side step the inherent difficulties in identifying "unobservable" mental states. This work is underpinned by the assumption that ToM is innate and exists therefore the researcher is not tasked with providing evidence that unobservable mental states exist in a meaningful way. Instead, their task is to observe behavioural evidence of ToM activity (Leudar & Costall, 2009). This behavioural evidence is then used to draw conclusions about computational processes derived from methods of Fodor (1983), who proposed a modular mental architecture (Fodor, 1983) and (Chomsky, 1959, 1980) who suggested that humans have evolved distinct mechanisms that carry out particular functions. This is best illustrated by his proposal of the 'Language Acquisition Device' in which linguistic rules he argued were "hard wired", thus allowing easy acquisition of language during childhood. Those in support of the ToM model have taken up this approach whereby observed behaviour and language of individuals are used as evidence for underlying (unobservable) cognitive structures that are believed to be equally modular and innate.

The Wittgensteinian perspective suggests that the very discussion of "mental states" as *unobservable* (a *necessary* component of the ToM theory) is an artefact of the Cartesian "language game" from which the theory is derived (Sharrock & Coulter, 2009). Sharrock and Coulter (2009) suggest that these behaviours provide a direct inventory of intentions, and that these intentions need only exist in the language and actions of the other person.

Others have also criticised the ToM model. Mental states such as 'thoughts' and 'feelings' are often used in a referential theory of meaning; that is, their use implies a reference to some 'thing' located in the mind (Antaki, 2004). Discursive psychologists see statements about someone as meaningful based on <u>what</u> is said, <u>when</u>, <u>by whom</u> and, <u>for what reason</u>, to think otherwise would be to view

'words' similarly to 'thoughts/feelings' in a referential way. Using this framework it has been argued that social interaction occurs when people judge visible 'behaviour' as meaningful within a particular context (Antaki, 2004).

1.2.2.5 Different Routes Theory - Beyond Single Domain Deficits
Despite their popularity the deficit theories alone do not account for all difficulties observed in people with the ASD diagnosis (Happe, 1999; Rajendran & Mitchell, 2007). Happe (2006) reviewed the biological and psychological literature and stated that no single deficit route could account for the differences observed clinically and described in personal accounts. An alternative view is to consider these difficulties as part of a wider framework, such as research avenues that focuses on the exploration of several routes (Herbert, 2005). This approach could allow an understanding of a "final common pathway" through a network of differences not just a domain (ToM) based deficit. Recent evidence has shifted towards the suggestion that there are no fundamental deficits in individual processing domains, but that interconnectivity differences between domains leads to the difficulties seen in ASD (Rippon, Brock, Brown, & Boucher, 2007).

Evidence from neurological examinations suggests brain growth during two to four years of age is much greater in those with a diagnosis of ASD (Hill & Frith, 2003). This coincides with the timing of processes such as specialisation, pruning and synaptic pathway reinforcement that take place. It has been suggested that this overgrowth interferes with the normal development in the cortices and disrupts the development of cortico-cortical and cortico-cerebellar connections, thus produces localised over-connectivity whilst the interconnectivity between brain areas is hampered (Courchesne & Pierce, 2005). Rubenstein and Merzenich (2003) describe this as the "noisy brain", as without communication between localised areas many areas activate to incoming information, but are not inhibited. This slows responsiveness to incoming information as individual areas are not working together and over-analysis of information is occurring locally. This theory is supported by research findings of differing rather than deficient, levels of activation in brain areas associated with performance on tasks of ToM, executive functioning and central coherence for people with ASD (Castilli, Happe, Frith, & Frith, 2000;

Mottron et al., 2006) and therefore implies a more global picture of difference rather than a singular deficit.

1.2.3 Differences in Cognition for ASD

1.2.3.1 General Cognition in ASD

Although there is neuropsychological evidence to suggest that there may be differences in connectivity between neural constructs for individuals with an ASD diagnosis this does not necessarily impair functioning (Dawson, Soulieres, Gernsbacher, & Mottron, 2007). 'Fluid intelligence', which requires that attention, working memory and executive functioning are used in combination for success, was tested in children and adults. Findings show performance was equal to if not better compared to matched controls (Dawson et al., 2007). Other tasks such as the WAIS block design which had been adapted so that success by local or configurable processing showed that the ASD participants performed better than controls and showed more versatility in using the processing routes. Conclusions from these studies suggest that individuals with an ASD diagnosis appear to be using different routes to achieve success on the tasks however they caution against interpreting this as a deficit in general cognition (Dawson et al., 2007). If general cognition is interconnected with social cognition it is possible that the different route approach taken in general cognition tasks may also occur in tasks of social cognition.

1.2.3.2 Social Cognition in ASD

Clinical and parental accounts have suggested that children with a diagnosis of ASD behave differently to 'typically' developing children in respect to the skills described by the 'like me' framework (Meltzoff, 2007). For example, eye gaze; joint attention and imitation (Park, 1972; Williams et al., 2001). However, recent evidence have suggested that these skills are arrived at differently and not absent. For example when viewing videos of others interacting, social competence for children with a ASD diagnosis was related to looking at the mouth of the actors compared with the control group who were looking at the eyes (Klin, Jones, Schultz, Volkmar, & Cohen, 2002). Equally, language comprehension, through social transmission was achieved over greater time periods (Murphy, Barnes-

Holmes, & Barnes-Holmes, 2005). Success at imitation was achieved when observing animations rather than actors (Shane & Albert, 2008) and these were generalisable in future contexts. Some studies have found that children with ASD had difficulty identifying their own emotional states (Kuusikko et al., 2008; Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007; Meltzoff, 2007). These findings however are not consistent. Other studies have found that they were able to self-report feelings of social anxiety and distress resulting in social withdrawal (Sutton et al., 2005) and were able to communicate their emotions in relation to satisfaction with friendship (Bauminger & Kasari, 2000). Therefore, it may be that those with a diagnosis of ASD do have access to their feelings but that these are expressed differently to those around them.

Researchers have generally discarded these accounts of success as 'learnt behaviour' and not 'true' social competence (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Happe, 1994a). The difference in processing described above appears to create different expressions of similar cognitive processes which could potentially explain the difficulties observed in social interaction. There are no clear answers as to whether those with a diagnosis of ASD are unable to recognise their own or others' mental states however if differences are present within these processes, then the routes to these differences are becoming less defined by traditional psychological and biological accounts (McKinnon & Moscovitch, 2007).

1.3 Measurement of Social Cognition in ASD

The dominant theory is the ToM model and therefore 'ToM tests,' are by far the primary source of empirical evidence supporting this theory (Baron-Cohen, 1989b; Happe, 1994a; Perner, Frith, Leslie, & Leekam, 1989).

1.3.1 ToM Tests - A Review of Literature

The following literature review was not intended to be a full systemic review and includes a summary of the most well validated and widely used ToM tests.

1.3.1.1 Search Criteria

Search engines used include Google Scholar, Science Direct, PubMed, EBSCO. Databases include Ovid Medline, PsycARTICLES, and PsycINFO. In addition the reference list of journal articles and books were used to identify further references.

The following keywords and phrases were used as search terms to identify the title and abstract of journal articles and/or book chapters. At least one of the following terms in each section were used:

1. *Autism; Autistic spectrum disorder; Asperger's Syndrome; High Functioning Autism* combined with
2. *Theory of Mind; Theory of mind Test, Test, Social cognition test.*

1.3.2 Early ToM Tests

The initial search led to a 15 year review by Baron-Cohen (2000) which details 20 ToM abilities and the tests used to assess them. Table 1 below summarises these.

Table 1

Early Tests of ToM

	Title <u>ToM ability</u>
	(Reference)
1	**The mental-physical distinction**
	(Baron-Cohen, 1989a)
2	**Understanding of the <u>functions of the mind</u>**
	(Baron-Cohen, 1989a)
3	**The <u>appearance-reality distinction</u>**
	(Baron-Cohen, 1989a)
4	**<u>First-order false-beliefs tasks</u>**
	(Baron-Cohen et al., 1985; Leekam & Perner, 1991; Perner et al., 1989; Reed & Peterson, 1990; Swettenham, 1996; Swettenham, Baron-Cohen, Gomez, & Walsh, 1996)
5	**<u>'Seeing leads to knowing'</u> tests**
	(Baron-Cohen & Goodhart, 1994; Leslie & Frith, 1988)
6	**Tests of <u>recognising mental-state words</u> in a word list**
	(Baron-Cohen & Goodhart, 1994)
7	**Tests of the production of the same range of <u>mental-state</u> words in their spontaneous speech**
	(Baron-Cohen, Leslie, & Frith, 1986; Tager-Flusberg, 1992)
8	**Tests of the production of spontaneous <u>pretend play</u>**
	(Baron-Cohen, 1987; Lewis & Boucher, 1988; Ungerer & Sigman, 1981; Wing & Gould, 1979)
9	**Tests of understanding more <u>complex causes of emotion (such as beliefs)</u>**
	(Baron-Cohen, 1991; Baron-Cohen, Spitz, & Cross, 1993)
10	**Tests of recognising the <u>eye region of the face</u> as indicating what a person is thinking and what a person might want**
	(Baron-Cohen, 1995; Baron-Cohen & Cross, 1992)
11	**Tests of being able to <u>monitor their own intentions</u>**
	(Phillips, Baron-Cohen, & Rutter, 1998)
12	**Tests of <u>deception</u>**

(Baron-Cohen, 1992; Sodian & Frith, 1992; Yirmiya, Solomonica-Levi, & Shulman, 1996)

13 **Tests of <u>understanding metaphors, sarcasm and irony</u>**

(Happe, 1993)

14 **Tests of <u>pragmatics</u> in their speech**

(Baron-Cohen, 1988; Tager-Flusberg, 1993)

15 **Tests of recognition of violations of pragmatic rules**

(Surian, Baron-Cohen, & Van der Lely, 1996)

16 **Tests of <u>imagination</u>**

(Scott & Baron-Cohen, 1996)

17 **Correlation with real-life social skills, as measured by modified version of the Vineland Adaptive Behaviour Scale**

(Frith, Happe, & Siddons, 1994)

18 **<u>Second-order false-beliefs</u> tests**

(Baron-Cohen, 1989d; Bowler, 1992; Happe, 1993; Ozonoff, Pennington, & Rogers, 1991)

19 **<u>Understanding stories</u> in which characters are motivated by complex mental states such as bluff and double bluff**

(Happe, 1994a)

20 **Decoding complex mental states from the expression in the <u>eye region of the face</u>**

(Baron-Cohen & Hammer, 1997; Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Baron-Cohen, Wheelwright, & Jolliffe, 1997)

1.3.3 Recent ToM Tests

The review by Baren-Cohen (2000) ends with two tests, one focusing on understanding stories and the other on eye region of the face. In the last 15 years, more recent literature appears to have developed those two areas further. There are two main approaches of ToM tests that are currently widely used. These include emotion recognition tests and non-literal language tests.

1.3.3.1 Emotion Recognition Tests

These tests attempt to measure a person's ability to recognise mental states (thoughts and feelings) from images of a person's face or the eye region of the face. There are four commonly known tests of this kind.

1.3.3.1.1 Pictures of Facial Affect (PoFA)

The PoFA was developed by (Ekman & Friesen, 1976). This test was based on stimuli consisting of 110 black and white images of caucasian actors portraying the six universal emotions (happy, sad, angry, surprise, fear and disgusted) and neutral expressions. The PoFA has been used to study emotion recognition rates in normal and psychiatric populations around the world. It did however receive criticism for including only European faces. A more culturally diverse set of stimuli called the Japanese and Caucasian Facial Expressions of Emotion (JACFEE) was later developed (Matsumoto & Ekman, 1988). Despite this addition many have argued the fundamental limitation of the PoFA as culturally flawed as emotions are not universal (Lutz & White, 1986). There are several studies of facial affect recognition in ASD, a meta-analysis of these concluded that this is difficult for individuals with ASD (Uljarevic & Hamilton, 2012). However in-depth analyses into the results suggest the differences not reaching statistical significance are often not reported in detail and that publication bias may have inflated specific results thus limiting the quality of the original data included in the meta-analysis (Uljarevic & Hamilton, 2012).

Ozonoff et al. (1990) suggested that for the emotion recognition difficulties to be considered a fundamental deficit in ASD, impairments should be apparent across studies, paradigms and control groups (Ozonoff, Pennington, & Rogers, 1990). The data reviewed in the meta-analysis did not strongly support a global emotion recognition impairment, because recognition of happiness was (just) intact across the studies sampled. Even a meta-analysis of this scale is fundamentally limited by the quality of the input data. Several researchers argue issues such as sample size, group matching and the tasks used are critical (Burack, Iarocci, Flanagan, & Bowler, 2004; Harms, Martin, & Wallace, 2010; Jarrold & Brock, 2004; Mervis & Klein-Tasman, 2004). Based on the studies reviewed larger sample sizes are required to increase the reliability and replicability of data. Ozonoff et al. (1990)

also strongly recommend the reporting of results in tables and of all statistical tests, even those which were not formally significant as lack of full data significantly reduced the sample of published papers which could be included.

1.3.3.1.2 Developmental Neuropsychological Assessment (NEPSY)
The NEPSY is a neuropsychological battery for children aged 3-16 years of age. In the second edition, the NEPSY-II (Korkman, Kirk, & Kemp, 2007) included a social perception domain. In 2010 research findings presented at the International Society for Autism Research demonstrated that children aged 3-12 with ASD performed significantly worse on the social perception tasks than the control sample (28 children with ASD and 48 controls) (Deerrose, Phillips, Parker, & Hardan, 2010). This battery is restricted to children only and therefore has limited/no utility for adults with ASD.

1.3.3.1.3 Wechsler Advanced Clinical Solutions (ACS)
Wechsler Advanced Clinical Solutions (Wechsler, 2009) was developed to include a social perception subset. The ACS provides opportunities to assess basic to more complex emotion recognition from faces and voices, including higher order meaning, such as sarcasm. The ACS Social Perception subtest has been validated against other social perception and cognition measures. In one of the validity studies consisting of 20 adults with AS and 19 controls, reported findings show significant correlations with five other social cognition measures, whereby ASD participants scored less well on all six measures including the ACS (Kandalaft et al., 2012).

Despite this, the greatest amount of convergent validity was with a version of Ekman's PoFA which has its own limitations described above. Furthermore the between group validation included a group of individuals with schizophrenia. The biggest effect was between controls and the schizophrenia group with the ASD group positioned in between thus questioning the size of the effect between the control and ASD group. Further limitations of the study include reduced generalisability of findings given that the sample size restricted the power for the statistical analyses. There also appeared to be age differences among the groups which may have influenced the results; missing data for some of the analyses may

have affected the magnitude of correlations (Kandalaft et al., 2012). A final and perhaps most crucial concern present in social cognition research is the potential association/influence of general intelligence. This is a complex issue due to the strong relationships between measures of social and general cognition. It has been noted that IQ and developmental disorders involving cognition are inextricably related (Dennis et al., 2009) thus any social cognition test validation study must demonstrate an attempt to separate the effects of general cognition.

1.3.3.1.4 Reading the Mind in the Eyes Test – Revised

The RMET was revised further following the original work in 1997 publications summarised in Table 1 above (Baron-Cohen et al., 2001). Fifteen adults (HFA and AS) and 239 controls (88 general population; 103 adult students; 14 IQ-matched controls) were presented with 36 images of a set of eyes each belonging to a face expressing an emotion. Participants were provided with four emotion terms per image of which only one was the correct answer. Participants were required to work out the correct emotion. The ASD group had a mean score lower than all three subtypes of the control group (Baron-Cohen et al., 2001).

The RMET has also been used in different cultural contexts where test-retest reliability has been investigated with inconsistent findings. In the Spanish version good test-retest reliability was demonstrated (Fernández-Abascal, Cabello, Fernández-Berrocal, & Baron-Cohen, 2013). In the French version it was reported that the stability of the test was not linear: participants obtained on average the same score from one week to the other, but they did not answer all the same questions correctly. Cultural factors were also considered in this study, in particular, participants born in Asia performed worse than participants born in North America, but no difference was observed for those born in South America, Europe, and Africa, suggesting that Asians may approach some ToM tasks differently than members of other cultures. Previous research has shown that people from different cultures might not make as much mental state inferences as westerners and might draw on different sources of information to explain behaviour (Choi, Dalal, Kim-Prieto, & Park, 2003; Morris & Peng, 1994). Neither of these reliability studies included a clinical population.

The RMET is perhaps the most widely used and known emotion recognition test used in adults with ASD. Whilst the RMET appears to discriminate between those with and without ASD, its focus on eyes pairs for emotion detection may present a fundamental limitation for the ASD population. Dysfunction of the amygdala in ASD might lead to a lack of orienting to social stimuli, in particular to the eyes in a face (Neumann, Spezio, Piven, & Adolphs, 2006; Spezio, Adolphs, Hurley, & Piven, 2007). For example, several studies have found reduced attention to the eyes (Boraston, Blakemore, Chilvers, & Skuse, 2007; Dalton et al., 2005; Klin et al., 2002; Pelphrey et al., 2002) and increased attention to the mouth region (Joseph & Tanaka, 2003). The meta-analysis described earlier found that not all emotions were equally difficult, in particular 'anger' and 'fear' was relatively more difficult for the ASD individual compared to 'happiness' which remained intact (Uljarevic & Hamilton, 2012). Processing of the eye region is particularly relevant to the recognition of fear, which requires attention to eyes and eye-brows (Dimberg & Petterson, 2000; Dimberg & Thunberg, 1998; Ekman, 2004; Smith, Cottrell, Gosselin, & Schyns, 2005). In contrast, processing of the mouth region could be sufficient to judge happiness. Thus, amygdala dysfunction in ASD could lead to reduced fixation on the eyes and to a difficulty in fear and anger recognition (Adolphs et al., 2005).

Specific attention to eyes only for emotion detection may well be a challenge to individuals with ASD however many normative social interactions are not limited static situations requiring eye contact and emotion recognition in this way. The RMET for instance doesn't explain why individuals who are able to detect emotions such as happiness more easily also continue to experience social interaction difficulties in these situations. The RMET *simply* demonstrates that those in the ASD group are less successful than the control group in accurately identifying emotions from eye pairs (Bartlett, 2010), it otherwise tells us very little about social functioning and also tells us little about the observed social interaction difficulties that people with ASD also acknowledge occur. The stimuli themselves are static and the real world never is (Baron-Cohen et al., 2001).

Furthermore, several of the items of the RMET appear gender biased. The images are black and white stills of actors in movies and are not representative of the

population. Though balanced male:female eyes pairs, there is a much greater range in ages represented by the males and all the females eyes are made-up with make-up conforming to gender stereotypes. Among the correct responses, there were 18 unique responses for male eyes and only 15 for the female eyes since some were duplicated with sexualised terms such as 'fantasising', 'desire', 'flirtatious' 'playful' and 'interested'. The RMET has been criticised for being gender biased due to the restricted range of female images and emotional expression and (Alvarez, 2013).

1.3.3.2 Non-Literal Language Tests

These tests attempt to measure detection/comprehension of non-literal communication between characters in stories and appear to move towards more complex ToM skills than emotion detection alone from statics images of faces and eyes. There are four commonly known tests of this kind.

1.3.3.2.1 Test of Similes, Metaphors and Irony

This test was developed by (Happe, 1993) informed by Sperber and Wilson's (1986) relevance theory (Sperber & Wilson, 1986), which makes explicit the role of the comprehension of intentions in human communication. According to relevance theory, then, people with ASD should have specific difficulties with the use of language for communication. Predictions from relevance theory prompted the design of three experiments to investigate the understanding of similes (literal), metaphors (1st order ToM) and irony (2nd order ToM), each therefore with increasing difficulty for the ASD person. The battery consisted of false belief and deception tasks at two levels of difficulty: 1st and 2nd order ToM. The predictions about the degree of ToM necessary for understanding simile, metaphor and irony were confirmed in Happe's (1993) study which lends support to relevance theory; however, is fundamentally limited as the study was not replicated and was not entirely on adults (15-19 years old) and conducted on a small sample (n=6 in each ASD arm) and controls had mild LD. Participants with ASD were also able to pass generic ToM tests or have no ToM skills at all suggesting that they were not at the high functioning end of the spectrum. The study also concluded that individuals with ASD were eventually able to attribute mental states (Happe, 1993). These limitations led to the development of the Strange Stories Questionnaire below.

1.3.3.2.2 Strange Stories Questionnaire (SSQa)

Developed by Happe (1994) this is set of vignettes/stories about everyday situations where people say things they do not mean literally. The stories were simple accounts of events, which assess the ability to interpret non-literal statement. The SSQa consists of 24 short vignettes, each accompanied by a picture and two test questions; the comprehension question which measures language comprehension and the justification question "Why did X say that?". There were 12 types of story, (two examples each) comprising: Lie, White Lie, Joke, Pretend, Misunderstanding, Persuasion, Appearance/Reality, Figure of Speech, Sarcasm, Forget, Double Bluff, and Contrary Emotions. Six control "physical stories" were also included. These did not involve mental states. In the study exploring the validity of the SSQa 18 ASD participants aged 16-20 were included; they were however divided into three groups based on their performance on a generic ToM battery (6='no ToM'; 6='1st order ToM only'; 6='1st and 2nd order ToM'). Age matched controls (n=10); children who all passed ToM tasks (n=26) and young adults with learning disability (n=13). Results indicate that the ASD participants scored on average lower than all three control groups on the mental state stories, furthermore within the ASD group a correlation between generic ToM ability and mental state stories was observed i.e. Those who passed 2nd order ToM tasks scored greater than those who passed 1st order tasks who in turn scored greater than those who passed none of the ToM tasks (Happe, 1994a). The study was largely involving children.

The study was replicated to measure the reliability of the SSQa using adults with HFA and AS (Jolliffe & Baron-Cohen, 1999). Some key limitations were identified. What distinguished the clinical participants on the metallisation condition was not a failure to use mental state terms but a failure to use the appropriate mental state term for the story's context. Jolliffe et al. (1999) also found that the AS group always performed better than the less high functioning ASD group in all question types. The finding that the clinical groups did not differ from the normal control group on the number of correct physical state justifications is at odds with Happe's (1994) original findings, where her second-order (ToM) ASD group made more correct physical state justifications than her normal adult control group. In the replication study (Jolliffe & Baron-Cohen, 1999) some differences were attributed

to the sample being older and higher functioning. It was important to understand why the clinical groups performed normally on the mentalistic comprehension questions, since these could be viewed as a test of appreciating non-literal language utterances, and it is well known from the pragmatics literature that even high-functioning individuals with ASD have problems appreciating such utterances (Happe, 1991, 1993, 1995; Ozonoff & Miller, 1996; Rumsey & Hanahan, 1990; Tantam, 1992). In the SSQa these were measured using two approaches i) language comprehension question, and the ii) justification question, which requires integration of information for higher-level meaning. The ASD group appeared to answer the mentalistic comprehension questions correctly but had greater difficulty with the justification question suggesting inability in context integration rather than language comprehension. Also another point of curiosity was why the ASD group did not perform worse than their normal controls on the Physical condition, since this condition also required the making of global inferences. Jolliffe et al. (1999) concluded that attempts to try to explain why the clinical group performed poorly on the Mentalistic condition, but not on the Physical condition, compared to controls was unresolved. One requirement of the SSQa is that the participant must infer the character's intended meaning not from the utterance but from the context in which it is embedded. The primary limitation of this approach is that these are not "pure" impairments as they could arise for ToM reasons, or central coherence reasons, or both (Jolliffe & Baron-Cohen, 1999).

Others have also highlighted the considerable cognitive demands that these tasks require while testing ToM, especially demands on working memory and in the case of verbal or text-based tasks; linguistic processing. For example, in interpreting a story describing a scenario in which a character tells a white lie, participants must process the language of the story and hold the relevant information in working memory while that information is integrated with prior knowledge and an interpretation is selected. These demands become especially critical when investigating ToM of individuals who may have language disorders or other cognitive impairments such as in working memory and executive function (Byom & Mutlu, 2013). Neither of the studies using the SSQa measured cognitive function to see if any difficulties in cognitive function accounted for the difficulties observed on the SSQa. Further, many of these tasks are passive and reflective in nature

which may overestimate ToM ability in daily life. For example, tasks requiring individuals to make mental state inferences from described scenarios generally allow ample response time and do not typically require individuals to formulate appropriate responses as if they themselves were in the situation (Byom & Mutlu, 2013).

1.3.3.2.3 Strange Stories Questionnaire (SSQa) – Revised

The SSQa has since been up-dated for children to include mental, human, animal and nature questions (White, Hill, Happe, & Frith, 2009). The updated version of the SSSQa includes the eight most demanding mental state stories (double bluff, white lie, persuasion, and misunderstanding). Eight control stories were created that required reasoning about physical states only. An additional set of eight passages of unlinked sentences was also created; here, participants were required to recall a specific fact from one sentence. All 5 sets therefore involved people and required attention to sentence meaning, memory, and question answering, whereas the mental and physical state sets also required the integration of information between sentences and inference from implicit information, and only the mental state set required ToM ability. In their primary study 45 children with ASD (aged 7-12) were divided into two groups based on their scores on the ToM battery: 'poor ToM' group and 'good ToM' group. In addition 27 control children matched on age and gender were included. The findings show that the children with 'poor ToM' performed less well than the controls and in the following order: unlinked sets, nature, animal human, mental, indicating that they found the mental state set the most difficult. Those in the 'good ToM' group performed less well than the control group, but to a less degree than the 'poor ToM' group and equally on the mental, human and animal sets. They however performed equally if not better than the controls on the unlinked and nature sets. These finding suggest a relationship between ToM ability, information integration and non-literal communication (White et al., 2009).

1.3.3.2.4 Faux Pas Test

This test was developed by (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999) and consists of 20 short stories containing incidents of faux pas (someone mistakenly saying something they shouldn't have) which are read to the child, who

is then asked questions to determine whether or not they recognised the faux pas. Each story involved two or three characters and at least two separate statements. The following questions are then asked in between the stories.

- Faux pa detection Question:

"In the story did someone say something that they should not have said?"

- Identification Question:

"What did they say that they should not have said?"

- Comprehension Question:

This question was different for each story

- False Belief Question:

"Did they know/remember that….?"

The recognition of faux pas was tested using two studies. Study 1 tested 7-9, and 11-year-old 'neurotypical' children. Results indicate the ability to detect faux pas developed with age and that there was a differential developmental profile between the two sexes (female superiority). Study 2 tested children with ASD, selected on their ability to pass generic ToM tasks. Results indicate that whereas 'neurotypical' 9 - 11-year-old children were able to detect faux pas, children with ASD were unable to (Baron-Cohen et al., 1999). Again the original faux pas test like many ToM tests was designed and tested on children. They therefore have limited utility in an adult population where often items reach ceiling effect (Jolliffe & Baron-Cohen, 1999; Lombardo et al., 2007; Ozonoff, Pennington, et al., 1991). The study did however enable the researchers to establish that faux pa detection in neurotypical children occurred aged 9-11 years suggesting it is a more advanced ToM skill given that generic ToM tests are achieved by neurotypical children aged 4-6 years. An adult version was also developed and was later developed further, described below (Stone, Baron-Cohen, & Knight, 1998).

1.3.3.2.5 Social Stories Questionnaire (SSQb)

Limitations of the original faux pas test led the development of the SSQb (Lawson, Baron-Cohen, & Wheelwright, 2004) based primarily on gender differences observed. These findings resulted in the Empathising-Systemising (E-S) theory of

ASD and the 'extreme male brain' theory. The SSQb provides more subtle examples of faux pas as a more stringent test of empathy. It contains 10 short stories and involves utterances made by one character that could upset another character in the story. Each story is divided into three sections making 30 sections overall with at least four utterances in each section. Ten of the sections contained a blatant target utterance, 10 contained a subtle target utterance and 10 contained no target utterance. Each section contained several questions for the participant to answer. First, they had to judge whether the section contained a potentially upsetting utterance and where relevant underline the text in question. Second, they had to judge whether this utterance (if present) would have upset the character concerned. Each of the 10 stories also included a control question. An experiment was devised to test the E–S theory. Three groups of adults took part in the study: (males with AS [n=18]; male control [n=44] and female control [n=45]). Each participant completed two tasks: one that involved empathising and another that involved systemising. On the empathising task, females scored significantly higher than control males who in turn scored higher than males with AS. Conversely, females scored significantly lower than both male groups on the systemising task, who did not differ significantly from each other; these findings lend support to the E-S theory of ASD (Lawson et al., 2004).

Some key limitations include those described of the SSQa. Some of the test material require integration with the social context of the story for example while an utterance said to person x in context x would cause no offence, it may do so to person y in context y, or even person x in context y. Weakness in central cohesion in ASD (Jarrold, Butler, Cottington, & Jimenez, 2000) could explain why these individuals' score lower of these tests that require integration. However in the validation study cognitive function was not measured other than IQ so it is not known what effect cognition function may have had on the scores of the SSQb. Similarly the cognitive demands placed on the participants could also explain the poor performance by the ASD group yet, executive function, a known weakness in ASD was not extensively measured in these participants (Jarrold et al., 2000).

The SSQb unlike the SSQa focuses particularly on the gender differences and uses the E-S theory to explain why males are more likely to diagnosed with ASD; however limited studies have been carried out on large number of females with ASD thus biasing these results and also conforming to cultural gender stereotyping of women having greater empathy (Lawson et al., 2004). This is not dissimilar to the gender biases noted in the RMET which has also been used to demonstrate gender differences and criticised for doing so (Alvarez, 2013). The E-S theory is limited by the lack of empirical validity and reliability (Baron-Cohen, 2009). Furthermore much less is known about systemising than empathising as empathy is seen as key to ToM, whereas systemising appears to be an altogether different skill. It is quite possible people with ASD have reduced ability to emphasise because it cannot easily be systemised thus requiring us to have a much greater understanding of systemising in both clinical and general populations (Baron-Cohen, 2009). The SSQb research however has shifted towards a focus on gender differences choosing instead to introduce the 'extreme male brain' theory of ASD (Baron-Cohen et al., 2014; Baron-Cohen, Knickmeyer, & Belmonte, 2005); which has received wide criticism (Attwood, Frith, & Hermelin, 1988; Carter et al., 2007; Spelke, 2005) especially the need for replication in broader samples (Buchen, 2011).

1.3.4 The Limitations of Existing ToM Tests

Despite their popularity, many individuals with ASD achieve scores suggesting no impairment in ToM (Jolliffe & Baron-Cohen, 1999; Lombardo et al., 2007; Ozonoff, Pennington, et al., 1991) particularly by later developmental stages i.e. post 14 years of age and adulthood. This suggests significant inconsistency in the literature and this conundrum has been minimised by assertions that non-impairment on ToM tests does not reflect 'true' ToM abilities, as it does not translate to levels of 'normative' social interaction (Baron-Cohen et al., 2001; Green, Gilchrist, Burton, & Cox, 2000; Happe, 1994a). This has resulted in more sophisticated ToM tests to capture the complexity of 'normative' social interaction. Various reasons may explain why existing ToM tests fail to capture this complexity of real-life social situations; one is the formal settings in which these tasks take place as well as their tendency to focus on specific aspects of social cognition such as 'shared expectation' (Curry & Jones Chesters, 2012).

The hallmark test for ToM thus far has been the false belief test (Baron-Cohen et al., 1985), however critics have argued too much emphasis has potentially been placed on false belief and other related tasks as key measures of this impairment. There is some evidence that contradicts the notion that ToM impairment is a core cognitive impairment in ASD. Bowler (1992) found that adults with AS pass first-order ToM tests (Bowler, 1992). Second-order ToM tests involve the individual reasoning about what one person thinks about another person's thoughts. Again, adults with HFA or AS pass these tests (Ozonoff, Pennington, et al., 1991). However these studies cannot be taken as conclusive evidence for an intact ToM in individuals with ASD because such second-order tests used can easily produce ceiling effects, if used with adults with a mental age above 6 years old. This is because neurotypical children pass second-order ToM tasks at about 6 years of age (Perner & Wimmer, 1985). To regard second order ToM tasks as "complex" in the context of adults is particularly misleading given 6 year old neurotypical children can pass these. They are indeed more complex than first-order tests (Baron-Cohen et al., 1985; Wimmer & Perner, 1983) but again neurotypical children aged 4 can pass first order ToM tasks. In summary adults particularly with AS or HFA can pass 1st and 2nd order ToM tasks and these do not translate to complex social skills in neurotypicals beyond the age of 6 years. First and second-order ToM skills will be referred to as generic ToM skills from here onwards.

The SSQa and SSQb described above begin to move towards a more advanced ToM test for adults; however the limitations of these tests are described above and more importantly since the development of these tests limited attention has been paid to the use of non-literal language in ToM tests as ways of moving away from a generic ToM impairment which has dominated the literature thus far.

1.3.5 Gaps in the Literature

In summary adults with ASD particularly AS and HFA pass generic ToM tests such as first order and second order ToM tests, despite continuing to show other social and communicative disabilities (Tager-Flusberg, 1999). However these studies have demonstrated that performance by children with ASD and other tasks that tap into a representational understanding of the mind is closely related to social language ability (Happe, 1995; Tager-Flusberg, 1994, 1997). ASD emerges much

earlier than age 4 when ToM is said to develop and since children of this age can pass 1st order ToM tasks, this suggests that impairments in ToM must predate this stage of development if it is to be used to provide a cognitive explanation for ASD (Klin & Volkmar, 1993; Klin, Volkmar, & Sparrow, 1992). Taking this broader perspective provides a clearer framework within which early signs of ASD may be interpreted; for example, studies of toddlers who later received a diagnosis of ASD have identified problems in eye gaze, affect, responsiveness to other people, and most crucially attention to language as important early markers of ASD (Lord, 1995; Stone et al., 1999). Future research on the social, language, and cognitive functioning particularly in adults with ASD may bring about a more comprehensive understanding of ASD. Thus future ToM tests should take forward what Happe's (1994) SSQa has begun to do which is to incorporate a more advanced ToM skills underpinned by social language impairment. Tests should be designed for adults particularly at the higher end of the autism spectrum i.e. HFA and AS to rule out the effects of skills developed at a later stage.

1.3.6 A More Advanced ToM Test

In order to take this challenge forward and develop a ToM test which can discriminate between those with and those without ASD (HFA and AS) in the adult population, a more subtle aspect of ToM in relation to normative social language and interaction needs to be understood and operationalised into a test format.

1.3.6.1 Non-Literal Language and ASD

Over the past decade the ToM model has been viewed as providing an important theoretical integration for our understanding of the key features of ASD (Baron-Cohen, Tager-Flusberg, & Cohen, 1993; Happe, 1994b). However some aspects of language impairment in ASD are not likely to be the result of ToM impairments alone. It is evident that some children with ASD also have language impairment that extends beyond the inability to use language appropriately in social contexts. What is significant about this is that these difficulties in communication occur to some degree across the entire spectrum, ability levels, language levels and perhaps most crucially across all the life span, suggesting adults who are otherwise quite high functioning may also present with these types of difficulties (Landa, Folstein, & Isaacs, 1991; Landa et al., 1992; Piven et al., 1997). The ToM

model has however also been important in our interpretation of the language and communicative impairments in ASD. The central difficulties encountered by all children with ASD are in the pragmatics of language that is the ability to use language appropriately in social contexts. Difficulties in *particular* aspects of pragmatic functioning are evident at all developmental stages, even in highly verbal adults with ASD (Lord & Paul, 1997). In ASD, there are unique and specific problems in understanding that language is a means for interacting with others, and for sharing information, thoughts or feelings between a speaker and listener (Tager-Flusberg, 1992, 1993). Related to this, people with ASD including adults have difficulty taking into account the listener's perspective, which effects their ability to engage in conversations in a sustained or meaningful way (Tager-Flusberg, 1996). While language is used in individuals with ASD to maintain some social contact (Wetherby & Prutting, 1984), it rarely goes beyond commentary on ongoing or past activity, to seek or share attention, provide new information, or express intentions, volition or other mental states (Tager-Flusberg, 1992, 1993, 1997) Thus, ASD is characterised by significant limitations in the range of functions served by language; which can be directly attributed to a lack of ToM. Therefore ToM is a much broader construct than simply an understanding of own and others' mental states. However, this ability gives rise to more complex social cognition skills such a as the ability to understand non-literal language.

The ability to use language in social context appropriately is best understood theoretically as the ability to understand 'non-literal language' or 'social language'. These constructs were informed by Sperber and Wilson's (1986) relevance theory. Relevance theory makes explicit the role of the comprehension of intentions in human communication. The ability to understand non-literal language thus requires the ability to understand the intentions of the individual and is therefore an important aspect of human interaction (Happe, 1993, 1994a; Sperber & Wilson, 1986).

1.3.6.2 Social Overtures and ASD

Studies of social motivation have shown that those with ASD typically do not respond to the social overtures (a type of non-literal language) of friendly strangers

or acquaintances (Lord, Rutter, & Le Couteur, 1994). The Oxford Dictionary definition of an 'overture' is as follows:

> An approach or proposal made to someone with the aim of opening negotiations or establishing a relationship

There are many terms used interchangeably that make reference to an inability often observed amongst those with an ASD to engage in this type of non-literal language. Some of these include 'social overtures', 'small talk' and 'social reciprocity'. Attempts to interact in a socially desirable way for the very purpose perhaps of starting social relationships can routinely be observed in normative social interaction (Lord et al., 1994). For example, social overtures include talking about the weather with a stranger as you both wait for the bus; patting children's heads; shaking someone's hand at the end of the meeting, waving hello at someone as you enter a vicinity you both regularly share. The intention of social overtures are not necessarily to share information, they rarely follow a logical order, have no moral basis, are not essential and, yet occur frequently in day-to-day normative social interactions. Individuals with ASD initiate far fewer approaches towards others in such unstructured ways, such as during free play or on playgrounds (Attwood et al., 1988; Lord & Magill, 1989). These difficulties are even more striking within sustained or reciprocal interactions (Lord, 1990) which demand a greater capacity to interpret the behaviour of the other person in order to maintain the social contact. Even when people with ASD do make overtures toward others, Lord and Magill (1989) found that these overtures were less likely to be sustained for even one minute, and were often not responded to at all by the others, partly because the quality is often reduced i.e. not making appropriate eye contact when attempting a specific overture (Lord & Magill, 1989).

Conversational difficulties such as these in ASD reflect fundamental problems in understanding that communication is about the expression and interpretation of *intended* rather than *literal* meaning (Happe, 1993; Sperber & Wilson, 1986). Several studies have found that even older high-functioning people with ASD have great difficulty interpreting non-literal or figurative speech (Happe, 1993, 1994a; Minshew, Goldstein, & Siegel, 1995). Pragmatic language difficulties in ASD are

found across different discourse contexts. These difficulties include: a narrower range of functions served by language; problems understanding that communication is about intention rather than literal or surface meaning; failure to view conversations as a means of modifying and extending the cognitive environment of a conversational partner; and failure to view narratives as a means for communicating about both events and psychological states. Across these studies the close connection between pragmatic knowledge and ToM has been highlighted. At both a theoretical and empirical level these domains seem to be closely linked (Locke, 1993; Sperber & Wilson, 1986; Tager-Flusberg, 1993).

1.3.6.3 Non-Literal Language in ToM Tests

Happe (1993) found that there was a close relationship between understanding metaphor or irony and performance on ToM tasks. Happe (1994) took this further in the SSQa and found a strong relationship between the ability to explain a variety of non-literal messages (e.g., lies, jokes, pretence, irony, sarcasm, double bluff) and ToM. The SSQb also developed the idea of non-literal language in ToM tests by using faux pas (White et al., 2009). Using social overtures within a test format would be an expansion of tests such as the SSQa and SSQb where non-literal language utterances were used in social stories. This would add another domain to the non-literal language tests as there does not appear to be any ToM tests that have specifically operationalised social overtures within a test format. The use of social overtures also develops the non-literal language framework within ASD further, which supports a multidimensional view of ToM rather than the one dimensional view of metallisation which it is often reduced to (Locke, 1993; Tager-Flusberg, 1993; Tager-Flusberg, 1999). The intention of social overtures in normative interaction is best viewed as an overall motivation for social relationships and social pleasantries and the individual behaviours themselves do not make this explicit. Therefore the ambiguous intentionality of social overtures present to us potentially a far more subtle and complex ToM ability. What is particularly complex about social overtures is that they often require interpretation based on multiple contextual factors and therefore appear different in different social contexts (Lord et al., 1994; Sperber & Wilson, 1986). For example two lone women are standing at the bus stop, one might compliment the other's dress and this makes for pleasant 'small-talk' and facilitates a positive social interaction as

they wait for the bus. Should the scenario include a male and a female and the man makes this comment, the female recipient of the overture may find this uncomfortable and potentially interpret his intentions as threatening. Social overtures are therefore judged on a situation by situation basis (Lord et al., 1994; Sperber & Wilson, 1986).

1.3.6.4 Specific Operationalisation of Social Overtures
The examples provided above of social overtures are but a mere few. There are many examples that may constitute social overtures and these examples thus became the basis for items in the new test. The ability to detect the social overtures within a complex social scenario was used as the behavioural response that infers this particular advanced ToM ability.

1.3.6.5 Test Development and Rationale
The aim of the current study was to develop a novel social cognition test which investigates social interaction difficulties observed between <u>adults</u> with and without a diagnosis of ASD (HFA/AS). Taking from the SSQa and SSQb stories were used demonstrate real-life situations with characters acting in ways one might expect day-to-day. Complexities in non-literal language were operationalised through the use of social overtures; items of the test include identification of social overtures (examples similar to those described above). Each story was sufficiently detailed and context specific making the social overtures subtle and not too obvious to detect especially for adults with AS/HFA. This could be viewed as an extension of the existing SSQa and SSQb. A full neuropsychology battery was also administered to take into account the cognitive demands of such a test for adults with ASD.

The new test is called the Social Situation Stories Questionnaire (SSSQ) and also includes a component with more generic ToM skills. This acts as a comparison for the more subtle advanced ToM component of the SSSQ. The SSSQ was administered to two groups of adults, those with a diagnosis of ASD (HFA and AS) and matched controls. The Differences in this test performance between the two groups will enhance our understanding of social cognition in ASD and will thus

potentially provide alternative research priorities and alternative loci for intervention.

CHAPTER 2
METHODOLOGY

2.1 Philosophy of Science

The purpose of research is to acquire knowledge through systematic investigation. There are many schools of thought on how best to achieve this, each with their own epistemological, ontological and/or methodological basis. The Oxford English Dictionary definitions, of epistemology and ontology are as follows, respectively:

- The branch of philosophy that deals with knowledge, especially with regard to its methods, validity, and scope.

- The branch of metaphysics concerned with the nature of being.

2.1.1 Epistemological Position

Positivism is an epistemological perspective which holds that the only authentic knowledge is that which is based on sense, experience and positive verification. This perspective was developed in the 19th century by the philosopher August Comte, and was later expanded by Emile Durkheim into sociological positivism as a foundation to social research. The term 'positivism' is now frequently used to designate research considered to be overtly deductive. A summary of this paradigm (traditionally known as the 'scientific' paradigm) might be based on the philosophy of scientific materialism, which views the natural world as material interaction therefore suggesting that all phenomena may be explained by observing the cause and effects of such interactions. In contrast, sociologist Max Weber argued that the social world was not equal to the natural world and simply observing and quantifying would not bring about a meaningful interpretation of observable phenomena. Human action does not, he argued, operate in the same way as the natural world. There is a need for interpretation of the meaning of phenomena in order to aid understanding. Social constructionism (Burr, 2003) or the social construction of reality is an alternative epistemological position that examines the development of a co-constructed understanding of the world. Key assumptions include that understanding, significance, and meaning are developed in coordination with others and not separately within the individual. Important features of this position is that that human beings rationalise their experience by co-creating a model of the social world and how this operates and 'language' and/or 'discourse' is the most essential system through which humans do this

(Burr, 2003).

ASD is a construct operationalised by various performances, which are considered to occur in those without this label for example intact executive function. It is recognised that these processes cannot be observed directly. The philosophical position underpinning the current research is critical realism (Lopez & Potter, 2005). The position taken is that these processes may exist but are shaped and positioned within the context in which they are located. By adopting a critical realist stance it is argued that there is a 'real' world and knowledge of it can be measured with objectivity but this method can encompass human error/biases and therefore cannot be entirely conceptualised in this way (Trochim, 2000).

All too often, research into ASD and 'disability' in general are dichotomised by being either underpinned by a realist/empiricist positions or social constructionist positions (Bhaskar & Danermark, 2006) resulting in polarised interpretations of findings which are reductionist in nature. The critical realist position attempts to move away from this, instead opting to look at the whole research process. For instance the aim of this research is to understand an underlying process by exploring measurable outcomes. Previous researchers have equally attempted this by suggesting various operationalised performances of this underlying process in what could be conceptualised as 'routes' such as executive function, central cohesion and theory of mind; we too are also attempting to demonstrate this, but in addition we acknowledge that this route is not a direct causal pathway and is one that is not observable; however by measuring responses from individuals about this process we are able to make inferences about the data we obtain; whilst also acknowledging that the results are constructed by our subjective interpretations, the language we use to describe it and the methodological limitations in our attempt to carry out such research.

In summary for theoretical and conceptual coherence a critical realist stance has been adopted which proposes one can observe 'reality' and the limits of 'reality'; the latter being the subjective element in knowledge production (Willig, 2008). This position supports the understanding of multiple interacting causal tendencies, from

biological (i.e. the causes of ASD) to discourse (i.e. the way we talk about ASD), providing a foundation for integration.

2.1.2 Methodological Techniques

In essence the use of quantitative, qualitative and mixed methods can be utilised irrespective of epistemological position, however some methods 'fit' better with some epistemological positions.

2.1.2.1 Quantitative Methods

Quantitative methods have traditionally been associated with realist ontology, i.e. with the proposition that the world described by science is the 'real world', as it is, independent of what we might take it to be. Scientists often adopt a deductive approach to discovering the 'truth' with the concepts of hypothesis testing and predictability at its core, leading to an emphasis on measurability and observational proof and methodologies which are typically based on experimental and large scale data collection. The aim is to establish causal laws by quantifying phenomena. In contemporary practice this means an inquiry into social or individual phenomena based on testing *a priori* hypotheses composed of variables, measured with numbers, and analysed with statistical procedures for the purpose of either disproving the hypothesis/theory or else inferring that the theory is generalisable with predictive properties.

2.1.2.2 Qualitative Methods

Qualitative methods are therefore an alternative approach to the acquirement of knowledge, often based on interpretation of meaning. Qualitative methods have therefore been associated with an idealist ontology (i.e. that there is no world independent of individual perceptions of it) and with a relativist theory of truth, in other words there will be many competing accounts or interpretations of the world, all of equal validity. An inductive approach is often utilised with the emphasis on theory building and hypothesis generation.

The qualitative method investigates the 'why' and 'how' of decision making, not just the 'what', 'where', or 'when'. Hence, smaller but focused samples are more often appropriate, rather than the large samples used in quantitative research.

Methodological emphasis is often placed on unstructured methods such as in-depth interviews, ethnography and phenomenology. The goal of qualitative research is to discover patterns which 'emerge' after close observation, careful documentation, and thoughtful analysis of the research topic. The discoveries arising from qualitative research are less about generalisations than about contextual findings.

2.1.2.3 Methodological Differences

The differences highlighted above underpin specific differences in method. For example sampling is usually carried out in different ways. In quantitative research, emphasis is often placed on selecting samples which are randomised and representative thus allowing the data to be generalisable or in experimental designs these may include identifying people with a 'factor' of interest and identifying matched controls. In qualitative research many sampling methods exist but one example is to purposefully select samples, according to whether or not the participants typify certain characteristics. Data collection between the two methods is also often a point of divergence; with quantitative methods usually adopting the use of structured questionnaires, pre-existing standardised questionnaires. Qualitative methods on the other hand often favour focus groups, in-depth unstructured interviews, participant observation and/or documentation such as diaries. This type of data collection method is often favoured primarily because the nature of the research question which allows for richer data to be collected. Another diverging factor is that qualitative research places emphasis on the understanding of phenomena through looking at detailed analysis of words and actions. A quantitative approach, in contrast looks past these words and actions to their statistical significance, usually expressed as the quantified results of such observations.

2.1.2.4 Current Study Methods

The purpose of the current study was to investigate whether individuals with ASD have difficulties with social interaction because an aspect of ToM is lacking or processed differently. This was achieved through the development of a social cognition measure (structured questionnaire). The outcome (scores) on this measure between those with and without ASD were compared in order to

determine whether they discriminate between the two groups on the particular dimensions operationalised within the questionnaire. The nature of this task was achieved through quantitative methods, as the instrument developed was structured, numerical and intended for use on a large sample size. Whilst there was space for qualitative feedback from the participants who completed it, this was to inform the future development of the instrument as opposed to a qualitative study of participant's experience.

2.2 Study Aims and Objectives

2.2.1 Primary Aim

To develop the SSSQ: a new social cognition test incorporating a generic ToM component as well a more subtle stringent ToM component for the specific use on adults with ASD (HFA/AS).

2.2.2 Secondary Aim

To assess the validity and reliability of the SSSQ.

2.2.3 Preliminary Objective

1) To obtain a sample of adult participants with ASD and a matched control sample.

2) To assess neuropsychological function of participants.

2.2.4 Primary Objective 1 – Validation Study

1) To assess experimental group validity (between group analyses) for the newly developed SSSQ and the existing RMET and MIT.

2) To assess convergent and divergent validity by assessing the relationship between each of the social cognition tests and the relationship between social cognition tests and relevant general cognitive function (Executive Function).

2.2.5 Secondary Objective 2 – Reliability Study

1) To assess Item level reliability using alpha coefficient analyses

2) To assess further Item level analyses depending on initial analyses

3) To investigate ceiling and floor effects for individual items

2.2.6 Hypotheses

2.2.6.1 Preliminary Objective

It was hypothesised that the two groups will match on key demographic variables however, will not match on executive function scores.

2.2.6.2 Primary Objective 1

A significant difference between the two groups was hypothesised on the more subtle ToM component of the SSSQ (Part 1) and the RMET however not on the generic ToM component of the SSSQ (Part 2) or the MIT.

The SSSQ – Part 1 was expected to show divergent validity with the SSSQ – Part 2 and the other social cognition tests. The SSSQ – Part 2 was hypothesised to show convergent validity with both the RMET and the MIT.

Executive function was hypothesised as a factor effecting social cognition abilities in the ASD group, thus reducing their performance on the SSSQ.

2.2.6.3 Secondary Objective 2

It was hypothesised that some of the items in the SSSQ – Part 1 will demonstrate good reliability.

2.3 Methods - Part 1

2.3.1 Instrument Development

Given that the nature of this research was to develop an instrument; the entire project is at a pilot stage in the development and validation of the SSSQ. The SSSQ format was informed by previous questionnaires described in chapter 1 and as such the definition of the construct had to an extent been achieved i.e. ToM as primary construct. The following stages of instrument development informed this development phase. Given the pilot nature of this study none of these steps were intended to be carried out using the desired sample size.

Stages of instrument development (Prince, Stewart, Ford, & Hotopf, 2003)
1. Definition of construct
2. Review of construct definition
3. Item drafting
4. Item review
5. Alpha testing
6. Beta testing
7. Post-development testing

2.3.2 Item Drafting

Draft versions of the SSSQ can be found in the Appendix 10. The final version used in the validation study can be found in Appendix 9. Initially a story was developed with social overtures imbedded within the story as well as four questions following, to produce the generic ToM component. These stories were reviewed in supervision and in consultation with the two collaborators.

Draft 1

Following consultation of draft 1, this process strengthened the definition of the construct particularly agreement of social overtures as a construct. This process also included item drafting and review, ideas for social scenarios and stories were developed as well as examples of social overtures. In particular the initial generic ToM component in draft 1 was considered far too complex particularly the last question which required participants to rank responses. Following draft 1, it was

agreed that the generic ToM component would only include a 1 response answer from a series of multiple choice options.

Draft 2

The focus of draft 2 was to review a complete SSSQ instrument where four stories had been developed with both the more subtle social overtures section as well as the generic ToM section of the SSSQ. During this stage greater attention was paid to the narratives in the stories and a clearer way of scoring the generic section of the SSSQ was discussed. For example from the multiple choice options only one clear answer would include references to a person's mental states (their thoughts/feelings) which was then considered the target answer indicating greater ToM skills. As well as the introduction of two test items to measure language comprehension of the stories and qualitative feedback from participants.

Draft 3 followed these changes and was subsequently sent to ten people; this process is described below.

2.3.3 Alpha testing

This is the process where remaining items are tested for test - retest reliability. This process can lead to further modification or elimination of items that show reduced internal consistency or unreliability i.e. those that endorsed by nearly everyone or no-one (ceiling and floor effects). It is normal to use a sample of 50-100 for this process however for a thesis of this nature 10 participants were identified to pilot draft 3 of the SSSQ. These included professionals in the field of epidemiology, statistics, clinical psychology and people who had expertise in ASD either professionally or personally. Following the evaluation of these ten participants further changes were made particularly to the language and presentation of question one (Except 2 below). Some of the multiple-choice answers were also modified to make a more obvious or less obvious ToM option. A more formal item reliability test was conducted as part of the secondary objectives presented in Methods - Part 2 onwards.

Responses from these ten participants allowed for one social overture to be removed from Story 4 as it was not considered an overture; re-formatting,

including clearer boxes and lines and further minor editing to narratives and answers. The key changes included re-wording question 1 which was the primary question in each story to elicit social overture detection (Excerpt 2) and the introduction of a practice item (Excerpt 1). The final SSSQ is described below and can be found in Appendix 9.

The SSSQ includes a practice item followed by four fictitious stories involving characters engaging in a wide range of social interactions. The practice item is presented below:

Excerpt 1

1   Ryan was riding his bike to work one morning.
2   On his way to work he saw his friend Angela. He tried to wave to her.
3   Angela did not notice Ryan.
4   Ryan stopped cycling to go up and say hello to Angela.
5   Angela then smiled and said hello to Ryan.
6   After a brief chat Ryan said he was running late for work and had to go.

The structure of SSSQ includes two parts. The first of which is always immediately followed by the story and is represented in question one (SSSQ- Part 1). In this section participants were asked to identify where in the story a social overture(s) occurred. This was presented in the following format following feedback from draft versions:

Excerpt 2

Q1. Was there a social interaction that occurred anywhere in the story that you believe was both
1. positive <u>and</u>
2. something the character did not really have to do in that situation

Yes ☐

No ☐ (Please go to Q2)

If yes: which line(s) did it occur in, you may select more than one line if you think there was more than one.

_____

There were two overtures in stories 1-3 and one in story 4. Seven lines in total contain the target answers. The seven lines were as follows:

Story 1/Line 5:	The man looks affectionately at Adam and pulls a silly face.
Story 1/Line 14:	The other mother comments "what a clever boy" in response to Adam's actions.
Story 2/Line 4:	then gave her best friend Mandy a wave whilst walking to an empty desk.
Story 2/Line 6:	Matthew shouted out "Simon is not here today sir, he's off sick".
Story 3/Line 6:	When the shop assistant returned with the dress, he said to Jane "that dress suits you, it matches your eyes".
Story 3/ Line 10	and shook his hand on the way out.
Story 4/ Line 9:	Aunt Eva pats both your heads and smiles.

The second component (SSSQ-Part 2) was included to measure generic ToM ability. Each story following question 1 (SSSQ-Part 1) was then followed by four

questions labelled Q2-Q5 in the questionnaire format. For improved readability the SSSQ will be described in two parts from here onwards and SSSQ-Part 2 items are presented as Q1-Q4. See Table 2 below.

Table 2

SSSQ Part 2 – Generic ToM questions

	Question	ToM Ability
Story 1		
Q1	Why did the mother tell the child not to be silly?	2nd order
Q2	Why did the man look affectionately and pull a silly smiley face at Adam?	2nd order
Q3	Why did the women laugh when they heard what Adam had said to the man?	Humour
Q4	Why did the other mother apologise to Amber when her child sneezed?	2nd order
Story 2		
Q1	Why did Mr Ali's facial expression change when he smiled?	Facial emotion
Q2	Why did Mandy offer Jessica a chocolate bar?	2nd order
Q3	Why did Jessica look anxious on the bus?	Facial emotion
Q4	Why did Jessica decline money from Mandy?	2nd order
Story 3		
Q1	Why did Jane's facial expression change?	Facial emotion
Q2	Why did David tut?	1st order
Q3	Why did the woman on the bus change seats?	1st order
Q4	Why do you think David described the bus as an awkward situation?	1st order
Story 4		
Q1	Why did your mother not look happy when she was speaking on the phone?	Facial emotion
Q2	Why did Robert's facial expression change?	Facial emotion
Q3	At the start of the ceremony several people were snapping at each other, why might that have been?	2nd order
Q4	Why did the all the women laugh when one of them commented on the colour of Lucy's dress?	Humour

<u>2.3.4 SSSQ Scoring</u>

2.3.4.1 SSSQ – Part 1

Participants were asked to record, as many lines as they thought were correct. In the original data all responses were captured. In summary the following patterns emerged. For Story 1 participants recorded 0-5 line numbers where they believed a social overture took place. The majority of people however only recorded 1 line. In Story 2 this ranged from 0-7 lines in total; however the majority of participants recorded between 1-2 lines only. In Story 3, the number of lines recorded ranged from 0-3 with majority scoring 1 line only and finally in Story 4, the number of lines recorded ranged from 0-6 however again the majority of people scoring only 1 line.

To make the SSSQ - Part 1 a scalable measure with so called correct and incorrect items, binary variables were created for each correctly identified line (0=incorrect; 1=correct). For example, in Story 1 the target lines were line 5 and 14 (See Excerpt 2 above). If participants recorded line 5 and 14 amongst any of their recorded numbers they would have achieved the full maximum score of 2. If they recorded only 5 or only 14 they would have achieved a score of 1. Therefore the maximum score achievable on this variable was 2 irrespective of any other line numbers they had recorded. The process was repeated for the remaining stories. For Story 2 and 3 these were also 2 points, for Story 4 this was 1 point only as there was only one social overture in the story to detect. A composite variable was then created combining the four sub-variables thus, ultimately producing a SSSQ - Part 1 Total score, which was a 0-7 point scale. Those detecting all 7 social overtures will have scored 7 points. There are obvious limitations to this process of scoring which are discussed later.

2.3.4.2 SSSQ- Part 2

The second part of the SSSQ consists of four questions per story with four multiple choice answers yielding an additional total of 16 items to the original 7 items described above. One of the multiple choice answers suggests the person choosing it is using generic ToM skills to make their decision. These answers were purposefully worded as described above in the item drafting section to include

mental states of the characters. The target answer in each question is the choice with the mental state reference. The SSSQ- Part 2 Total therefore is a scale of 0-16. A greater score indicates greater use of generic ToM ability. See Appendix 9 for final version of SSSQ; target answers for the SSSQ-Part 2 are in bold.

In total the SSSQ has 20 items on the questionnaire format. The SSSQ-Part 1 yields 7 variables for analyses and the SSSQ-Part 2 yields 16 variables for analyses. The total achievable score is therefore 23 points. Because the two components measure slightly different constructs (generic ToM ability Vs. more subtle ToM ability) the SSSQ is always presented and discussed in two parts.

At the end of each story, participants were also provided with an opportunity to give feedback on how they experienced the questionnaire i.e. if they found any questions harder than others etc. This was recorded as hand written free text.

2.3.5 Beta testing

Surviving items are then tested for validity in a separate sample where the sample size is large enough to perform a factor analysis (Prince et al., 2003). Again it was never anticipated that the current study would be sufficiently large enough to meet formal beta testing criteria. However the current study attempted a pilot phase of this step.

2.3.6 Assessment of Validity

There are two key typologies of validity (Benson & Clark, 1982; Prince et al., 2003). First, 'construct validity', this is the measure of the extent an instrument is measuring a meaningful, real entity. For example whether ToM/Social overtures is a 'real' meaningful entity. The construct can be homogenous or multidimensional. Second, 'predictive validity'. This is when an instrument is associated with a likely predicted outcome and with 'real world' function or with performance on another test. The focus of the current study will be to determine some level of construct validity. There are typically four ways in which this is addressed.

2.3.6.1 Qualitative

2.3.6.1.1 Content Validity

This is a non-statistical type of validity that involves the examination of the instrument content to determine whether it covers a representative sample of the domain that is attempted to be measured (Anastasi & Urbina, 1997).

2.3.6.1.2 Face Validity

This is an estimate of whether an instrument appears to measure a certain construct. It relates to whether a test appears to be a good instrument or not. This judgment is made on the "face value" of the instrument and thus can also be judged by non-experts in the field (Holden, 2010).

2.3.6.2 Quantitative

2.3.6.2.1 Criterion Validity (Experimental Group Validity)

This is achieved by comparing the instrument with a current 'gold standard' (Campbell & Fiske, 1959; Prince et al., 2003). The justification for the current study was that the consensus is that there is no current 'gold standard' as such in ASD so this was not possible here. It could be argued that the current 'gold standard' in ASD is 'clinical judgement'. In the absence of a 'gold standard', external criteria such as two groups can be used that are identified as different in some specific way. This is perhaps the primary validation approach we are using in addition to the others described. We have two groups that we believe to be different based on a diagnosis of ASD or not. An instrument producing different results between these two groups would go towards confirming validity of said instrument.

2.3.6.2.2 Concurrent Validity (Convergent and Divergent Validity)

This type of validity relates primarily to how a new instrument measures up against exiting instruments (Campbell & Fiske, 1959). Convergent and divergent validity are best understood together and should be tested in relation to each other. For example an instrument should be related to an alternative instrument measuring the same construct (convergent), than one not measuring the same construct

(divergent). The SSSQ was compared with the MIT and the RMET which measures also measure ToM skill. Neuropsychological test which measures general cognition rather than social cognition can also be used as a divergent construct.

The quantitative approaches to validation (criterion and concurrent) described above have been carried out in the next stage of this study. The process of which, are describe in the Methods - Part 2 below.

2.4 Methods - Part 2

2.4.1 Power Calculation

Statistical power is defined as the probability of rejecting the null hypothesis when the alternative hypothesis is true. Power calculations are often undertaken *a priori* to determine sample size for prospective studies. Generally, the sample size for any study depends on the following: a) Acceptable level of significance (α), b) Power of the study ($1-\beta$), c) Expected effect size, d) Underlying event rate in the population and e) Standard deviation in the population (Kirby, Gebski, & Keech, 2002). Using statistical software sample size calculations can be estimated when these parameters are set.

A formal power calculation was not undertaken in the current study, as the SSSQ had never been used and it was not possible to estimate the mean difference between groups or the standard deviation to determine a reliable effect size. Our collaborating clinicians confirmed approximately 20 adult ASD diagnoses had been achieved each year in their services. Therefore a reasonable target of 20 per group was assumed. However in keeping with the time frame of a taught doctoral programme of study, a minimum of 15 people in each group was regarded more realistically achievable and this was the agreed sample size target.

Some free software packages such as GPower (Faul, Erdfelder, Lang, & Buchner, 2007) allow for sample size calculations using standard accepted parameters for the first three parameters described above. These usually include 0.05 for level of significance (α) (Craparo, 2007), 0.80 for power ($1-\beta$) (Cunningham & McCrum-Gardner, 2007) and 0.05 for effect size (Cohen, 1988) which is considered moderate. Using these parameters in GPower the sample size required was 64 in each group. However if the effect size was set at 1.0 which is considered a large effect size (Cohen, 1988) the required sample size would have been 17 participants in each group. This would however mean a much wider difference in the mean scores between the two groups would be required in order to detect any significant difference. It was likely that the current study was underpowered, the limitations of which are discussed in the 'Methodological Limitations' section.

2.4.2 Study Design

A matched cohort study design; including 12 people with ASD and 16 matched controls.

2.4.3 Ethical Consideration

The study was approved by the University of East London Ethics Committee (Appendix 1). Given the recruitment of NHS patients from two NHS services, NHS ethical approval was also sought and achieved through the National Research Ethics Service Committee South West – Exeter (Appendix 2). In additional Research and Development (R&D) approval for both the two collaborating NHS sites were also approved. The ethics application included a detailed analysis of all ethical considerations; however the following key areas were germane to the application.

2.4.3.1 Mental Capacity and Informed Consent

Consent and inclusion was prioritised, as it is common for people with learning disability (which can be considered an umbrella term for a range of difficulties including ASD) to be excluded and often their consent is not sought as their identities are often overshadowed by dominant narratives of inability and incompetence (Fredman, 2006). It was not anticipated that potential participants would lack capacity to consent as patients were identified based on a diagnosis of HFA and AS. Neither of these labels suggests a lack of capacity. However in general, capacity will always be required in order to provide full consent. Participants were offered a brief screening assessment prior to completing the consent form. During this process the researcher examined capacity to consent following the Mental Capacity Act (2005) guidelines. The participants were given an information sheet fully describing the nature of the research study. They were also given an opportunity to ask questions prior to signing a consent sheet to confirm consent. Participants were also informed via the information sheet as well as verbally by the researcher of their right to withdraw consent at any time for any reason. Participants recruited via clinical sites were initially approached by their clinician where capacity to consent was also assessed. In total there were two information sheets for the ASD group as participants were recruited via two different routes. A third information sheet was used for the control participants and

a single consent sheet was used for all participants (See Appendix 3-6 for all participant material).

2.4.3.2 Confidentiality and Data Protection

Each participant was given a unique identification number. This was used to link identifiable and unidentifiable data as the two were stored separately to ensure data protection. All data was managed securely with password protection. Hard copies were filed in secure locations. Identifiable/personal data (names, addresses, dates of birth) was recorded and stored separately in hard copy format to prevent accidental electronic transfer. Only anonymised data files were stored electronically on university computers with secure severs which only the researcher and supervisor had access to. Data for analysis was presented in an anonymous format. Hard copies of the data were kept securely in the School of Psychology department and will be destroyed once they are no longer required which is expected to be within 1 year from study end, in keeping with the university research data archiving policy which allows up to 5-10 years data storage.

2.4.3.3 Participant Burden and Emotional Wellbeing

There are two aspects of the study, which require participants to undergo a neuropsychological assessment and then answer questions relating to social cognition. There is substantial evidence that asking questions that test people's social skills and cognitive function is not stressful to the vast majority of participants in studies of this nature (Bennett-Levy, Klein-Boonschate, Batchelor, McCarter, & Walton, 1994). Our interview was made up of standardised neuropsychology measures, which have been widely used. The social cognition battery include a standardized instrument, an existing measure which has previously been used in a similar student study as well as the experimental measure which is a self-administered paper based questionnaire. Participants may however wish to perform well on these tests and therefore may feel some anxiety around this; it is also not unusual for neuropsychological tests to cause some performance anxiety (Bennett-Levy et al., 1994). However since these tests do not inform any clinical decisions and participation was completely voluntary this anxiety was anticipated to be less. However, participants may perform less well than what they would like to, potentially impacting on esteem. Therefore a full

debrief was included at the end of the interview and participants were given the option to decide whether they wish to know how they performed or not. Where participants had performed less well this information was provided sensitively and in a manner that was not damaging to their well-being. The interview itself took up to 1.5 - 2 hours. This may cause fatigue; signs of which were monitored and participants were reminded that they could have a break at any time.

2.4.4 Sample/Participants

There were two groups in this study, a group of participants who had a diagnosis of ASD and a control group. The control group were referred to as such rather than 'neurotypical' a term often used is in this type of research. The purpose of the control group in the current study was act as a comparison group by virtue of not having a diagnosis of ASD. There was otherwise nothing to suggest that this group was neurotypical, as the term implies assumptions of normality and expectations of group differences other than ASD diagnosis, which is not and cannot be defined in the current research (Saxe, 2006).

2.4.4.1 ASD Participants

A total of 15 ASD participants were required for the current study. Recruitment for participants with ASD took place via two different approaches. From a cohort of previous ASD research carried out by the current supervisor, participants who had previously consented to re-contact (n=16) where contacted via e-mail regarding the current study. Because these studies were undertaken at UEL, the UEL ethics approval provided adequate approval for this approach of contact. The supervisor would initially contact these participants; those that responded and/or gave consent to be contacted further were contacted by the researcher.

ASD participants were also recruited via the two collaborators involved in the study. It was anticipated that each service would have a minimum of 20 participants who could potentially be approached to take part in the study. Both these clinicians would initially approach their service users who would then be contacted by the researcher following their verbal consent to do so.

2.4.4.2 Inclusion/ Exclusion Criteria

There were clear inclusion and exclusion criteria that the clinicians used to judge the appropriateness of recruitment. These are summarised below. Whilst one would like to be as inclusive as possible there were some factors that needed further consideration. Age was restricted to 65 as there is evidence to suggest that increased age may cofound cognitive assessment outcomes (Lezak, Howieson, Loring, Hannay, & Fischer, 2004). Whilst age 65 is an arbitrary cut-off in keeping with European retirement age this tradition is used throughout the NHS and it was highly likely that people over 65 would be more likely to be in older adult's services given how NHS services are structured. Similarly factors such as substance use, serious mental illness and educational attainment also significantly impact on neuropsychological assessment outcomes and therefore were considered in the inclusion/exclusion criteria (Lezak et al., 2004). Fluency in English language comprehension and literacy were also required as the experimental questionnaire was based around literacy and social stories. Similarly those with low functioning autism or learning disabilities may likely have found the testing and questionnaire too challenging and unable to complete. We did not exclude on the basis of gender, ethnicity or common mental health problems such as low mood or anxiety.

Inclusion Criteria

- Diagnostic label of ASD (HFA/AS)
- Age 18-65 years
- Fluency in English language comprehension and literacy
- Formal education minimum secondary school

Exclusion Criteria

- Current psychotic and/or serious mental illnesses
- Current illicit substance use/misuse in the last 6 months
- Learning Disability and/or (IQ <70)

2.4.4.3 Control Participants

Given that the sample size was small in the ASD group it was particularly important that the control grouped matched the ASD group on key variables and

not the general population. Matching enables the conditions in both the ASD and the control group to be as alike as possible thus enabled us to estimate the effect of the primary outcome by reducing bias due to confounding (Rubin, 1973). For matching purposes control participants were targeted based on their age, gender and education level. It is widely accepted that age and education level effects scores on cognitive tests (Lezak et al., 2004). There are also important gender differences in ASD (Baron-Cohen et al., 2002) thus gender was also a key matching variable. The control participants were also subject to the inclusion/exclusion criteria with the exception that they did not have a diagnosis of ASD. The control group is best described as a convenience sample recruited essentially via email contact and/or word of mouth through the following approaches below, until target sample size was reached:

- Researcher personal contact within own social and professional network.
- Using a snow balling method technique, researcher's contact's social and professional network as deemed appropriate by them i.e. friend or colleague's partners/spouses.
- Standard research recruitment circular email sent to the student/staff population of the university.
- Poster advertisements in local community settings with consent from organisation. For example GP surgeries, local supermarkets, libraries and ASD/LD community support groups.

Each step of recruitment described above was seen as increasing in potential difficulty and complexity so recruitment of control sample was carried out in this order to minimise potential difficulties. An adequate sample was achieved using steps 1-2 alone.

2.4.5 Procedure
2.4.5.1 Consent and Screening
Eligible persons were initially approached by their clinician, supervisor or the researcher depending on which group they belonged to. Interested volunteers were all provided with a study information sheet adapted for them (i.e. patient,

existing participants or control) and invited to ask questions. Those agreeing to participant were invited to the interview on a day and time of their choice. Location option included their regular clinical service, university campus sites or their home. On the day of testing, capacity to consent was assessed and written consent obtained. Participants were also encouraged to ask any further questions during this process. Those claiming travel expenses were also reimbursed during this time.

2.4.5.2 Neuropsychology Function

As part of the validation of the SSSQ, it was important to ascertain that the SSSQ and the other social cognition tests scores reflect social cognition function as opposed to the effect of general cognitive function. Key cognitive functions that are likely to impact on social cognition include verbal function, visuo-spatial functions; short term stores and working memory and executive functions (verbal and visual) (Lezak et al., 2004). Psychological theories described earlier in the introduction chapter have suggested that executive function may impact on social cognition for individuals with ASD (Ozonoff, Pennington, et al., 1991; Shallice, 1988) and these test scores were later adjusted for in the validation analyses. The administration of the neuropsychological assessment was standardised using verbal instructions located in the examiner's handbook from original manuals.

2.4.5.3 Social Cognitive Tests

Participants were then asked to complete the RMET, MIT and lastly the newly developed SSSQ. This was given to the participant at the end as there was no time limit for the completion of the SSSQ.

2.4.5.4 Debriefing

The total assessment time lasted on average 1.5-2 hours. After study completion participants were offered verbal debriefing and cognitive profiles which were optional. Participants were offered a brief summary of their scores using qualitative descriptions, given this information sensitively using the language of individual relative strengths and weaknesses.

2.4.6 Measures

Assessment was divided into three components: demographic characteristics, followed by a battery of neuropsychological tests and finally a battery of social cognition tests including the self-administered SSSQ. Data were collected on the following:

2.4.6.1 Socio-demographic Information

2.4.6.1.1 Age

Reported age of participants was recorded in years and months to allow for accurate comparison with normative data to obtain age adjusted scaled scores. However for the purpose of analyses only age in years was used.

2.4.6.1.2 Gender

Reported gender was recorded as control participants were matched by gender.

2.4.6.1.3 Education

The number of years spent in full time education was calculated from the age of starting and leaving full time education including those attended as a mature student.

2.4.6.1.4 Employment

Employment was measured using the Registrar General Classification system. This is a 5-point system based on the person's occupation. For this sample, the current occupation was ascertained. The following categories are defined in this classification: (1) professional, (2) managerial, (3) skilled non-manual occupations such as administrative and clerical categories, (4) skilled manual occupations such as electricians and plumbers, (5) semi-skilled, (6) unskilled. In addition categories for the following were also included: unemployed (0) parent/carer (7), armed services (8) and student (9). Self-employed (9) and volunteer (10) were also included as some people with ASD are unable to work in mainstream employment however carry out work related activities on either a self-employment or volunteer basis.

2.4.6.1.5 Ethnicity

Reported ethnicity was recorded. The following categories were based on the self-ascribed ethnicities included in the study: White British, Chinese, Irish, Scottish, Mixed ethnicity and Black.

2.4.6.1.6 Handedness

Reported handedness was recorded as it is recognised to be a key factor required when interpreting neuropsychological assessment scores (Lezak et al., 2004).

2.4.6.1.7 ASD Diagnosis

Diagnosis was recorded in the first instance to determine control and ASD group. ASD group participants were also asked to confirm diagnosis of either HFA or AS.

2.4.6.1.8 Age of Diagnosis

Age of diagnosis was also recorded. All participants were diagnosed at a time suggesting the DSM-IV or earlier editions were used.

2.4.6.2 Neuropsychological Assessment

A brief screening tool was used to confirm reading ability, followed by assessment of verbal function and visuo-spatial functions; short term stores and working memory and executive functions (verbal and visual).

2.4.6.2.1 Screening

The Test of Premorbid Functioning (TOPF) - UK version (Wechsler, 2011) was used to measure reading ability, which provided a brief assessment of the English language/literacy skills necessary to take part in the remaining assessment. This was a reading task requiring participants to read out single word items. A total of 70 words were included. The raw score was converted to a predicted full scale IQ.

2.4.6.2.2 Verbal Function

Verbal function was measured using the Vocabulary subtest of the Wechsler Adult Intelligence Scale – IV (WAIS-IV) (Wechsler, 1997). Participants were asked the meaning of 30 words. Answers include scores between 0-2 though the first three

items only achieve a maximum score of 1. Certain 0-1 point answers were allowed prompts by the examiner to achieve the full 2 point score. The task is discontinued after three consecutive incorrect answers. A total score of 57 is achievable on this measure.

2.4.6.2.3 Visual Function

Visual function was measured using the Matrix Reasoning subtest of the WAIS-IV (Wechsler, 1997). After two practise items where participants are demonstrated why the correct answer is so, using standardised instructions, participants were then presented with a further 26 visual puzzles each of which has a missing component. Participants were required to select the missing component from 5 options presented. The task is discontinued after three consecutive incorrect answers. A total of 26 points is achievable on this measure.

2.4.6.2.4 Short-term Stores (STS) and Working Memory

The digit span subtest of the WAIS -IV (Wechsler, 1997) was used to assess short term memory and working memory. This task was divided into three parts. In part 1 participants were required to repeat a string of numbers in the same order (forward span), in part 2 they were asked to repeat a string of numbers in reverse order (backward span) and in part 3 they were asked to repeat the string of numbers starting with the lowest number first and working upwards (sequencing). Each part has eight trials though parts 2 and 3 both include a practice trial that is not scorable. Each trial starts with a string of two numbers increasing by one up to either 8 or 9 numbers (Backward span =8). Each trial has two strings with equal numbers. Participants must fail to answer correctly on both strings within the same trial to discontinue. A score of 16 can be achieved in each part. Therefore a maximum total score of 48 is possible when combined.

2.4.6.2.5 Executive Function - Verbal

Verbal executive function was measured using the Delis-Kaplan Executive Function System (DKEFS) (Delis, Kaplan, & Kramer, 2001) which measure semantic and phonetic fluency as well as switching ability. There were three separate tasks:

<u>Letter (Phonemic) fluency subset</u>

Participants were asked to name as many words beginning with the letters 'F', 'A'' and 'S' in one minute each. They were required to name as many words excluding the names of people, places or the same words with different endings. The total of the three letters are combined to produce a raw total 'Letter fluency' score.

<u>Category (Semantic) fluency subset</u>

Participants were then asked to repeat the process but with categories. This time they would be provided with a category and would be required to produce as many words belonging to that category in one minute. There were two trials, and the categories included (Animals) and (Boy's Names). Both trials scores were combined to produce a raw total 'Category Fluency' score.

<u>Category switching subset</u>

Participants were then given two categories (Fruit) and (Furniture) and asked to name as many as they could whilst also switching between the categories. The total number of correct items of fruit and furniture produced a 'Switch Total' raw score. The number of correct switches between the categories produced a 'Switch Accuracy' total raw score.

2.4.6.2.6 Executive Function - Visual

Visual executive function was assessed using the Brixton Spatial Anticipation Test (BSAT) (Burgess & Shallice, 1997), which is a visual task of rule induction and change. Participants were presented with a visual illustration, a basic design consisting of 10 positions. Each position numbered 1-10. One of the positions was coloured blue to form a circle. Participants were informed using standardised instructions that the blue circle moves according to a pattern as you turn the pages, which from time to time will change. Participants had to work out each time which position the blue circle would be on as the pages were turned. In total there were 54 scorable items which required a response. Incorrect responses were scored as errors. Total raw error scores were recorded.

All raw total score for each test described above were then age adjusted to produce scaled scores for interpretation purposes only.

2.4.6.3 Social Cognition Battery

Two existing social cognition tests were also used to measure experimental group validity as well convergent and divergent validity between the newly developed SSSQ.

2.4.6.3.1 Facial Emotion Recognition

ASD diagnosis and severity was determined using the RMET (Baron-Cohen et al., 2001) (Appendix 7). In addition to confirming group status this measure was included to provide validation for the SSSQ. Following a practice item participants were presented with 36 images of a set of eyes each belonging to a face expressing an emotion. Participants were provided with four emotion terms per image of which only one is the correct answer. Participants were required to work out the correct emotion.

2.4.6.3.2 Non- Literal Language (Intentionality)

The Moral Intentionality Task (MIT) (Bartlett et al 2010) (Appendix 8) consisted of 9 short stories (including a practice item, which was not scored). Each story was presented with two likert scales following immediately below on an A4 sized laminated card. The practice item is presented below:

Excerpt 3:

> Dr. Irwin went to see a patient who was very ill. Dr Irwin wanted to help the patient, so he did some tests. The patient needed an emergency dose of antibiotic to survive.
>
> Fortunately, Dr Irwin had a full bottle of the antibiotic in his bag.
> Dr Irwin gave his patient an injection of the drug, and the patient recovered immediately.

Participants were asked to score Dr Irwin's behaviour on two likert scales ranging in scores 1-7. First a scale of permissibility (1=completely forbidden; 7 completely allowed), second a scale of judgement (1=completely blamed; 7 = completely praised). The characters in eight stories follow a pattern of intention and behaviour. These include:

- Positive intention with truthful behaviour

- Positive intention with untruthful behaviour

- Negative intention with truthful behaviour

- Negative intention with untruthful behaviour

There are two stories per pattern. In combination of the two scales of permissibility and judgement a total of 16 variables are created from this measure. The stories were presented in random order to prevent systematic scoring based on pattern identification (please see Appendix 8 for full instrument).

2.5 Statistical Analyses

All data were entered using SPSS for Windows. After labelling and cleaning all statistical analyses were carried out using SPSS for Windows, version 20 and Stata Version 10.

2.5.1 Exploratory Data Analysis (EDA)

All variables undergoing any investigation were initially explored using Tukey's EDA model (Tukey, 1977). The following steps were undertaken in a general way to prepare data for analyses. These steps were by no means exhaustive:

- Look at distribution using explore function in SPSS.
- Check for outliers using stem and leaf plots.
- Check for data coding/entry errors.
- To determine whether any data transformations were necessary for parametric testing.
- To determine whether parametric or non-parametric tests should be used for further analyses. Given that the sample was small and several key variables were non-normal date transformations were not carried out and non-parametric tests were undertaken unless otherwise stated.

2.5.2 Re-sampling Procedures

In view of the small sample size and the undetermined underlying distribution range, re-sampling procedures was applied where appropriate throughout (Fisher, 1935). In SPSS the re-sampling procedures used were the permutation tests also known as exact tests. By using the appropriate methods in SPSS to carry out these analyses we were able to produce an exact *p*-value which was obtained in the SPSS output. Throughout the analyses where appropriate the exact *p*-value was obtained i.e. Fisher's exact when using Chi Square analyses or the exact two tailed significance for the Mann Whitney U test. The goal of using exact tests such as these is to enable reliable inferences when data are small, sparse and when the validity of the large sample theory is in doubt. This is achieved by computing exact *p*-values as described (Mehta & Patel, 2012).

2.5.3 Preliminary Analyses

Sample characteristics were first described and the two groups compared. Descriptive statistics were compared qualitatively and sample representativeness considered. In particular comparisons were carried out using Mann Whitney U tests (continuous) and Chi Square tests (categorical) for age, gender, education and reading ability to confirm that the two groups matched. Preliminary analyses also sought to scrutinise any unusually high or low scores in individual cases to determine intact cognition and prepare for additional analyses which may be required should the two groups not match on neuropsychological function. The two groups were compared on all neuropsychological outcomes using Mann Whitney U tests.

2.5.4 Analyses of Validity

Between group analyses were carried out to assess the validity of each social cognition test using Mann Whitney U tests. For the MIT, the two scales were correlated using Spearman's rank correlation coefficient (Spearman's rho) following which, appropriate composite scores were created to increase data robustness which were then compared across the two groups using Mann Whitney U tests. Convergent and divergent validity between each of the social cognition tests were also assessed using Spearman's rho. General Linear Models (Fields, 2013) were then introduced to also investigation the effect of any neuropsychological variables that were significantly different between the two groups i.e. executive function.

2.5.5 Analyses of Reliability

Internal consistency was measured using alpha coefficients (Cronbach, 1951). Additional item level analyses were also carried dependent upon the results of the initial internal consistency scores. These included Chi Square tests.

2.6 Preliminary Analyses

2.6.1 Sample Recruitment

In the ASD sample from service 1, 14 participants were approached, 6 accepted and 8 declined. Two did not respond, the remaining 6 cited the following reasons for decline: 'no cash incentive', 'too busy', 'in f/t education' and 'did not like the sound of study'. The second service was delayed (See Discussion Chapter) and was only able to approach and recruit 1 person within the time frame. From the 16 existing ASD participants who were e-mailed about the current study (a maximum of two times), 5 people responded wishing to take part, the remaining 9 did not respond. A total of 12 ASD participants were recruited. In the control group 18 people were approached, 16 accepted and 2 declined stating 'too busy' as reason for decline. A total of 16 control participants were recruited. The total study sample was 28.

2.6.2 Sample Characteristics

The sample as a whole had a mean (sd) age of 39.57 (10.09). Gender was unequal which was anticipated given the male:female ratio in the sample. There were more males, by a ratio of 5:2. The sample was predominately white British, of the 28 participants 6 were non-white, self-ascribed ethnicities were as follows: Chinese, Irish, Scottish, Mixed ethnicity (Asian/White) and two people were Black. The ASD group was more likely to be unemployed or working in the voluntary sector and/or self-employed. Table 3 below describes the demographic characteristics of the sample by group status.

Table 3

Sample Characteristics

	ASD (n=12)				Control (n=16)			
	N	*%*	*M*	*SD*	*N*	*%*	*M*	*SD*
Age (years)			42.5	9.14			37.38	9.14
Gender								
Male	10	83.3			14	87.5		
Female	2	16.7			2	12.5		
Education (years)			16.00	1.95			16.94	2.08
Ethnicity								
White	7	58.3			15	93.8		
Non-white	5	41.7			1	6.3		
Employment								
Unemployed	5	41.7			0	0.0		
Prof/Man	1	8.3			12	75.0		
Non Prof/Man	2	16.7			4	25.0		
*S/E, **Vol,	4	33.3			0	0.0		
Handedness								
Right handed	11	91.7			15	93.8		
Left handed	1	8.3			1	6.3		
Diagnosis								
HF	3	25.0			0	0.0		
AS	9	75.0			0	0.0		

Note. N=28; *S/E= self-employed; **Vol=volunteer

2.6.3 Relationship Between ASD and Control Group

The control participants were targeted based on their age, gender and education in order to match the ASD group. Therefore the relationship between these variables as well as reading ability (TOPF) was investigated further. Given this is ordinal data and two small samples, non-parametric tests were performed to investigate how well matched the two groups were.

There was no significant difference between the two groups on all four variables. Table 4 below summarises these scores. For age, education and TOFP scores, Mann-Whitney U tests were used and exact significance p values were obtained from SPSS output. For gender Fisher's Exact was used to provide an exact p-value calculation. Chi-square test analyses indicate there was no significant difference between the two groups for gender $\chi2$ (1, *N*=28) =0.10, exact *p*=1.00).

Table 4

Analyses of group matching for age, education and reading ability

| | ASD (n=12) | | Control (n=16) | | | | |
	M	*SD*	*M*	*SD*	**Mann Whitney U**	**Exact Sig**	**Effect Size**
Age	42.50	10.9	37.38	9.14	65.50	0.16	0.51
Education	16.00	1.95	16.94	2.08	68.00	0.19	0.47
TOFP	57.25	11.76	59.25	6.14	87.00	0.69	0.22

Note. N=28; Reading ability measured using Test of Premorbid Functioning (TOFP); Exact Sig=Exact *p*-value; Effect size= Cohen's *d.*

2.6.4 Neuropsychology Function

In order to investigate cognition, a comprehensive neuropsychological battery was used. Prior to investigating group difference on these scores, normality tests were carried out in the first instance. Shapiro-Wilk results indicate only the TOPF was not normally distributed (control group *p*= <0.01; ASD group *p*= <0.01) all other variables were normally distributed.

Skewness and kurtosis analysis indicated that all variables followed a normal distribution with the exception of some skewness in the control group for TOPF scores (-1.67), DKEFS - letter fluency scores (-1.28) and WAIS matrix scores (-1.76); all exceeding +/- 1.0. In the ASD group only the TOPF scores were skewed (-1.81). With respect to kurtosis TOPF scores in the ASD group appeared not normal (3.35) as well as the WAIS matrix scores in the control group (3.90) both exceeding the recommend +/- 3.0.

Given that some of the variables described above appear not to meet assumptions of parametric tests to be consistent all group analyses for the neuropsychological battery will be compared using the non- parametric Mann-Whitney U test with exact significance. Tables 5 below summarises these results.

Mann Whitney U test results indicate there was a significant difference in the BSAT scores (a measure of visual executive function). The ASD group had more errors (*M*=13.58, *SD*=4.03) compared to the control group (*M*=9.75, *SD*=4.33), *U*=55.00, Exact *p*=0.02, *d*=0.92. The effect size of 0.92 suggests this difference is reliable. Of the verbal executive function tasks DKEFS- switch total and accuracy were also appearing to be very different between the two groups (*U*=55.00, Exact *p*=0.06, *d*=0.61; *U*=55.00, Exact *p*=0.06, *d*=0.61) respectively. Again the effect sizes of 0.61 can be considered moderate. Switching tasks in comparison to verbal fluency tasks can be viewed as a higher order task along with the BSAT which also looks at rule deduction and the ability to detect rule change/switch. Executive function has previously been reported in existing literature as being significantly different in people with ASD. It is possible that executive function, particularly the ability to switch between tasks, could have some impact on social cognition as such this will be explored further using a general linear model.

Table 5

Between group analyses of neuropsychological battery variables

	ASD (n=12)		Control (n=16)		Mann Whitney U	Exact Sig	Effect Size
	M	*SD*	*M*	*SD*			
Reading Ability							
TOPF	57.25	11.76	59.25	6.14	87.00	0.69	0.22
Verbal Function							
WAIS Vocabulary	45.67	9.27	46.50	5.69	87.00	0.69	0.11
Visual Function							
WAIS Matrices	17.25	4.71	18.56	3.33	89.00	0.76	0.32
STS/ Working Memory							
WAIS Digit Total	30.42	6.99	30.63	5.64	90.50	0.81	0.03
Executive Function – Verbal							
DKEFS Letter Fluency	38.83	12.11	45.13	9.55	61.50	0.11	0.58
DKEFS Category Fluency	36.92	12.70	44.31	11.28	64.00	0.14	0.62
DKEFS Switch Total	14.08	3.09	15.88	2.85	55.00	0.06	0.61
DKEFS Switch Accuracy	13.25	2.93	15.06	2.96	55.00	0.06	0.61
Executive Function - Visual							
BSAT	13.58	4.03	9.75	4.33	55.00	0.02*	0.92

Note. N=28; Exact Sig=Exact *p*-value (2 tailed); *p<0.05 level, *Effect size*=Cohen's *d*;
TOPF=Test of Premorbid Functioning, WAIS= Wechsler Adult Intelligence Scale, DKEFS= Delis-Kaplan Executive Function System, BSAT= Brixton Spatial Anticipation Test.

CHAPTER 3
RESULTS

Whilst it would be conventional to present the reliability results of the study followed by the validation results, in the current study further individual items analyses were undertaken following the results of both the reliability and validation results and in order to keep all item level results together we present the validation study results first followed by the reliability study results.

3.1 Primary Objective Results - Validation Study

3.1.1 Between Group Analyses for SSSQ
The SSSQ has two components, which were analysed separately.

3.1.1.1 SSSQ – Part 1 (Social Overtures)
In total there were 7 lines within the four stories where a social overture was present. Correct identification of these lines would therefore yield a correct response on the SSSQ – Part 1 (see Methods - Part 1 for exact scoring).

For each correct line, scores were recoded to produce a binary variable (correct or incorrect). These seven variables were recoded further to produce a total composite scale (0-7 points). The higher the score achieved the greater number of correct answers. This total composite scale variable is referred to as SSSQ – Part 1. Exploratory analyses were carried out to test normality. The results indicate a normal distribution. Skewness, kurtosis and Shapiro-Wilk scores for the control group and ASD group were as follows: (0.00; -0.96; p=0.30) and (0.60; -0.54; p=0.16) respectively.

Results of the Mann-Whitney U test indicate a significant difference between the ASD and control group on correctly identifying social overtures (SSSQ-Part 1). The ASD group were less able to identify the social overtures (*M*=2.08, *SD*=1.51) compared to the control group (*M*=3.75, *SD*=1.57), *U*=42.50, Exact *p*=0.01, *d*=1.08. The effect size of 1.08 also suggests that the magnitude of difference between the two groups was strong.

3.1.1.2 SSSQ – Part 2 (Generic ToM)

The second component of the SSSQ consisted of 4 questions per story (16 in total). Each item had multiple-choice options, of which one was considered to reflect greater generic ToM ability such as those described in the early ToM tests in Chapter 1. For each item therefore participants scored 1 correct point if they chose this response. The four binary variables per story were recoded to produce a composite score per story (0-4). These were then combined to produce a final composite scale (0-16). The higher the score the more ToM is demonstrated.

This total composite scale is referred to as SSSQ – Part 2. Exploratory analyses were carried out to test normality. The results indicate a normal distribution. Skewness, kurtosis and Shapiro-Wilk scores for the control group and ASD group were as follows: (-0.24; -0.28; p=0.44) and (-0.80; 1.24; p=0.66) respectively.

Results of the Mann-Whitney U test indicate no significant difference between the ASD and control group on the SSSQ-Part 2. The ASD group were just as able to identify the answers suggesting first and second level ToM ability (*M*=10.83, *SD*=2.62) compared to the control group (*M*=12.00, *SD*=2.37), *U*=74.00, Exact *p*=0.32, *d*=0.47.

3.1.2 Between Group Analyses for RMET

Of the social cognition battery the RMET was used in the first instance to confirm group status and so therefore a significant difference in scores was hypothesised in keeping with exiting literature. Confirmation of normality was obtained with the skewness and kurtosis and Shapiro-Wilk, analyses. For the control groups these results were (0.59, 0.02, *p*=0.31) respectively indicating normal distribution. Similarly for the ASD group the results were (0.02, 0.16, *p*=0.86) respectively also indicating normal distribution. To remain consistent with analyses performed elsewhere previously, the non-parametric tests will continue to be used.

Results of the Mann-Whitney U test indicate a significant difference between the ASD and control group on correctly identifying emotion terms (RMET). The ASD group were less able to identify the correct emotion terms (*M*=23.92, *SD*=5.38) compared to the control group (*M*=29.00, *SD*=3.12), *U*=38.00, Exact *p*=0.01,

d=1.16. The effect size of 1.16 also suggests that the magnitude of difference between the two groups was strong. This confirms group status, which is also consistent with previous findings (see discussion).

3.1.3 Between Group Analyses for MIT

The MIT storyline were combined and labelled in the following ways:

- MIT 1 = Items 1 and 3 were positive intention and truthful behaviour
- MIT 2 = Items 2 and 5 were positive intention and untruthful behaviour
- MIT 3 = Items 4 and 7 were negative intention and truthful behaviour
- MIT 4 = Items 6 and 8 were negative intention and untruthful behaviour

These items were combined to produce four MIT composite scores as described above. Each had a 7-point likert scale of permissibility (described as forbidden or allowed [FA]) and a 7-point likert scale of judgement (described as blamed or praised [BP]). A correlation matrix using Spearman's correlation coefficients was performed to investigate the correlation between the FA and BP scales. Table 6 below summarises these results. For each of the four MIT items the FA and BP scales were highly positively correlated. MIT1- MIT4 respectively: $r(26) = -0.55$, $p<$ .01; $r(26) = 0.46$, $p< .05$; $r(26) = 0.55$, $p< .01$ and $r(26) = -0.84$, $p< .01$.

Table 6

Correlation between FA and BP scales of the MIT

	1	2	3	4	5	6	7	8
1. MIT 1 FA	-							
2. MIT 2 FA	0.09	-						
3. MIT 3 FA	0.38*	-0.00	-					
4. MIT 4 FA	0.42*	0.08	0.41*	-				
5. MIT 1 BP	0.55**	-0.18	0.03	-0.08	-			
6. MIT 2 BP	-0.18	0.46*	-0.26	-0.44*	-0.11	-		
7. MIT 3 BP	0.08	-0.08	0.55**	0.15	0.30	-0.43*	-	
8. MIT 4 BP	0.36	0.02	0.27	0.84**	0.09	-0.41*	0.26	-

Note. N=28; Spearman's rho correlation coefficient; MIT=Moral Intentionality Scale, FA=Forbidden/Allowed Scale, BP=Blamed/Praised Scale.

*p< 0.05 level (2 tailed); **p< 0.01 level (2 tailed).

In view of these results the FA and PB scales were combined to produce four final more robust MIT composite scales, each with scores 0-38. These four composite sores were than investigated for normality. Skewness and kurtosis analyses indicate that the variable MIT 2 for the control group were both non-normal (skewness= -1.76; kurtosis=4.86). Variable MIT 3 was skewed in the ASD group only (skewness=1.57). Shapiro-Wilk tests for normality indicated that none of these variables were normally distributed: MIT 1 (ASD group p=0.06); MIT 2 (Control group p=0.01); MIT 3 (ASD group p=0.02) and MIT 4 (Both control and ASD group p=0.01, respectively).

The non-parametric Mann-Whitney U test was used to compare the MIT scores between the two groups. Table 7 below summarises these results. There were no significant differences between any of the MIT composite scales. Both the ASD and control group did however score much lower on the MIT 3 and MIT 4 suggesting that both groups were more approving of the characters based on their intention irrespective of whether the behaviour associated was truthful or untruthful. This is consistent with the previous study where the MIT scale was developed further (Bartlett, 2010). These findings will be considered further in the discussion chapter.

Table 7

Between group analyses for MIT composite scales

	ASD (n=12)		Control (n=16)		Mann Whitney U	Exact Sig	Effect Size
	M	*SD*	*M*	*SD*			
MIT 1	23.92	4.23	23.94	2.64	89.00	0.76	0.01
MIT 2	19.42	3.40	20.65	3.56	68.00	0.20	0.35
MIT 3	8.75	5.38	10.94	4.61	66.00	0.17	0.44
MIT 4	8.50	4.42	9.13	5.39	93.00	0.90	0.13

Note. N=28; MIT=Moral Intentionality Scale.

Exact Sig=Exact *p*-value (2 tailed); *p<0.05 level, *Effect Size*=Cohen's *d*.

3.1.4 Convergent and Divergent Validity

3.1.4.1 Analyses Between Social Cognition Tests

Each of the scales were correlated with each other using Spearman's correlation coefficient. Tables 8 and 9 below summarises these results by each group. There were significant negative relationship between SSSQ - Part 2 and MIT 1 $r(26) = -0.61$, $p < .05$ and a significant positive relationship between SSSQ 2 and MIT 2 $r(26) = 0.72$, $p < .01$. No other significant correlations were observed.

Table 8
Correlations between SSSQ, RMET and MIT in the ASD Group

	1	2	3	4	5	6	7
1. SSSQ 1	-						
2. SSSQ 2	0.40	-					
3. RMET	-0.33	-0.14	-				
4. MIT 1	-0.53	-0.61*	0.46	-			
5. MIT 2	0.28	0.72**	0.19	-0.53	-		
6. MIT 3	-0.57	-0.07	0.25	0.16	-0.21	-	
7. MIT 4	-0.75	-0.15	0.01	0.41	-0.28	0.15	-

Note. N=12; Spearman's rho correlation coefficient; SSSQ= Social Situation Stories Questionnaire; RMET=Reading the Mind in the Eyes Test; MIT=Moral Intentionality Test.

*p < 0.05 level (2 tailed); p **< 0.01 level (2 tailed).

Table 9

Correlations between SSSQ, RMET and MIT in the Control Group

	1	2	3	4	5	6	7
1. SSSQ 1	-						
2. SSSQ 2	0.27	-					
3. RMET	-0.11	0.21	-				
4. MIT 1	-0.10	-0.12	0.16	-			
5. MIT 2	-0.48	0.32	0.06	0.49	-		
6. MIT 3	0.14	-0.36	-0.23	0.15	-0.32	-	
7. MIT 4	-0.17	-0.31	-0.15	-0.11	-0.16	0.60*	-

Note. N=16; Spearman's rho correlation coefficient; SSSQ= Social Situation Stories Questionnaire; RMET=Reading the Mind in the Eyes Test; MIT=Moral Intentionality Test.

*p< 0.05 level (2 tailed); **p< 0.01 level (2 tailed).

3.1.4.2 Analyses Between Social Cognition Tests and Executive Function

There was a significant difference between the two groups on SSSQ - Part 1 and the RMET. Given the differences observed in executive function scores, in order to look for the contribution of variables such as executive function scores on SSSQ and RMET scores two general linear models were performed.

General linear model procedures do not in fact require multivariate normality, only that the model residuals are normally distributed thus permitting the use of general linear model procedures on small sample studies where non-parametric tests might otherwise be indicated (Fields, 2013). Accordingly the data was subject to tentative general linear model with the results interpreted conditionally upon there being normally distributed residuals. Unstandardized residuals for SSSQ – Part 1and RMET were saved as variables and were subjected to skewness, kurtosis and Shapiro-Wilk tests for normality. The results of which were (0.28; -0.57; *p*=0.78) and (0.21, 0.68, *p*=0.65) respectively.

Results of the first general linear model indicate that the main effect between SSSQ – Part 1(DV) and group status (IV) was significant *t*=2.83(26), *p*=0.01.

and remained significant following the addition of each executive function variable Model 2-4: $t=2.12(25)$, $p=0.04$; $t=2.34(25)$, $p=0.04$ and $t=2.30(25)$, $p=0.03$ respectively. Table 10 below summarises these results. The BSAT scores made the greatest unique contribution of the three executive function variables. However, following the combined contribution of both BSAT and DKEFS scores (Model 5 and 6) the main effect reduced to non-significance $t=1.89(24)$, $p=0.07$ and $t=1.89(23)$, $p=0.07$ respectively.

Table 10

General Linear Model: SSSQ – 1 (DV) and group status (IV)

Independent variables		*t*	*df*	*β(SE)*	*P*	Effect Size
Model 1	Group Status	2.83	26	1.67(0.59)	0.01*	0.24
Model 2	Model 1 + BSAT	2.12	25	1.38 (0.65)	0.04*	0.15
Model 3	Model 1 + DKEFS - ST	2.34	25	1.43 (0.61)	0.03*	0.18
Model 4	Model 1 + DKEFS - SA	2.30	25	1.39 (0.60)	0.03*	0.18
Model 5	Model 2 + DKEFS - ST	1.89	24	1.24 (0.66)	0.07	0.13
Model 6	Model 5 + DKEFS - SA	1.89	23	1.20 (0.64)	0.07	0.13

Note. N=28; SSSQ=Social Situation Stories Questionnaire; DKEFS-ST= Delis-Kaplan Executive Function System- Switch Total; DKEFS-SA= Delis-Kaplan Executive Function System- Switch Accuracy, BSAT= Brixton Spatial Anticipation Test.
df=degrees of freedom; SE=Standard Error; *p<0.05 level; *Effect size*= Partial Eta Squared indicates the proportion of variance in the dependent variable explained by the independent variable.

Results of the second general linear model indicate that the main effect RMET (DV) and group status (IV) was significant $t=3.15(26)$, $p=<0.01$ and following both additional independent variables, continued to remain significant, Models 2-4: $t=2.64(25)$, $p=0.01$; $t=2.81(25)$, $p=0.01$ and $t=2.81(25)$, $p=0.01$ respectively. When all independent variables were added; Model 6 continued to have little effect of the main effect $t=2.43(23)$, $p=0.02$. Table 11 below summarises these results.

Table 11

General Linear Model: RMET (DV) and group status (IV)

Independent variables		*t*	*df*	β(SE)	*P*	Effect Size
Model 1	Group Status	3.15	26	5.08 (1.62)	<0.01*	0.24
Model 2	Model 1 + BSAT	2.64	25	4.78 (1.81)	0.01*	0.15
Model 3	Model 1 + DKEFS - ST	2.81	25	4.81 (1.72)	0.01*	0.18
Model 4	Model 1 + DKEFS - SA	2.81	25	4.84 (1.72)	0.01*	0.18
Model 5	Model 2 + DKEFS - ST	2.47	24	4.62 (1.88)	0.02*	0.13
Model 6	Model 5 + DKEFS - SA	2.43	23	4.65 (1.91)	0.02*	0.13

Note. N=28; RMET=Reading the Eyes in the Mind Test; DKEFS-ST= Delis-Kaplan Executive Function System- Switch Total; DKEFS-SA= Delis-Kaplan Executive Function System- Switch Accuracy, BSAT= Brixton Spatial Anticipation Test.

SE=Standard Error; *p*<0.05 level; *Effect size*=Partial Eta Squared indicates the proportion of variance in the dependent variable explained by the independent variable.

3.2 Secondary Objective Results - Reliability Study

A final objective of the study was to explore individual item reliability and ceiling and floor effects.

3.2.1 Item Level Reliability Analyses

Internal consistency, or item homogeneity, was examined using alpha coefficient (Cronbach, 1951). With this method, scale consistency is determined by the interrelationships between items, accounting for the total number of items that the scale comprises. Cronbach's α estimates the proportion of variance that is systematic or consistent in a set of test scores.

Cronbach's α is a function of the number of items in a test, the average covariance between item-pairs, and the variance of the total score.

Widely accepted cut-off scores in the social sciences range from approximately 0.6 to 0.8 (Nunnally & Bernstein, 1994; Reynaldo & Santos, 1999). A commonly accepted guide for Cronbach's α is as follows:

$$
\begin{aligned}
\alpha \geq 0.9 \quad &= \quad \text{Excellent} \\
0.7 \leq \alpha < 0.9 \quad &= \quad \text{Good} \\
0.6 \leq \alpha < 0.7 \quad &= \quad \text{Acceptable} \\
0.5 \leq \alpha < 0.6 \quad &= \quad \text{Poor} \\
\alpha < 0.5 \quad &= \quad \text{Unacceptable}
\end{aligned}
$$

Tables 12 and 13 summarises the results for the two parts of the SSSQ.
For the SSSQ- Part 1 the Cronbach's α was 0.55. This is therefore poor. Following individual item correlation analyses line 14 (Story 1) appeared to have the weakest corrected item correlation, however even the removal of this item would lead to minimal differences in Cronbach's α which increases to 0.56 and thus still remains poor.

Table 12

Item reliability test SSSQ – Part 1

	Total Scale Mean		Cronbach's Alpha
SSSQ – 1	3.04		0.55
	Scale Mean **If item deleted**	**Corrected Item –** **Total Correlation**	**Cronbach's Alpha** **If item deleted**
Story 1			
Line 5	2.50	0.21	0.53
Line 14	2.82	0.11*	0.56*
Story 2			
Line 4	2.71	0.28	0.50
Line 6	2.71	0.28	0.50
Story 3			
Line 6	2.36	0.38	0.47
Line 10	2.68	0.37	0.47
Story 4			
Line 9	2.43	0.28	0.47

Note. N=28; *$p<0.05$ level.

For SSSQ – Part 2 the total Cronbach's α was 0.60 suggesting this is acceptable. Again individual corrected item correlations indicate that Q1 and Q4 (Story 2) and Q1 (Story 3) were all relatively weaker. Even if these items were removed the Cronbach's α would increase to only 0.61 and 0.62 which is minimal.

Table 13
Item reliability test SSSQ – Part 2

	Total Scale Mean		Cronbach's Alpha
SSSQ – 2	11.50		0.60
	Scale Mean If item deleted	**Corrected Item – Total Correlation**	**Cronbach's Alpha If item deleted**
Story 1			
Q1	10.68	0.30	0.57
Q2	10.68	0.34	0.57
Q3	11.25	0.11	0.60
Q4	10.71	0.40	0.55
Story 2			
Q1	10.57	-0.05*	0.61*
Q2	11.07	0.13	0.60
Q3	10.96	0.17	0.60
Q4	10.64	-0.06*	0.62*
Story 3			
Q1	10.71	0.01*	0.62*
Q2	10.64	0.57	0.53
Q3	10.79	0.11	0.60
Q4	10.54	0.45	0.57
Story 4			
Q1	10.61	0.09	0.60
Q2	10.79	0.27	0.57
Q3	10.96	0.41	0.55
Q4	10.89	0.46	0.54

Note. N=28; *$p < 0.05$ level.

Correlation coefficients are affected if variability is reduced in both the item selection and the sample selection. Given the small samples, these findings may not entirely reflect poor item reliability (See Discussion). Given that the Cronbach's alpha was not particularly high but yet the results of the validation study indicate a

significant difference between the ASD and the control groups on the SSSQ further individual item level analyses were indicated (Cronbach, 1951).

<u>3.2.2 Further Item Level Analyses</u>

3.2.2.1 SSSQ – Part 1

In order to explore the individual items of the SSSQ – Part 1 in more detail, further analyses were carried out on the seven items individually. Figure 1 below shows the difference in scores between the two groups by story and line number, raw scores were converted to total percentage correct, in order to factor in the different sample sizes in the two groups. In addition Table 14 below summarise the results of chi square analyses between the two groups by individual items of the SSSQ – Part 1 that were correctly identified. Line 6 in story 3 and line 9 in story 4 were the items that were significantly different in the two groups. Phi values indicate a moderate negative relationship. These items appear to reflect more subtle social overtures whereby the intentionality of the characters might be considered more complex.
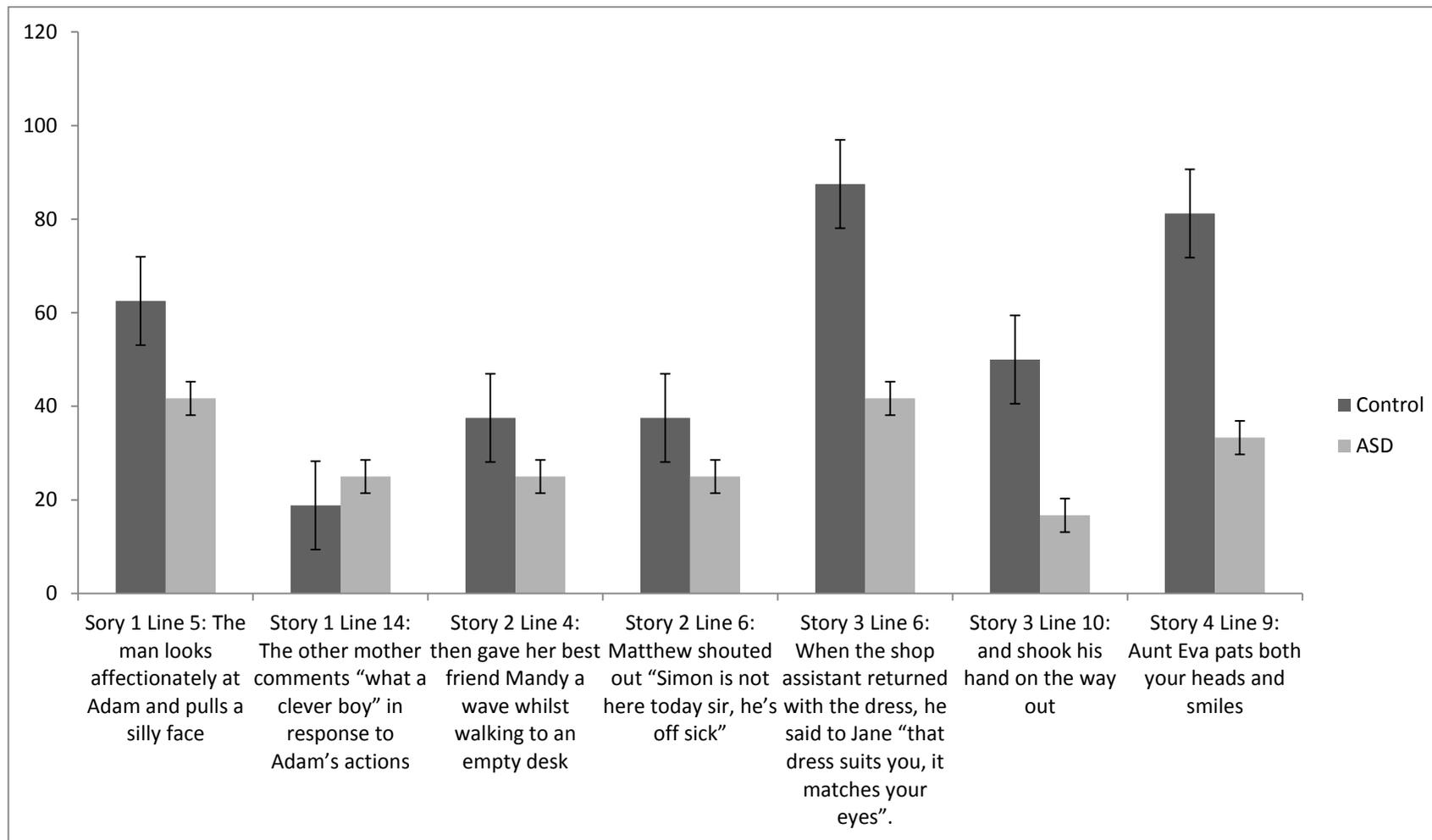
Figure 1. Proportion of correctly identified social overtures (ASD vs. control group)

Note. Raw scores converted to percentages; Error bars=Standard Error.

Table 14

Between group analyses of individual correct items in SSSQ – Part 1

	ASD (n=12)		Control (n=16)				
	N	*%*	*N*	*%*	$\chi 2$	**Exact Sig**	**Phi**
Story 1							
Line 5	5	41.7	10	62.5	1.20	0.45	-0.21
Line 14	3	25.0	3	18.3	0.16	1.00	0.08
Story 2							
Item 4	3	25.0	6	37.5	0.49	0.69	-0.13
Item 6	3	25.0	6	37.5	0.49	0.69	-0.13
Story 3							
Item 6	5	41.7	14	87.5	6.60	0.02*	-0.49
Item 10	2	16.7	8	50.0	3.32	0.11	-0.34
Story 4							
Item 9 N	4	33.3	13	81.3	6.60	0.02*	-0.49

Note. N=28; *p<0.05; Exact Sig=Fisher's Exact; Phi=effect size

In addition to the findings described above, whilst Line 6 in story 3 and line 9 in Story 4 were significantly different between the two groups, the control group also scored higher on all the other items with the exception of line 14 in story 1, which was 'The other mother comments "what a clever boy" in response to Adam's actions'. It is not clear why this item showed an inverse trend.

3.2.2.2 SSSQ – Part 2

Further analyses were also carried out on individual stories to see if any part of the SSSQ – Part 2 was able to discriminate between the two groups as at a scale level there was no difference observed. The data are ordinal and thus not normal in distribution. Table 15 below summarises these results.

Table 15

Between group analyses by each story for the SSSQ – Part 2

	ASD (n=12)		Control (n=16)		Mann-Whitney U	Exact Sig	Effect Size
	M	*SD*	*M*	*SD*			
SSSQ 2 – Generic ToM							
Story 1 (0-4)	2.33	1.23	2.94	0.68	69.0	0.20	0.61
Story 2 (0-4)	2.58	0.79	2.88	0.81	76.0	0.38	0.37
Story 3 (0-4)	3.00	0.85	3.56	0.73	57.0	0.05	0.71
Story 4 (0-4)	2.92	0.90	2.63	1.30	85.5	0.70	0.26

Note. N=28; Exact Sig=Exact *p*-value; Effect size= Cohen's *d*.

In each story the control group always scored higher than the ASD group. Given the effect size in story 3 (U=57.0, Exact p=0.05, d=0.71) this does appear to be a reasonable difference. Given this, Fisher's exact analyses were carried out on the four individual items within story 3. Question 3 was significantly different between the two groups $\chi2$ (1, N=28) =4.73, Exact p=0.04) and there was a moderate negative relationship (Phi= -0.4). Figures 2-5 below illustrate the raw scores on each item per story. These have been converted to percentages to take account of different sample sizes in the two groups.
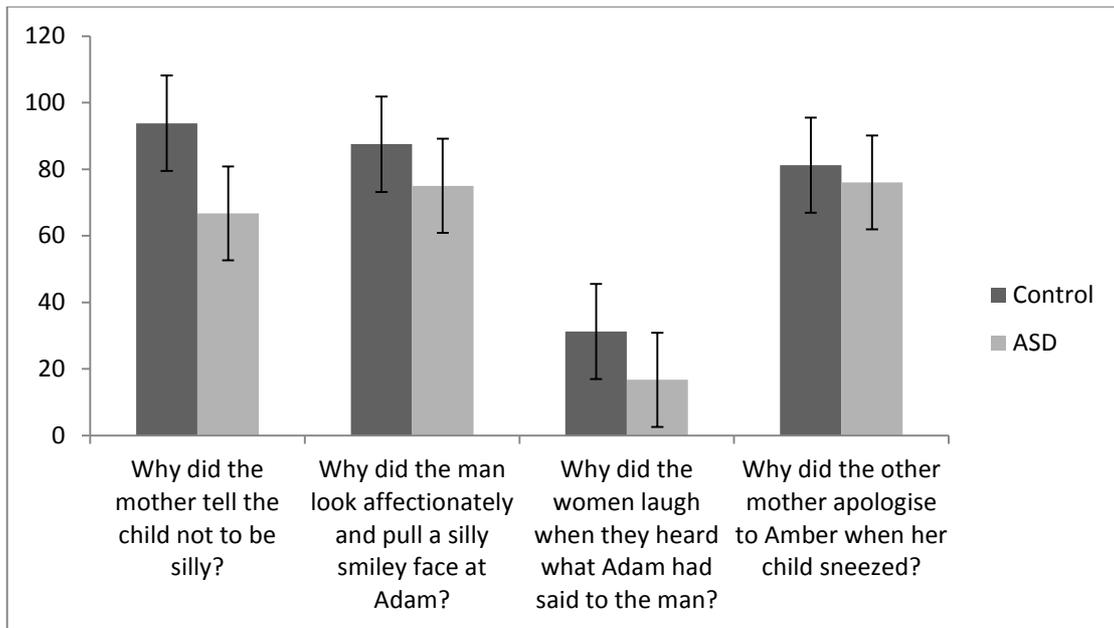
Figure 2. Story 1: Generic ToM questions (ASD vs. control group)

Note. Raw scores converted to percentages; Error bars=Standard Error.
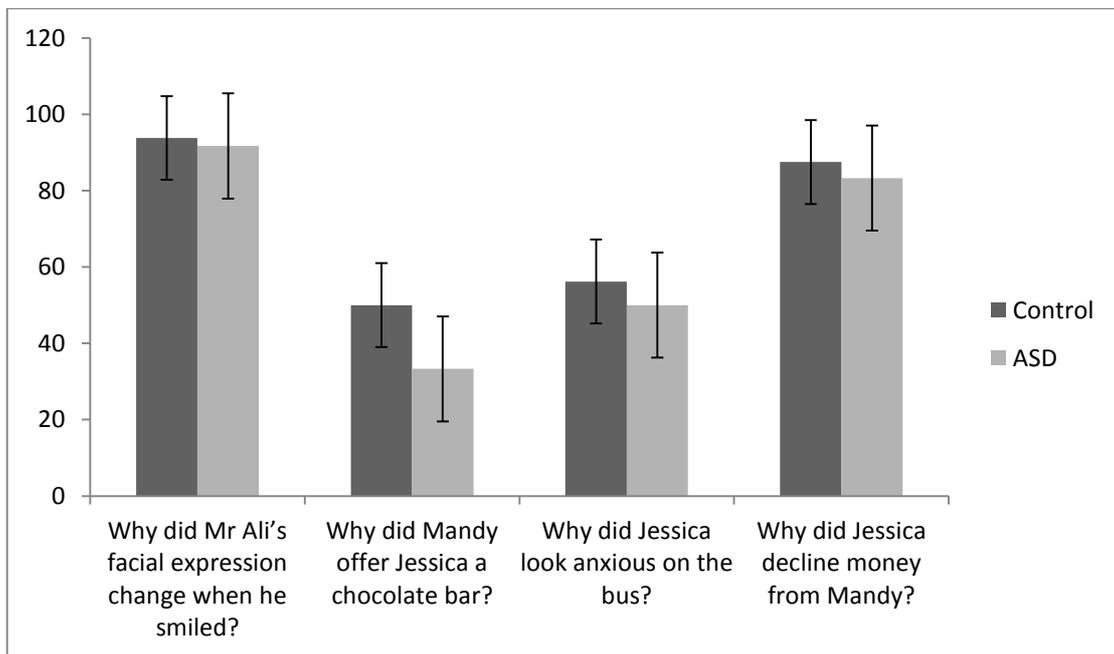
Figure 3. Story 2: Generic ToM questions (ASD vs. control group)

Note. Raw scores converted to percentages; Error bars=Standard Error.
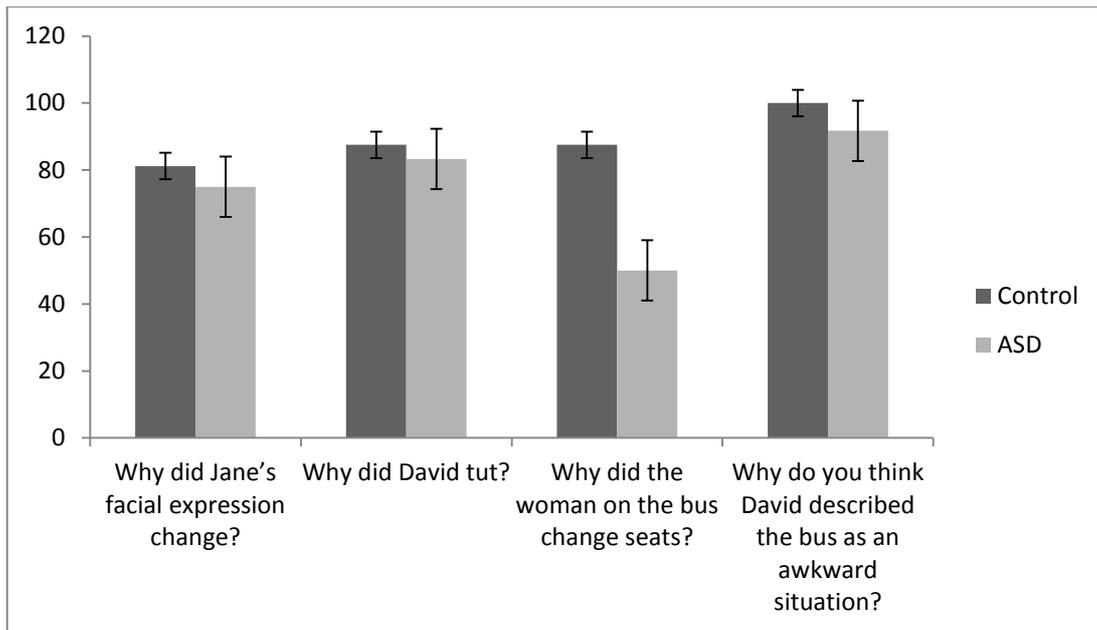
Figure 4. Story 3: Generic ToM questions (ASD vs. control group)

Note. Raw scores converted to percentages; Error bars=Standard Error.
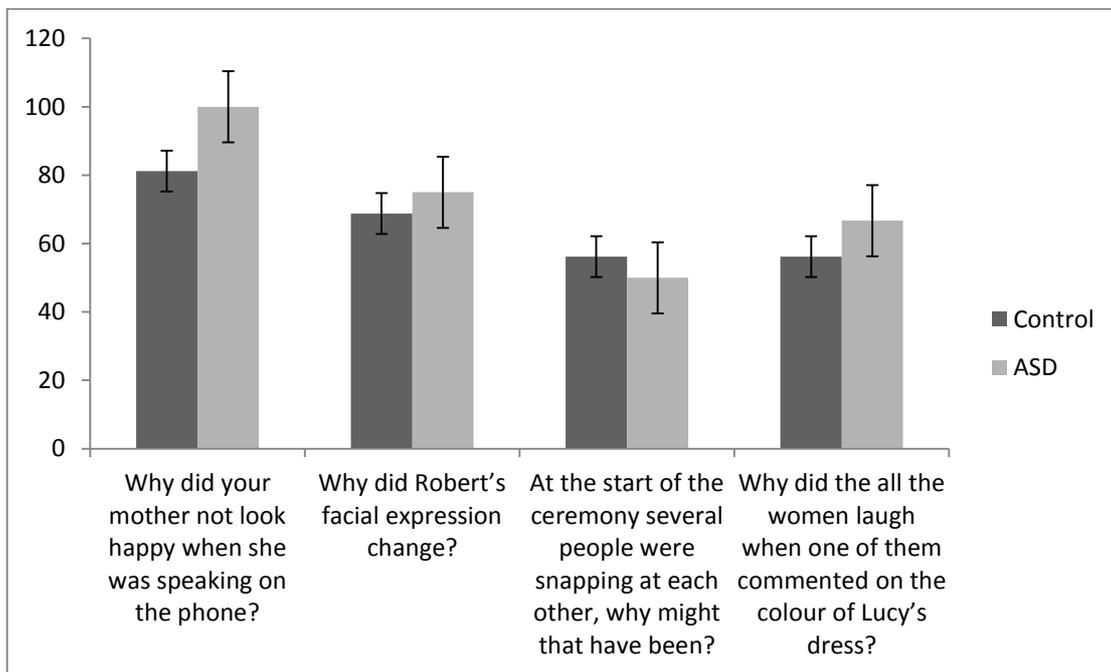
Figure 5. Story 4: Generic ToM questions (ASD vs. control group)

Note. Raw scores converted to percentages; Error bars=Standard Error.

These column graphs show that whilst control participants overall tended to score higher; in story 4, ASD participants scored higher on three of the four individual

items. Though these appeared to be emotion recognition and humour tasks as opposed to first and second order mental state tasks.

3.2.3 Ceiling and Floor Effects

These terms are used here to describe items which almost everyone answered correctly (ceiling) suggesting the item might be too easy/obvious and failing to discriminate between the two groups. Or items that hardly anyone answered correctly (floor) again suggesting the item was too difficult and again unable to discriminate between the two groups. Given the small sample size the cut-off values for determining ceiling and floor effects were larger than usual. A minimum of one person scoring an item correctly would result in either 6.3% for the control group (1/16) and 8.3% for the ASD group. The larger of these values rounded up would therefore equal 10%. Ceiling and floor effects were therefore determined at 90% and 10% respectively.

Table 16 and 17 below summarises the percentage of people correctly scoring on each items of the SSSQ. On the SSSQ – Part 1 no items appeared to meet ceiling or floor effects suggesting participants overall found the items neither too easy nor too difficult. With adequate power these items may discriminate well between the two groups. The only item that may be worthy of omitting or editing is Story 1 line 14. The percentage difference between the two groups appear to be smaller than the remaining items, this may be an issue of power but also may suggest the item was ineffective in discriminating between the two groups.

Table 16

Correct responses per item of the SSSQ – Part 1

SSSQ - 1	ASD n=12		Control n=16		Total n=28	
	N	*%*	*N*	*%*	*N*	*%*
Story 1						
Line 5	5	41.7	10	62.5	15	53.6
Line 14	3	25.0	3	15.8	6	21.4
Story 2						
Line 4	3	25.0	6	37.5	9	32.1
Line 6	3	25.0	6	37.5	9	32.1
Story 3						
Line 6	5	41.7	14	87.5	19	67.9
Line 10	2	16.7	8	50.0	10	35.7
Story 4						
Line 9	4	33.3	13	81.3	17	60.7

Results of the SSSQ - Part 2 reveal that some of the items reached ceiling effect, and on half of these instances, ceiling effects were also observed in both the ASD and control group, possibly suggesting that the items may have been too easy for both groups (Story 2, Q1 and Story 3 Q4). These items could be omitted or modified on the grounds that both groups found them too easy. This section of the SSSQ however demonstrates no difference between the groups which is consistent with exiting literature that ASD participants are often able to perform well on less subtle ToM tasks.

Table 17

Correct responses per item of the SSSQ – Part 2

SSSQ - 2	ASD n=12		Control n=16		Total n=28	
	N	%	N	%	N	%
Story 1						
Q1	8	66.7	15	93.3*	23	82.1
Q2	9	75.0	14	87.5	23	82.1
Q3	2	16.7	5	31.3	7	25.0
Q4	9	75.0	3	81.3	22	78.6
Story 2						
Q1	11	91.7*	15	93.3*	26	92.9*
Q2	4	33.3	8	50.0	12	42.9
Q3	6	50.0	9	56.3	15	53.6
Q4	10	83.3	14	87.5	24	85.7
Story 3						
Q1	9	75.0	13	81.3	22	78.6
Q2	10	83.3	14	87.5	24	85.7
Q3	6	50.0	14	87.5	20	71.4
Q4	11	91.7*	16	100.0*	27	96.4*
Story 4						
Q1	12	100.0*	13	81.3	25	89.3
Q2	9	75.0	11	68.8	20	71.4
Q3	6	50.0	9	56.3	15	53.6
Q4	8	66.7	9	56.3	7	60.7

Note. *Ceiling effect >90%

3.3 'Qualitative Feedback'

The qualitative feedback described in this section refers only to the optional brief handwritten feedback provided to further develop the SSSQ.

A key piece of feedback included the multiple options available in the SSSQ – Part 2. Many people felt that there was more than one correct answer from the multiple choice options; however despite this feedback all participants were able to pick one answer. Table 3.14 summarises participant's responses below where more than one person had stated this per item.

Table 18

Number of participants indicating item had multiple responses

SSSQ - 2	ASD	Control
	n=12	n=16
Story 1		
Q1	2	2
Q2	2	
Q3	5	4
Q4	3	4
Story 2		
Q2	1	4
Q3	3	4
Q4	3	
Story 3		
Q2	2	2
Q3	2	2
Q4	3	3
Story 4		
Q3	1	1
Q4	2	1
Q5	4	3

Note. N=28

In addition the following comments were noted:

Three control participants were not certain about the concept in Q1 of the SSSQ: *'something the character did not really have to do in that situation'*. The idea of *have* to do was subjective, in that it could have been interpreted as a subjective expectation of 'what to do' or that 'have to do' was potentially interpreted as 'must' do. None of the ASD participants commented on this phrasing of the question.

Two control participants stated that Question 1 (Story 2) *'Why did Mr Ali's facial expression change when he smiled'?* was confusing and oddly phrased.

Two control participants felt that further information was required in the stories. One participant stated that in order to answer Q3 (Story 2) '*Why did Jessica look anxious on the bus'?* they felt they needed to know how others on the bus felt. Another participant stated that in order to answer Q4 (Story 1) '*Why did the other mother apologise to Amber when her child sneezed'?* they needed further information about what the mother felt.

A participant from both the control group and ASD group had difficulty understanding the *man's* motivation/reaction in Story 1. Although the ASD participant also reported to not understanding why the woman reacted in the story the way she did as well. The theme of this section of the storyline was embarrassment.

Another ASD participant stated he guessed the source of amusement was the embarrassment in Story 1.

Two ASD participants described the shopkeeper's behaviour in Story 3 as potentially "over familiar" and "creepy" therefore not readily interpreting his comment as complimentary.

Two participants stated that there was an alternative response to the multiple choice answers available. In Story 1, Q2 *'Why did the man look affectionately and pull a silly smiley face at Adam'? -* a control participant felt the best answer was

'wanted to make Adam smile'. Equally in Story 2, Q4 *'Why did Jessica decline money from Mandy'?* - an ASD participant felt the best answer was ' best friends so didn't need to pay'.

Two ASD participants stated that they had learnt to answer these items correctly and would not have been able to answer such a questionnaire when younger, especially complex emotions such as embarrassment. They both stated that they had learnt social skills through active participation with others which they believed enabled them to answer these questions correctly.

CHAPTER 4
DISCUSSION

4.1 Summary of Results

The aim of the current study was to develop and validate a new social cognition instrument that could discriminate between adults with and without a diagnosis of ASD (particularly those with HFA and AS). The two part instrument aimed to operationalse social interaction skills using stories where both generic and more subtle aspects of ToM skills were required to understand a social interaction.

In summary, the findings of the study were:

4.1.1 Preliminary Analyses

The two samples were well matched on key variables as there were no differences on factors such as age, gender, education level and reading ability. Neuropsychological results indicate that the ASD group scored significantly less well than the control group on the BSAT (a measure of visual executive function). The verbal executive function tasks (DKEFS- switch total and accuracy) also showed reliable differences between the two groups. The ASD group scoring less well than the control groups on both tests.

4.1.2 Between Group Validation of Social Cognition Tests

There was a significant difference observed between the two groups on the SSSQ - Part 1 with the control group more able to detect the social overtures. No significant difference was found on the SSSQ - Part 2. Results also indicate that the ASD group was significantly less able to identify the emotions correctly on the RMET. No significant difference was found for the MIT; both control and ASD groups were more approving of characters that had positive intentions irrespective of their behaviours.

4.1.3 Convergent and Divergent Validation - Social Cognition Tests

There was a significant negative relationship between SSSQ - Part 2 and MIT 1 and a positive relationship between SSSQ - Part 2 and MIT 2. No other significant correlations between the social cognitive batteries were observed.

4.1.4 Convergent and Divergent Validation - Executive Function

The primary effect between SSSQ - Part 1 and group remained significant following the addition of executive function variables. The BSAT scores made the greatest unique contribution of the three executive function variables. However, the combination of both BSAT and DKEFS scores reduced the primary effect to non-significance. The strength of the difference between RMET and group status remained significant following the addition of all the executive function variables.

4.1.5 Reliability of Individual Items

Internal consistency for the SSSQ – Part 1 was poor, for the SSSQ – Part 2 however this was acceptable though not high either. Further individual item analyses however do show that some individual items of the SSSQ – Part 1 in particular, have potential reliability to discriminate between the two groups.

4.1.6 Qualitative Feedback

The key qualitative feedback from participants was that several items of SSSQ - Part 2 had several potential correct options from the multiple choice answers available.

4.2 Interpretation

These results will now be discussed in more detail with references to previous literature followed by a discussion of methodological limitations and clinical and research implications.

It has been argued that the 'result' of any given experiment is indisputable, but what is open to interpretation is what caused that result (Prince et al., 2003). From a critical realist perspective what is <u>also</u> open to interpretation is how we talk about these results and how that impacts on our interpretation of the results. Throughout the discussion confounding factors will also be considered. These are the effects of additional variables that might be responsible for the observed findings (Hennekens & Burning, 1987).

<u>4.2.1 Preliminary Analyses</u>

The neuropsychological findings suggest that the two groups were well matched on measures of attention, learning and memory but not on the BSAT (measure of visual executive function). In the current study there also appeared to be a reasonable effect size on the DKEFS Switch Total and Switch Accuracy scores (measure of verbal executive function). These findings are consistent with previous literature, which has also reported difficulties in executive function. A similar study by (Bartlett, 2010) reported significant differences with moderate effects sizes for each of the DKEFS (Switch Total and Switch Accuracy) variables. Verbal fluency and switching tasks such as these have been argued by some to differentiate to some extent, between basic cognitive functions (memory and retrieval) and higher level executive functions (Delis, et al., 2001). Since the ASD group have otherwise intact verbal function, their scores on the DKEFS switching tasks may suggest problems in memory search.

Previous studies have reported that persons with a diagnosis of ASD appear to perform well or above average in general cognitive domains, including executive functioning but appear to struggle with verbal switching tasks (Dawson et al., 2007; Kleinman, Marciano, & Ault, 2001). This is also consistent with the 'different route theory', which suggests there are different connecting pathways in the brain for individuals with an ASD diagnosis. 'Switching' ability they argue may be

disrupted and/or reduced as domains are not adequately integrated, inhibitory control is encumbered resulting in less active responsiveness to incoming information (Mottron et al., 2006; Rippon et al., 2007). Our findings are therefore consistent with previous literature.

The Bartlett (2010) study however did not report a significant difference between the two groups on the BSAT. This is also consistent with another study (Boucher et al., 2005). One possible explanation for the significant difference observed in the current study is that the control sample appeared to have scored very well on this task even in comparison to the control groups of the other two studies; they appear to have fewer errors. The control group was a convenience sample drawn from the researcher's colleagues and associates and therefore likely represent individuals with higher academic abilities than general population normative comparisons (discussed further in methodological considerations section).

However since this significant difference is limited only to the BSAT in this study it is unlikely to be a definitive explanation, particularly, as deficits in executive function have previously been considered potential causes of ASD (Ozonoff, Pennington, et al., 1991; Shallice, 1988). Clinical accounts from individuals with ASD also include how 'switching' or 'diverting' from routines and repetitive behaviours are difficult to manage (Frith, 2003). In the BSAT participants are required to detect a rule/pattern; however, this pattern changes without warning and could be seen as an inability to switch to new information by the ASD group who performed less well on this task.

The current study findings for both the BSAT scores and the DKEFS switching tests supports potential weakness in executive function; and therefore social cognition results were further scrutinised in general linear models with executive function variables added as independent variables.

<u>4.2.2 Validation Analyses</u>

It was hypothesised that a significant difference between the two groups would be found on the more subtle ToM component of the SSSQ (Part 1) and the RMET however not on the generic ToM component of the SSSQ (Part 2) or the MIT. Results are consistent with these hypotheses.

4.2.2.1 Between Group Analyses for SSSQ- Part 1

The SSSQ included two parts. Part 1 was intended to utilise more subtle forms of ToM abilities than Part 2 which comprised relatively more generic ToM abilities. We found a significant difference on SSSQ - Part 1. The control participants scored better on six of the seven overtures and in particular the identification of the two following overtures showed the largest difference between the two groups:

[When the shop assistant returned with the dress, he said to Jane "that dress suits you, it matches your eyes"]

[Aunt Eva pats both your heads and smiles]

It could be argued that the intentions of both the 'shop assistant' and 'Aunt Eva' were more ambiguous. From the qualitative feedback ASD participants described the shopkeeper's behaviour as potentially "creepy" and "over familiar" highlighting how something such as a 'compliment' can quite easily be perceived *differently* by different people.

The SSSQ - Part 1 focused on social overtures which when described earlier highlighted the complexity of comprehending intentionality behind social overtures. It has previously been recognised that intentionality is a ToM skills that individuals with ASD struggle with (Baron-Cohen, 2000). However despite demonstrating an overall significant difference between the two groups on this scale, it is important to critically reflect on these findings. The concept that there is a 'right or wrong' answer in these social situations is arbitrary and culturally loaded. For example it might be considered a 'social overture' to pat the heads of young family members as it was intended to demonstrate in the SSSQ, however it could easily be seen as

a behaviour that was 'necessary' by some. The aunt's behaviour appears to be potentially ambiguous which could explain these findings.

The question itself for eliciting these answers in the SSSQ was:

> "Was there a social interaction that occurred anywhere in the story that you believe was both positive <u>and</u> something the character did not really have to do in that situation?"

This question is open to interpretation, which was also noted by some of the control participants suggesting they too had some difficulty deciding on answers. If the question had been "were there any social overtures in the story?" it is likely that we would not know how people are interpreting what 'social overtures' are which would lead to a measurement error of sorts. However, similarly what people determine as 'necessary' or not in different social situations seems very much a subjective opinion, the storyline of aunt Eva being a good example. It seems that finding a significant difference between the two groups on this instrument show exactly that, a 'difference'. This reinforces the way in which differences in a minority group compared to a larger dominant group warrant the justification of labelling these people as 'defective' or 'deficient' or 'lacking'; in some way, language that ultimately reifies an ASD diagnosis. There does not appear to be a scientific rational for concluding this *difference* is indeed a deficit or impairment.

4.2.2.2 Between Group Analyses for SSSQ-Part 2

The SSSQ –Part 2 was incorporated to show the different types of ToM skills, prompting thinking towards ToM as a multi factorial construct. It was hypothesised that there would be no significant difference between the two groups on this part of the SSSQ as existing research shows that people with ASD often can and do pass ToM tests such as these. This was achieved in the current study. The ToM skills in this part were largely first and second order, humour and emotion recognition. A key feature of this part of the SSSQ was that it was more literal. Of particular interest were the numerous accounts from both ASD and control participants stating that there were potentially several answers to these questions. Participants were given multiple-choice answers to each question. Each option of answers

included a more literal option and an option that demonstrated some level of ToM ability such as inferences about another's mental state.

The potential for several answers being correct can be viewed as supporting Antaki's (2004) framework of 'referential theory of meaning'. Social interaction occurs when people judge visible 'behaviour' as meaningful in reference to other contextual factors (Antaki, 2004). The fact that both control and ASD participants commented on the numerous options as potentially correct answers, could be viewed as each interpreting various other references in the story to determine a meaningful interpretation of the characters behaviour and not necessarily their mental state. This supports the view that social cognition is not simply reducible to ToM. It may also suggest ToM as a multifactorial construct in that it is understood in reference to other social context.

4.2.2.3 Between Group Analyses for RMET
Significant differences were found between the two groups on the RMET. The findings are consistent with previous studies, which have also reported this difference (Baron-Cohen et al., 2001; Bartlett, 2010). Whilst the RMET demonstrates the ability to discriminate between the two groups, it fails to measure complex social interaction. The detection of social overtures in differing complex social contexts between people requires more advanced ToM skills that are distinct from ToM skills such as emotion recognition in measures such the RMET.

4.2.2.4 Between Group Analyses for MIT
This task looked specifically as characters internal intentions (positive vs. negative) and their external behaviours (truthful vs. untruthful) in different scenarios. Participants were asked to rate characters on whether they felt their actions were permissible (forbidden or allowed) and how the character in the story should be judged (blamed or praised). The findings suggest that there were strong correlations between permissibility and judgement by both groups. There was no significant difference between the two groups; furthermore they scored in a similar way. For example both groups were more approving of the action when the character was motivated by positive rather than negative intention, and this remained the case regardless of whether their behaviour was truthful or untruthful.

These findings are not too surprising as people often speak of 'intentionality' during relational difficulties. What is important to acknowledge is that ASD participants scored in the exact same way suggesting that the aspects of ToM such as internality is not difficult for them to interpret. One possible explanation is that the character's intentions in the MIT unlike the social overtures in the SSSQ examples are quite 'obvious' for example:

[Mark went to a party for his brother's recent promotion.
Mark was jealous of his brother's success.
At the party, he went up to his brother and said:
"I think this promotion will be bad for you: your boss will see that you can't do the job."]

[Neil went to his sister's engagement party.
He had noticed that his sister's boyfriend was always mean to her. At the engagement party, Neil went up to his sister and said: "Please don't get married; your boyfriend is terrible to you."]

The intentions of 'Mark' and 'Neil' may have been more obvious, than the more subtle intentions portrayed in the SSSQ – Part 1. Qualitative feedback from both control and ASD participants also confirms that the intentions of some of the characters particularly in Story 1 were difficult to interpret. Perhaps the use of social overtures present a way in which the complexity of the intentionality of others in social situations is operationalised successfully in ToM tests.

With all the social cognition tests, participants had time to reflect on their answers as they were untimed. The SSSQ in particular was a self-administered paper-based questionnaire. In day-to-day complex social situations which often happen at a quicker pace and where intentionality is not always obvious and behaviours not easily interpretable and where a response might be required, the social task can easily become more difficult. This was also one of the criticisms of Happe's (1994) SSQa (Byom & Mutlu, 2013). The SSSQ - Part 1 may show that control participants correctly identified the social overtures over the ASD participants. But what does this tell us about social interaction? it merely tells us that these can be

detected in fictional stories, however gives us limited information about how control participants may respond in this situation and most crucially whether they would necessary know at the time what others were thinking or feeling which is primarily what ToM is often reduced to in similar research (Baron-Cohen, 2000).

4.2.2.5 Convergent and Divergent Validity – Social Cognition Tests
It was hypothesised that The SSSQ – Part 1 would show divergent validity with the SSSQ – Part 2 and the other social cognition tests. The SSSQ – Part 2 was hypothesised to show convergent validity with both the RMET and the MIT. In the control group no such correlations were observed. In the ASD group however there was a strong correlation between SSSQ- Part 2 and 2/4 components of the MIT. This suggests that there is some construct validity in generic ToM non-literal language tasks. It is also possible that constructs such as generic and more subtle ToM skills are not best measured against existing measures which themselves have numerous limitations. Instead between group analyses may be a stronger indication of validity until a gold standard measure is achieved.

4.2.2.6 Convergent and Divergent Validity – Executive Function
Executive function scores were hypothesised to contribute to reducing the social cognition abilities of those in the ASD group thus affecting their scores on the social cognition tests. The effects of execution function scores, which include the BSAT scores (measure of visual executive function) and the DKEFS Switch Total and Switch Accuracy scores (measure of verbal executive function) were investigated on both the primary effects of RMET and group status and the SSSQ- Part 1 and group status. The executive function scores made no difference to the RMET and individually also made no difference to the SSSQ- Part 1, suggesting that the differences between the two groups observed on the RMET and SSSQ- Part 1 were not underpinned by executive function difficulties. However when the effects of the executive function tests were combined i.e. both verbal and visual executive function the SSSQ - Part 1 no longer showed a significant difference between the two groups. The SSSQ – Part 1 attempts to capture more subtle/nuanced social interactions compared to the RMET, it is therefore arguable that these findings could suggest that when dealing with more demanding social interaction tasks and when having increased executive function difficulties, these

factors in combination may start to have an impact when peoples with ASD are interpreting behaviours in social situations.

The need for consistency and difficulties with adaptation in ASD has been considered to impact upon social interaction abilities, as interaction with others is fast paced and ever changing (Bennetto et al., 1996). These findings could be seen to support the existing 'deficits in executive function' theories (Ozonoff, Rogers, et al., 1991; Shallice, 1988). However the combination of executive function difficulties required as well as the presence of more complex social situations could equally support the 'different routes theory' (Rippon et al., 2007). Furthermore the BAST scores made the greatest unique contribution of the three executive function variables, and these scores alone accounted for no significant effect in the unadjusted differences observed for both social cognition tests.

A study looking specifically at ToM, executive function and ASD severity concluded that there was a limited relationship between these (Joseph, Tager-Flusberg, & Lord, 2002). It is also important to consider the role of executive function in social cognition independent of ASD, for example there are other conditions that effect social cognition including frontal lobe dementia etc. Equally there are those labelled with 'social anxiety' that may have difficulties in social situations despite having intact executive function. Therefore whilst these factors may sometimes appear correlated in ASD, they do not necessarily infer causality.

4.2.3 Reliability Analyses

Internal consistency for the SSSQ – Part 1 was poor, for the SSSQ – Part 2 however this was greater though not particularly high either. The reliability analyses were likely limited by the small sample size and reduced variability within the sample. It is therefore difficult to draw adequate conclusions about the internal consistency of the items at this stage.

4.2.4 Summary

Findings from the SSSQ - Part 2 and MIT suggest people with ASD are able to demonstrate generic ToM skills in these contexts. Furthermore both these tests potentially demonstrate how both control and ASD participants are able to

demonstrate not only ToM skills but how different situations could lead both groups to answer differently, placing greater emphasis on other reference points within the wider social context. The SSSQ - Part 1 was designed to operationalise aspects of ToM that were more subtle and occurring in more complex social situations when intentions were less obvious. The significant differences found between the groups could suggest that this instrument has successfully captured ways of translating real life social situations into a paper based questionnaire and supporting the 'ToM theory' of ASD. However the reduced effect found when adjusting this for executive function, particularly the combination of both verbal and visual executive function could be used to support the 'different route theory', which promotes understanding ASD as a network of differences rather than a single domain based deficit (Rippon et al., 2007).

A critical realist position also requires one to pay attention to how the differences observed between the groups on the SSSQ – Part 1 can either be talked about as a 'deficit' or simply a 'difference'.

The most relevant Oxford dictionary definition of deficit is:

> A deficiency or failing, especially in a neurological or psychological function

Implicit in this definition is the assumption of a 'normative' reference point or baseline from which the deficit is measured. It would seem more likely that *deficit* is indeed a socially 'undesirable' difference and unfortunately for those with an ASD label they continue to experience the consequences and stigma for having their differences talked about as deficits.

4.3 Methodological Limitations

In addition to the possible explanations discussed above of the findings observed in the current study, it is also important to consider the methodological limitations of the study when drawing conclusions as these not only impact on the results observed but may also compromise the reliability of the study.

4.3.1. Sample Size

The sample size planned was 15 per group. Two services were recruited and unfortunately due to unplanned circumstances outside of the research project the second service had limited involvement and subsequently only achieved one referral to the study. This limited the ASD sample to 12 individuals only. A small sample size has the following potential limitations:

4.3.1.1 Type 1 and Type 2 Errors

The role of chance can be best understood by considering Type 1 error; this refers to falsely rejecting the null hypothesis when it is true, in other words finding a difference through chance when there is no 'real' difference. The threshold for statistical significance (where applicable) in this study was agreed at 5% or less this corresponds to a 5% or less chance of rejecting the null hypothesis when it is true. The lower the p-value the lower the probability that chance alone accounts for any given association observed. Type 2 error refers to accepting the null hypothesis when it should be rejected i.e. failing to identify a difference or correlation when there is one. Undetected associations in this scenario may be due to lack of statistical power (i.e. the sample size may be too small to detect the relationship of interest).

4.3.1.1.1 Type 1 Error (False Positives)

Overall we found three significant differences between the two groups:

- BSAT (measure of visual executive function)
- SSSQ-Part 1
- RMET

All three differences were statistically significant (i.e. p-value less than 0.05) therefore suggesting that there is less than 5% chance that Type 1 errors were made.

4.3.1.1.2 Type 2 Error (False Negatives)

Differences between the two groups which were hypothesised but not found at conventional significance levels include:

- DKEFS Switch Total and Switch Accuracy scores (measure of verbal executive function).
- All items of the SSSQ-Part 1
- MIT

There was no initial power calculation to determine the sample size as the size of the effect required was not known, it is therefore highly likely that the study lacked adequate power to detect the remaining differences that were not found; however, findings relating to the DKEFS and MIT are consistent with exiting literature. Furthermore re-sampling procedures utilising exact tests were used for several of the analyses to account for the small sample size. In addition effect size was interpreted to measure strength of any given difference/correlation.

4.3.1.2 Sample Variability

A small size also limits sample variability. Limited sample variability impacts of correlations. There were numerous correlation analyses between the social cognition measures as well the items of the SSSQ. Before conclusions are drawn about the outcome of these analyses the study should be replicated on a larger sample for increased variability.

4.3.1.3 External Validity

A small sample study such as this also has reduced external validity as the findings may not be generalisation to the wider general population.

4.3.1.4 Exact Test

Exact tests were used to compute exact *p*-value instead of using the asymtotic *p*-value in several of the analyses. This was appropriate for the current study given the sample size and has increased the interval validity of the study; however the extent of the genralisability of our findings to a wider population will be determined by the representativeness of the study samples. This likely to be poor in the current study given the small sample.

4.3.2 Bias

Bias is the systematic errors that occur in collecting or interpreting data (Hennekens & Burning, 1987).

4.3.2.1 Selection/Recruitment Bias

4.3.2.1.1 ASD Group

Given how recently the changes to the diagnostic criteria took place, all participants in the study would have met DSM-IV criteria for AS and HFA. However even within these diagnostic criteria there is significant heterogeneity. Furthermore these diagnostic categories are no longer in use supporting their limited validity in the first place. For the current study a key limitation was that of the 14 eligible new patients that were approached by our collaborating clinician, those who declined to take part were considered more severe on the spectrum. The five existing participants who took part, had previously taken part in similar ASD research and are likely more familiar with this type of research, which could potentially confound the findings. However both these limitations are likely to bias the sample towards a higher functioning and a more experienced sample compared to a random sample of individuals with ASD, thus leading us to not finding a significant difference on the SSSQ- Part 1. However, since there was a significant difference between the two groups, these effects may have potentially been minimal.

4.3.2.1.2 Control Group

The control samples were a convenience sample primarily drawn from the researcher's colleagues and associates. Several of whom were professionals with

either academic and/or psychology backgrounds, however significant attempts were also made to include those with different educational backgrounds. There is a possibility that the control sample were above average compared to a general population sample in terms of their intellectual ability, therefore their results may be unlikely to be generalisable to the general population. However since this was a matched cohort design and our ASD group were also equally very high functioning, again these effects may have had minimal impact on the overall study findings.

4.3.2.2 Information Bias/Measurement Bias

4.3.2.2.1 Neuropsychological Assessment

It is well known that poor performance on the day due to known and unknown factors may significantly impact on neuropsychological outcomes, for example low mood, anxiety, medication etc (Lezak et al., 2004). These factors were not assessed or adjusted for. It is also very common for people to have performance anxiety about doing well on these types of assessments more so than other types of assessments such as a clinical interview for instance. With regard to the ASD participants, on the one hand due to their social interaction differences they may have found this more anxiety provoking, however may equally have not felt so given that some of these participants had previously taken part in similar studies. Also some ASD participants are familiar with neuropsychological testing and may have found this easier than some of the control participants. This would result in the ASD group performing better on these tasks, which was not the case. Equally some of the control participants who had a psychology background may be more familiar with these types of tests however, since this only included 4 out of 16 participants this effect could also be seen as minimal.

4.3.2.2.2 Social Cognition Battery

For the SSSQ in particular there is also increased performance anxiety that may occur amongst the ASD group who may have felt they were disadvantaged in tasks relating to social situations. However participants were informed throughout that there were no right or wrong answers, which was also intended to reduce such anxiety. Unlike the neuropsychology battery the social cognition battery has

limited norm data or none at all depending on the measure in question. The subjective nature of correct or incorrect answers increases the limited validity of such measures. Since the purpose of the study is to pilot and investigate the validity of the SSSQ, these issues have been addressed.

4.3.3 Data Analyses

The data analyses carried were largely limited by the small sample size, thus reducing the power of the study and limiting the study to the use of less powerful non-parametric tests and the use of exact tests. Non-parametric tests require a larger sample than parametric tests to achieve the same power. Some authors have argued that the Fisher's exact test for instance is too conservative, i.e. that its actual rejection rate is below the nominal significance level (Liddell, 1976). Other limitations include the fact that re-sampling procedures (exact tests) are based only on the primary sample and therefore cannot be generalisable beyond that particular sample (Ludbrook & Dudley, 1988). The small sample also potentially reduced variability within the sample limiting the findings of the reliability analyses for which adequate inferences could not be drawn. If a larger sample size was used the study would have had greater power, there would have most likely been greater variability within the sample thus permitting more confident interpretations of correlation analyses and there would have been potential to use more powerful parametric tests such as principal axis factoring (factor analysis).

4.3.4 SSSQ Scoring

The results were also limited by the scoring of the SSSQ, particularly the way in which the SSSQ- Part 1 was scored and analysed. There was a possibility that some people may have randomly scored the target answer for example those indicating more than 1 line had a greater probability of correctly identifying the target line. However in each story the majority of people did chose 1-2 lines only. An alternative way to improve the scoring would have been to instruct participants to only select 1 or 2 lines depending on the number of actual social overtures present in the story. Participants could also be instructed to state why they scored the line that they did demonstrating actual understanding of the social overture itself. The qualitative feedback from participants from both groups was largely around there being multiple correct answers for the SSSQ-Part 2. This may have

limited the study with target answers being underpinned by assumptions of what constitutes generic ToM skills. Again asking participants to pick an answer and explain why they did so may have contributed further to our understanding of processes underlying social interaction in ASD.

4.3.5 Epistemological Position

Using an alternative epistemological position such as social constructionist; the way in which the SSSQ- Part 1 was administered and scored could have been completely different. For example a study using qualitative methods might have asked the participants to read each story and then discuss what they think happened. Bartlett (2010) used mixed methods study which included the MIT as well as other social cognition tests. The study design incorporated qualitative analyses of why participants answered the way they did. Key themes described included: Group affiliation (i.e. ASD participant's praised some of the behaviours of MIT as they recognised them to be typical of ASD and thus found it amusing); Strategy used (relational vs. personal); Self vs. other reasoning (own needs vs. others' needs); confidence in the material and thinking style (i.e. using prediction vs. guesswork). The last theme particularly seems very relevant as many participants may have been guessing which lines of the SSSQ-Part 1 to choose. Without qualitative data there is limited evidence to infer actual social overture detection took place. The use of a critical realist epistemological position ultimately implies that inferences about a person's social cognition skills/abilities can be made from scores of a social cognition test. This assumption has fundamental limitations such as negating the need to provide evidence for constructs such as social cognition and more specifically ToM in the first place (Leudar & Costall, 2009). Furthermore the continued use of quantitative methods and 'formal tests' continue to reduce the 'social environment' to an artificial 'laboratory environment' where a significant number of unknown confounding variables cannot possibly be accounted for (Leudar & Costall, 2009) and thus makes the stimuli (test) more static than the real world (Baron- Cohen et al., 2001) and responses are from passive individuals i.e. participants do not formulate a response as if they themselves were in the situation when answering questionnaires (Byom & Mutlu, 2013).

4.4 Implications

<u>4.4.1 Clinical Implications</u>

Clinical implications of the current research are discussed within the current national policy. Three key areas relevant to the national policy described earlier will be discussed further.

4.4.1.1 Community Awareness and Social Inclusion

Narratives of deficits associated with the medical model (Paley, 2002) over differences not only promote social exclusion and impacts negatively on quality of life for such people but behavioral research has clearly shown a correlation between a person's acceptance of disability and that person's psychological well-being. Researcher's using various measures of 'disability acceptance' have collected data from people of all ages, in numerous countries, and with many types of disabilities; these studies consistently show that the more an individual accepts his or her disability, the more positive the psychological effects (Gernsbacher, 2013). However acceptance needs to promote acceptance of difference rather than accepting you are different from the 'norm' thus prompting a socially undesirable *difference*. Following normalisation theory (Wolfensberger, 1972), several policies have focused on normalisation and social inclusion however many failed because they were underpinned by assumptions that dispersal of peoples into the community will enable them to feel better (Szivos, 1992). Festinger (1954) introduced social comparison theory, which demonstrates that we tend to feel more comfortable with people who display similar levels of ability and experience. The current study not only highlights differences between the controls and ASD groups but we purposefully have chosen to interpret these findings as differences and not deficits. Those with lesser or greater difference may find social interaction with others unlike them, particularly challenging and anxiety provoking. It is not uncommon for people with ASD to experience depression and risk of suicide. Of particular interest was that findings reveal that suicidal ideation was less related to neurological differences or ASD, but more related to social factors i.e. how people are treated as a result of these differences (Mayes, Gorman, Hillwig-Garcia, & Syed, 2013). It would seem that tackling stigma and discrimination around these differences would be a clinical priority.

4.4.1.2 Improving Access to Services and Diagnosis for Adults

Currently one of the main benefits of a diagnosis is to gain access to services and support. It is clear that many people who are diagnosed with ASD do not receive as much support as they could hence the high prevalence of mental health difficulties often observed and the low employment rates. As such adults with ASD living in the community tend to be unrecognised and social disadvantaged (Brugha et al., 2011). If the SSSQ was developed further it has the potential to aid diagnosis in adults particularly the severity of social interaction difficulties. For example it focuses on more subtle social interaction behaviour and could inform social skills workshops.

However the current study has considerably low clinical significance despite some analyses showing significant differences between the two groups. The SSSQ is currently unlikely to demonstrate any predictive diagnostic properties and as such has limited diagnostic utility. Instead in its current state is best utilised as an additional evaluation method to understand the different level of social skills ability within individuals with ASD. It may also have better utility amongst individuals who are high functioning and desire to improve social skills (see below).

4.4.1.3 Skills Training and Employment Opportunities

Whilst the SSSQ could potentially inform social skills training the emphasis of difference rather than deficits is important to uphold and one way to do this is to promote community awareness and social inclusion by delivering skills training to all those with and without a label of ASD. For example individuals with ASD could also be supported further in workplace settings if employers and colleagues had a better awareness of different ways of interpreting social situations. The SSSQ story examples could be used to inform social skills training interventions to facilitate a greater awareness of social interaction differences. This could be seen as supporting aspects of the social disability model by locating these difficulties as concerns for all and not just those with an ASD diagnosis. This opens up the idea of ASD as a social construct and as such this could be deconstructed with a view to reduce stigma and social exclusion (Oliver, 1996).

<u>4.3.2 Research Implications</u>

The SSSQ has potential and further development of the SSSQ would be required to take the current study further. In the first instance an extension or replication of the current study would need to address the sample. A larger sample size would increase wider sample variability and would give adequate power to potentially detect associations that were not found i.e. the correlation analyses.

Individual items can also be removed from the SSSQ once adequate sample variability is achieved. Future research on the SSSQ could also focus entirely and the SSSQ - Part 1 adding further social overtures to develop the psychometric properties of the instrument. The scoring of the SSSQ- Part could also be considered further as described above.

Qualitative methods could also be introduced to investigate why participants scored the way they did. This could develop a further understanding of the *differences* between those with and without an ASD label. In order to demonstrate clinical significance future work on the SSSQ may also need to demonstrate predictive validity.

4.5 Conclusion

There remains a need for more sensitive tests in ASD presentations for the particular use on adults. The SSSQ offers a novel way to develop the ToM framework as social overtures present an additional ToM skill that has otherwise been neglected in ToM tests. The SSSQ also demonstrates some discriminating properties even within a very small pilot validation study. However, despite these findings the results of the study also show a number of methodological as well as theoretical limitations. The process by which participants answer the SSSQ-Part 1 in particular is not known and there is no evidence to suggest that participants understand the construct underlying the SSSQ and whether it is indeed underpinned by a valid construct.

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APPENDICES

Appendix 1: UEL Ethical Approval

ETHICAL PRACTICE CHECKLIST (Professional Doctorates)

SUPERVISOR: Matthew Jones Chesters   **ASSESSOR:** Helen Murphy

STUDENT: Aysha Begum   **DATE (sent to assessor):** 01/07/2014

Proposed research topic: Social Interaction in Autism Spectrum Presentation: The Development of the *Social Situation Stories Questionnaire* (SSSQ).

Course: Professional Doctorate in Clinical Psychology

1. Will free and informed consent of participants be obtained?   YES

2. If there is any deception is it justified?   N/A

3. Will information obtained remain confidential?   YES

4. Will participants be made aware of their right to withdraw at any time? YES

5. Will participants be adequately debriefed?   YES

6. If this study involves observation does it respect participants' privacy? NA

7. If the proposal involves participants whose free and informed consent may be in question (e.g. for reasons of age, mental or emotional incapacity), are they treated ethically?   YES

8. Is procedure that might cause distress to participants ethical?   NA

9. If there are inducements to take part in the project is this ethical?   NA
10. If there are any other ethical issues involved, are they a problem?   YES

APPROVED

	YES, PENDING MINOR CONDITIONS	

MINOR CONDITIONS: 1) Dr, Jones Chesters to oversee the recruitment of the control sample with scrutiny as there is inadequate detail in the application. 2) Ms Begum to refrain from asking participants why they wish to withdraw from the study as this is contradictory to BPS regulations, no matter how sensitively this is communicated.

REASONS FOR NON APPROVAL:

Assessor initials: HM   Date: 07/07/2014

RESEARCHER RISK ASSESSMENT CHECKLIST (BSc/MSc/MA)

SUPERVISOR: Matthew Jones Chesters   **ASSESSOR:** Helen Murphy

STUDENT: Aysha Begum   **DATE (sent to assessor):** 01/07/2014

Proposed research topic: Social Interaction in Autism Spectrum Presentation: The Development of the *Social Situation Stories Questionnaire* (SSSQ).

Course: Professional Doctorate in Clinical Psychology

Would the proposed project expose the <u>researcher</u> to any of the following kinds of hazard?

1	Emotional	NO
2.	Physical	NO
3.	Other (e.g. health & safety issues)	NO

If you've answered YES to any of the above please estimate the chance of the researcher being harmed as: HIGH / MED / LOW

APPROVED

YES

Assessor initials: **HM**   Date: 07/07/2014

Appendix 2: NHS Ethical Approval

NHS
Health Research Authority

NRES Committee South West - Exeter

Whitefriars
Level 3
Block B
Lewins Mead
Bristol
BS1 2NT

Telephone: 01173421390
Fax:01173420445

13 October 2014

Dr Aysha Begum
School of Psychology
University of East London
Stratford Campus Water Lane
E15 4LZ

Dear Dr Begum

Study title:	**Social Interaction in Autism Spectrum Presentation: The Development of the Social Situation Stories Questionnaire (SSSQ)**
REC reference:	**14/SW/1102**
IRAS project ID:	**160572**

Thank you for your letter of 10th October 2014, responding to the Proportionate Review Sub-Committee's request for changes to the documentation for the above study.

The revised documentation has been reviewed and approved by the sub-committee.

We plan to publish your research summary wording for the above study on the NRES website, together with your contact details, unless you expressly withhold permission to do so. Publication will be no earlier than three months from the date of this favourable opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to withhold permission to publish, please contact the REC Manager Mrs Kirsten Peck, nrescommittee.southwest-exeter@nhs.net.

Confirmation of ethical opinion

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On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations.

Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database within 6 weeks of recruitment of the first participant (for medical device studies, within the timeline determined by the current registration and publication trees).

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g. when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non-clinical trials this is not currently mandatory.

If a sponsor wishes to contest the need for registration they should contact Catherine Blewett (catherineblewett@nhs.net), the HRA does not, however, expect exceptions to be made. Guidance on where to register is provided within IRAS.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at http://www.hra.nhs.uk/hra-training/

14/SW/1102	Please quote this number on all correspondence

With the Committee's best wishes for the success of this project.

Yours sincerely

pp.

Joan Ramsay
Vice Chair

Email: nrescommittee.southwest-exeter@nhs.net

Enclosures: *"After ethical review – guidance for researchers"* [SL-AR2]

Copy to: *Prof Neville Punchard*

        Ms Lynis Lewis, Camden and Islington NHS Foundation Trust

PARTICIPANT INFORMATION SHEET

Title of Study: Social Interaction in Autism Spectrum Presentation:
The development of the Social Situation Stories Questionnaire

Principal Investigator:
Dr Aysha Begum (Trainee Clinical Psychologist)
Research Supervisor:
Dr Matthew Jones Chesters (Senior Lecturer Clinical Psychology)

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being carried out and what it would involve for you. **Your clinician Dr Andrew Greenhill/Josef Schwaerzler will inform you of the study initially and will go through this with you.** We'd suggest this should take about 5-10 minutes. Please ask us if there is anything that is not clear. You may also take time to decide and discuss with others before making your decision.

_____

What is the purpose of the study?
This research study aims to understand more about individuals with autism spectrum diagnosis (ASD) and how they socially interact and coordinate their behaviours with others. Previous research has shown that people are able to guess how another person will behave in a situation and attempt to match their behaviour. This is used in everyday interactions between people and allows for a shared understanding of problems and reduced anxiety in the interaction. This research aims to see if the processes are the same or different for people with an ASD.

Why have I been invited?
The current research study intends to recruit two groups of participants: one group of individuals with an ASD and another group of individuals without an ASD (control group), so that data can be compared between the two groups. We aim to recruit 15-20 per group. As we understand that you have already been informed that you have an ASD, we are therefore inviting you to take part in this study.

Do I have to take part?
It is your choice to join the study as your participation is voluntary and you do not have to give a reason if you chose not to. If you agree to participate you are still free to withdraw at any time, without giving a reason if you wish not to. There will be no consequences to the quality of care you receive. If you decide to withdraw during or after you have started the research you can take your data with you, or leave it to be used in the research or it can be destroyed before or after you leave.

Will my taking part in the study be kept confidential?
All information collected about you during the course of the research study will be kept strictly confidential and held securely, following ethical and legal practice. All

data collected will be anonymised using a participant ID number.

Who is organising and monitoring the research?
The current study takes forward previous research in this area, and our clinical experience. The study has been approved by the University of East London School of Psychology Ethics Committee and by the South West – Exeter Research Ethics Committee.

How long will it take?
The study will take up to 1.5 hours. You will be asked to complete several different tasks and you will be able to have natural short breaks as well as a longer break if you require this. During breaks you will be able to eat and drink something if you need to and you will be able to use the bathroom/toilet whenever you wish.

What will I be asked to do if I take part?
You will initially be contacted via telephone to make an appointment on a day and time convenient for you. The test will take place at the University of East London or at a safe convenient location for you. We are able to refund any travel expenses that you may incur. On the day of testing you will asked to sign a consent form and provide some information about yourself, this includes your employment status and educational background as well as your current medication use and if you have any other serious medical diagnoses. You will then be asked to complete a number of different mental tasks in a face-to-face 'interview' style. For example you might be asked to repeat a string of numbers to see how many you can remember. You may find some of the tasks more difficult than others but don't worry, this is normal for everybody. You will also be asked to fill in the Social Situation Stories questionnaire, which contains four stories, which you will need to read through and write down what you feel are the best answers. At the end of this questionnaire you will be asked to write which questions you found most difficult.

What are the possible disadvantages and risks of taking part?
There are no known risks to taking part. If you feel tired at any time during the assessment, we can stop and/or take a break. Neither the questions nor procedures are in any way harmful. If at any point you are upset or worried about the tasks please tell the researcher and we will stop.

What are the possible benefits of taking part?
Your participation may contribute to helping clinicians and people with an ASD to better understand how and why they interact with others in the way they do. The Social Situation Stories Questionnaire is a new questionnaire that might help us better understand the difficulties that some people have described in social interaction and perhaps may allow us to find new ways in which we can make everyday interactions easier. We hope the results which will be available in 2015 will be of interest to you and if you would like a summary of the findings then you will be asked to give some contact details so that we may send this to you.

PARTICIPANT INFORMATION SHEET

Title of Study: Social Interaction in Autism Spectrum Presentation:
The development of the Social Situation Stories Questionnaire

Principal Investigator:
Dr Aysha Begum (Trainee Clinical Psychologist)
Research Supervisor:
Dr Matthew Jones Chesters (Senior Lecturer Clinical Psychologist)

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being carried out and what it would involve for you. Please ask us if there is anything that is not clear. You may also take time to decide and discuss with others before making your decision.

What is the purpose of the study?
This research study aims to understand more about individuals with autism spectrum diagnosis (ASD) and how they socially interact and coordinate their behaviours with others. Previous research has shown that people are able to guess how another person will behave in a situation and attempt to match their behaviour. This is used in everyday interactions between people and allows for a shared understanding of problems and reduced anxiety in the interaction. This research aims to see if the processes are the same or different for people with an ASD.

Why have I been invited?
The current research study intends to recruit two groups of participants: one group of individuals with an ASD and another group of individuals without an ASD (control group), so that data can be compared between the two groups. We aim to recruit 15-20 per group. We are aware you do not have an ASD and are therefore inviting you to take part as a control group participant.

Do I have to take part?
It is your choice to join the study as your participation is voluntary and you do not have to give a reason if you chose not. If you agree to participate you are still free to withdraw at any time, without giving a reason if you wish not to. If you decide to withdraw during or after you have started the research you can take your data with you, or leave it to be used in the research or it can be destroyed before or after you leave.

Will my taking part in the study be kept confidential?
All information collected about you during the course of the research study will be kept strictly confidential and held securely, following ethical and legal practice. All data collected will be anonymised using a participant ID number.
Who is organising and monitoring the research?
The current study takes forward previous research in this area, and our clinical

experience. The study has been approved by the University of East London School of Psychology Ethics Committee and by the South West – Exeter Research Ethics Committee.

How long will it take?
The study may take up to 2 - 2.5 hours. You will be asked to complete several different tasks and you will be able to have natural short breaks as well as a longer break if you require this. During breaks you will be able to eat and drink something if you need to and you will be able to use the bathroom/toilet whenever you wish.

What will I be asked to do if I take part?
You will initially be contacted via telephone to make an appointment on a day and time convenient for you. The test will take place at the University of East London or at a safe convenient location for you. We are able to refund any travel expenses that you may incur. On the day of testing you will asked to sign a consent form and provide some information about yourself, this includes your employment status and educational background as well as your current medication use and if you have any other serious medical diagnoses. You will then be asked to complete a number of different mental tasks in a face-to-face 'interview' style. For example you might be asked to repeat a string of numbers to see how many you can remember. You may find some of the tasks more difficult than others but don't worry, this is normal for everybody. You will also be asked to fill in the Social Situation Stories Questionnaire, which contains four stories, which you will need to read through and write down what you feel are the best answers. At the end of this questionnaire you will be asked to write which questions you found most difficult.

What are the possible disadvantages and risks of taking part?
There are no known risks to taking part. If you feel tired at any time during the assessment, we can stop and/or take a break. Neither the questions nor procedures are in any way harmful. If at any point you are upset or worried about the tasks please tell the researcher and we will stop.

What are the possible benefits of taking part?
Your participation may contribute to helping clinicians and people with an ASD to better understand how and why they interact with others in the way they do. The Social Situation Stories Questionnaire is a new questionnaire that might help us better understand the difficulties that some people have described in social interaction and perhaps may allow us to find new ways in which we can make everyday interactions easier. We hope the results which will be available in 2015 will be of interest to you and if you would like a summary of the findings then you will be asked to give some contact details so that we may send this to you.

PARTICIPANT INFORMATION SHEET

Title of Study: Social Interaction in Autism Spectrum Presentation:
The development of the Social Situation Stories Questionnaire

Principal Researcher:
Dr Aysha Begum (Trainee Clinical Psychologist)
Research Supervisor:
Dr Matthew Jones Chesters (Senior Lecturer Clinical Psychology)

We would like to invite you to take part in our research study. We have obtained your details from a previous study you participated in where you consented to being re-contacted if any new similar research studies were being carried out.

What is the purpose of the study?
This research study aims to understand more about individuals with autism spectrum diagnosis (ASD) and how they socially interact and coordinate their behaviours with others. Previous research has shown that people are able to guess how another person will behave in a situation and attempt match their behaviour. This is used in everyday interactions between people and allows for a shared understanding of problems and reduced anxiety in the interaction. This research aims to see if the processes are the same or different for people with an ASD.

Why have I been invited?
The current research study intends to recruit two groups of participants: one group of individuals with an ASD and another group of individuals without an ASD (control group), so that data can be compared between the two groups. We aim to recruit 15-20 per group. As we understand that you have already been informed that you have an ASD, we are therefore inviting you to take part in this study.

Do I have to take part?
It is your choice to join the study as your participation is voluntary and you do not have to give a reason if you chose not. If you agree to participate you are still free to withdraw at any time, without giving a reason if you wish not to. If you decide to withdraw during or after you have started the research you can take your data with you, or leave it to be used in the research or it can be destroyed before or after you leave.

Will my taking part in the study be kept confidential?
All information collected about you during the course of the research study will be kept strictly confidential and held securely, following ethical and legal practice. All data collected will be anonymised using a participant ID number.

Who is organising and monitoring the research?
The current study takes forward previous research in this area, and our clinical

experience. The study has been approved by the University of East London School of Psychology Ethics Committee.

How long will it take?
Because we have your data from a previous study you took part in, we will need your consent to use this data. The new part of the study will take between to 20-40 minutes. If we are unable to use your old data then the full duration will be 1.5-2 hours. You will be asked to complete several different tasks and you will be able to have natural short breaks as well as a longer break if you require this. During breaks you will be able to eat and drink something if you need to and you will be able to use the bathroom/toilet whenever you wish.

What will I be asked to do if I take part?
You will initially be contacted to make an appointment on a day and time convenient for you. The test will take place at the University of East London or at a safe convenient location for you. We are able to refund any travel expenses that you may incur. On the day of testing you will asked to sign a consent form and to provide some information about yourself, this includes your employment status and educational background as well as your current medication use and if you have any other serious medical diagnoses. You will then be asked to complete a number of different mental tasks in a face-to-face 'interview' style. For example you might be asked to repeat a string of numbers to see how many you can remember. You may find some of the tasks more difficult than others but don't worry, this is normal for everybody. You will also be asked to fill in the new Social Stories Situations Questionnaire, which contains four stories, which you will need to read through and write down what you feel are the best answers. At the end of the questionnaire you will be asked to write which questions you found most difficult.

What are the possible disadvantages and risks of taking part?
There are no known risks to taking part. If you feel tired at any time during the assessment, we can stop and/or take a break. Neither the questions nor procedures are in any way harmful. If at any point you are upset or worried about the tasks please tell the researcher and we will stop.

What are the possible benefits of taking part?
Your participation may contribute to helping clinicians and people with an ASD to better understand how and why they interact with others in the way they do. The Social Situation Stories Questionnaire is a new questionnaire that might help us better understand the difficulties that some people have described in social interaction and perhaps may allow us to find new ways in which we can make everyday interactions easier. We hope the results which will be available in 2015 will be of interest to you and If you would like a summary of the findings then you will be asked to give some contact details so that we may send this to you.

Included in all three information sheets (reference to Health Research Authority not included in the Existing ASP Participant Information Sheet).

What will happen to the results of the research study?
The results obtained from this research will be incorporated into a doctoral thesis that will be submitted to the University of East London. The thesis may be published in an academic journal; however any identifiable data about you will not be included in any report or publication.

Further Information:
Please feel free to ask the researcher any questions. If you are happy to continue you will be asked to sign a consent form prior to your participation. We thank you for taking the time to read this information sheet. Please retain this for your reference.

What if there is a problem?
If you have any concerns about any aspect of this study, you should contact the Principal Investigator, who will do their best to answer your questions. If you remain unhappy and wish to complain formally, please contact the Research Supervisor or the Chair of the School of Psychology Research Ethics Sub-committee or the Health Research Authority, Research Ethics Committee detailed below.

Contact Details:

Principal Investigator
Dr Aysha Begum
Email: Mobile:

Research Supervisor
Dr
Email: Tel:

Chair of the School of Psychology Research Ethics Sub-Committee
Dr
                                                                Tel:

Appendix 6: Consent Sheet

CONSENT FORM

Title of Study: Social Interaction in Autism Spectrum Presentation:
The development of the Social Situation Stories Questionnaire

Principal Investigator: Dr Aysha Begum (Trainee Clinical Psychologist)
Research Supervisor: Dr Matthew Jones Chesters (Senior Lecturer Clinical Psychology)

Please Tick:

I confirm that I have read and understand the information sheet dated 03/10/2014 (version 2.0) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

☐

I understand that data collected during the study may be looked at by individuals from the University of East London, from regulatory authorities or from the NHS Trust, where this is necessary. Identifiable information will be kept confidential. I give permission for these individuals to have access to this information.

☐

I give permission for my clinician to be informed if I become upset by the test assessment _**(patients only)**_.

☐

I agree to take part in the above study.

☐

Travel expense claim: original receipts provided

☐

I would like to receive a summary of the results of the research when completed (*please circle*):

YES / NO   If YES, contact details (address or email):

....
....

_____   _____   _____
Name of Participant   Date   Signature

_____   _____   _____
Name of Researcher   Date   Signature

Appendix 7: RMET

SAY: *"Now, I am going to show you some photographs of people's eyes, one at a time, like this* [turn to practice item]. *For each set of eyes, look carefully and then decide which one of these words* [point to each of the four words] *best describes what the person in the photo is thinking or feeling. Read all four words before making your choice; if you don't know what a word means, just ask me and I will tell you. You may feel that more than one word is right, but please choose just one; the word that you think is* **most suitable**. *Work as quickly as you can without making too many mistakes. Ready?"*

Mark response on sheet. Score 1 point per **bold** item selected, otherwise zero.

jealous   panicked

arrogant   hateful

Appendix 8: MIT

Instructions

Present the practice item (Dr Irwin Story Card) to participant and SAY:
"Now, I am going to read to you some short stories. Here is the first [point to practice item] *and you can also read it for yourself. Listen carefully, for when I have finished I am going to ask you to tell me whether the person in the story said or did something that was **forbidden** or **allowed**, and whether the person should be **blamed** or **praised** for what they did.*

I will ask you to rate whether their action was forbidden-or-allowed on this scale [point to Likert scale A] *where 1* [point to 1 on left] *is definitely forbidden and 7* [point to 7 on right] *is definitely allowed. You can use any of the numbers, or places between them on the line, to show if something is neither forbidden-nor-allowed* [gesture to region around 4]*; or if it is more forbidden than allowed* [gesture to region around 5/6]*; or more allowed than forbidden* [gesture to region around 2/3]*.*

I will then ask you to rate whether the person should be blamed or praised for what they said or did on this similar scale [point to Likert scale B]*, where 1 means the person should definitely be blamed, 7 means they should definitely be praised, and again you can use any of the points in between if the situation is not so clear* [gesture to region between 3 and 5]*.*

Do you have any questions? [Give further advice as necessary.] *Let's begin. Here is the first story."*

Read story aloud. If questioned, clarify any points of material substance, but do not supply evidence of the characters' intentions, relationships, background situations etc.
If participant does not give a number (e.g., only points to a place on the Likert scale) clarify: e.g., SAY:
"So, you would say that is a 2 (4, 5 etc)?" or *"So, you would say that was a 3.5?"*

Scoring
- Enter Likert numbers chosen on the record form.
- Note any comments or verbalisations (if relevant).

Practice Item

Dr. Irwin went to see a patient who was very ill. Dr Irwin wanted to help the patient, so he did some tests.
The patient needed an emergency dose of antibiotic to survive.
Fortunately, Dr Irwin had a full bottle of the antibiotic in his bag.
Dr Irwin gave his patient an injection of the drug, and the patient recovered immediately.

SAY: *"Do you think that what Dr Irwin did is forbidden or allowed?*
Where on this scale [point to Likert scale A]*, would you rate what Dr Irwin did?*
Do you think that Dr Irwin should be blamed or praised for what he did?
Where on this scale [point to Likert scale B]*, would you rate what Dr Irwin did?"*

Check: Ensure that participant understands the use and directions of the Likert scales.
If participant rates Dr Irwin' behaviour as forbidden or blame-worthy, (1 or 2 on either scale) SAY:
"So, you think Dr Irwin saving the patient was completely forbidden?" OR
"So, you think that Dr Irwin should be blamed for saving the patient?"
Reinforce the direction of the scales as necessary.

1	2	3	4	5	6	7

	Forbidden						Allowed

                    1   2   3   4   5   6   7

Blamed   **Praised**

1. Neil went to his sister's engagement party.
He had noticed that his sister's boyfriend was always mean to her.
At the engagement party, Neil went up to his sister and said:
"Please don't get married; your boyfriend is terrible to you."

2. Rachel was opening her presents at Christmas.
All year she had been asking Mum and Dad for the new Playstation 3.
However, when she opened her present, it was set of water paints.
"Oh thank you!" Rachel said, "It's just what I wanted."

3. Sarah was invited by her best friend to go on a shopping trip.
Sarah knew her friend's extravagant spending was getting her into debt.
In a shop, the friend decided to buy an expensive silver necklace as a gift for someone.
"Please don't buy that," Sarah said, "all these expensive gifts are getting you deeper into debt."

4. Michael had been invited to dinner by his boss.
Michael found his boss loud and boring, so he said that he couldn't go to dinner.
The boss called Michael to ask why he wasn't able to join him for dinner.
"I'd love to, " Michael said, "but I have to work late that night."

5. Lucy was invited by a neighbour to go to the cinema.
But Lucy thought her neighbour was boring, so she decided to ignore the invitation.
The neighbour was confused, and telephoned Lucy to ask why she hadn't been in touch.
"You are too boring and ordinary," Lucy said to her, "for someone like me to be friends with."

6. Maria was judging the painting competition at the village fair.
The best painting was from an old school-friend that Maria didn't like.
Maria met up with the competitors, to say what she thought of their paintings.
"Your painting was lifeless and dull," she told the woman, "I don't think you have much talent."

7. Haydn was visiting his family for their annual gathering.
He knew that his aunt Imelda would be there, who always wore terrible outfits.
Aunt Imelda appeared at the gathering, proudly wearing a big brown hat.
"That's a terrible hat!" he told his aunt, "it makes you look old and ugly!"

8. Mark went to a party for his brother's recent promotion.
Mark was jealous of his brother's success.
At the party, he went up to his brother and said:
"I think this promotion will be bad for you: your boss will see that you can't do the job."

Appendix 9: SSSQ

Social Situation Stories Questionnaire (SSSQ)

Instructions:

There are four stories below. Please read through each one carefully and then answer the questions. There may not always be an obvious right or wrong answer so pick the answer that you feel is the best response. You may go back to the story as many times as you need to if you have forgotten any specific details.

Let's begin with an example:

Example Story

1	Ryan was riding his bike to work one morning.
2	On his way to work he saw his friend Angela. He tried to wave to her.
3	Angela did not notice Ryan.
4	Ryan stopped cycling to go up and say hello to Angela.
5	Angela then smiled and said hello to Ryan.
6	After a brief chat Ryan said he was running late for work and had to go.

Q1. Was there a social interaction that occurred anywhere in the story that you believe was both

1. positive <u>and</u>
2. something the character did not really have to do in that situation

Yes ☐

No ☐ (Please go to Q2)

If yes: which line(s) did it occur in, you may select more than one line if you think there was more than one.

_____

Answer:

Yes, line 4 because Ryan did not have to get off his bike to say hello to Angela, as she had not seen him.

If you got the answer correct please continue

Story 1

1   A young mother called Amber and her baby Adam aged 18 months
     take a brief walk to their local play activity.

2   Adam is in a pram, as Amber walks by she passes a man who she
     has never met before.

3   Adam points enthusiastically at him and says "dada"

4   Amber looks a little embarrassed and says "don't be silly"
     to Adam in a child-friendly voice.

5   The man looks affectionately at Adam and pulls a silly face.

6   Once they arrive at the play activity they are met by two other
     mothers who each have a child.

7   They all say hello to each other and hug.

8   The mothers arrange their children to play together in the play area,
     while they sit at a nearby table and drink coffee.

9   The children start to play together, a little while passes and one of
     the children sneezes, splattering Adam.

10   The child's mother apologises to Amber and quickly gets up to wipe
     her child's nose.

11   Amber also gives Adam a quick wipe.

12   The children resume their play activity.

13   Adam attempts to wipe the other child's nose mimicking his
     mother's action. The three women smile at Adam and laugh.

14   The other mother comments "what a clever boy" in response to
     Adam's actions.

15   Amber tells the other two mothers about the encounter with Adam
     and the man.

16   They find the story very amusing and laugh aloud.

Test Questions:

Q1. What was the main child in this story called?   _____

Q2. How many other mothers did Amber meet?   _____

Please do not proceed until the researcher has reviewed these questions.

Q1. Was there a social interaction that occurred anywhere in the story that you believe was both

1. positive <u>and</u>
2. something the character did not really have to do in that situation

Yes ☐

No ☐ (Please go to Q2)

If yes: which line(s) did it occur in, you can select more than 1 line if you think there was more than one.

_____

Q2. Why did the mother tell the child not to be silly?

Select 1 answer only ☐

1) Because she felt embarrassed and did not want the man to also feel embarrassed
2) Because the man might misunderstand and think he was the father
3) Because the man was silly and so pulled a silly face
4) Because the child was being silly not knowing the man was not his father

Q3. Why did the man look affectionately and pull a silly smiley face at Adam?

Select 1 answer only ☐

1) Because Adam was his child
2) Because he has a similar aged child at home
3) Because he thought that Adam was silly
4) Because he wanted to make Amber feel less embarrassed

Q4. Why did the women laugh when they heard what Adam had said to the man?

Select 1 answer only ☐

1) Because the story was funny
2) Because Adam was funny
3) Because a child caused his parent some embarrassment
4) Because Amber told the story in a funny way

Q5. Why did the other mother apologise to Amber when her child sneezed?

Select 1 answer only

1) **Because the mother felt bad about her child sneezing over another child**
2) Because her child splattered Adam
3) Because Amber looked upset that Adam got splattered
4) Because her child did not cover his mouth when he sneezed

Did you find any of the above questions more difficult than others, please describe which ones you found difficult and explain why?

_____

_____

Story 2

1   In a classroom at school Mr Ali is about to start his science class,
       where 28 students are expected to attend.

2   Jessica walked in a little late as she had been to the toilet.

3   As she walked in she apologised to Mr Ali for being late and

4   then gave her best friend Mandy a wave whilst walking to an empty desk.

5   Mr Ali noticed that one child was missing and looked curious
       whilst looking around the class.

6   Matthew shouted out "Simon is not here today sir, he's off sick"

7   Mr Ali smiled at Matthew.

8   After the science class the students all went to the canteen for lunch.

9   After eating her lunch Jessica said she was still a bit hungry.

10   Mandy offered her a chocolate bar, which Jessica accepted.

11   Mandy and Jessica live on the same road so they often get the bus
       to and from school together.

12   On the way home Mandy was holding up the bus by taking too long
       to find her purse as her bus pass had just run out.

13   The bus driver was looking inpatient, Mandy looked embarrassed
       and Jessica looked a little anxious.

14   Jessica paid for Mandy's bus fare as she had her purse to hand.

15   When they sat down Mandy found her purse and tried to re-pay
       Jessica the money. Jessica declined but Mandy insisted.

16   Jessica still declined and smiled saying; "consider it payment for the
       chocolate".

Test Questions:

Q1. What was Mandy's best friend called?   _____

Q2. What subject does Mr Ali teach?   _____

Please do not proceed until the researcher has reviewed these questions.

Q1. Was there a social interaction that occurred anywhere in the story that you believe was both

1. positive <u>and</u>
2. something the character did not really have to do in that situation

Yes ☐

No ☐ (Please go to Q2)

If yes which line(s) did it occur in, you can select more than 1 line if you think there was more than one.

_____

Q2. Why did Mr Ali's facial expression change when he smiled?

Select 1 answer only ☐

1) Because he smiled at Matthew
2) Because Matthew helped him work out which child was missing
3) Because Matthew is his favourite student
4) Because Matthew gave him the correct answer

Q3. Why did Mandy offer Jessica a chocolate bar?

Select 1 answer only ☐

1) Because Jessica said she was still hungry
2) Because Mandy didn't want to eat her chocolate bar
3) Because Mandy and Jessica are best friends
4) Because Mandy thought a chocolate bar would stop Jessica from feeling hungry

Q4. Why did Jessica look anxious on the bus?

Select 1 answer only ☐

1) Because Mandy was holding up the bus
2) Because she felt bad for Mandy during a difficult situation
3) Because Mandy was taking too long to find her purse
4) Because other people on the bus were making her feel anxious

Q5. Why did Jessica decline money from Mandy?

Select 1 answer only ☐

1) Because she forgot to pay for the chocolate earlier
2) Because Mandy had not asked her for payment earlier
3) Because the chocolate and the bus fare cost approximately the same
4) Because Jessica felt this was a way to reimburse Mandy for the chocolate

Did you find any of the above questions more difficult than others, please describe which ones you found difficult and explain why?

_____

_____

1 Imagine you and your friend David went to a clothing store one sunny afternoon.

2 David needed to buy a new shirt for an upcoming party.

3 Once inside you overheard a conversation with a customer.

4 The shop assistant had been to the store room to get a reserved dress for a customer called Jane which she had already paid for.

5 Jane still wanted to try on her blue dress.

6 When the shop assistant returned with the dress, he said to Jane "that dress suits you, it matches your eyes".

7 Jane's facial expression changed.

8 She then noticed you and David. Jane decided to buy the dress.

9 As she left the shop she thanked the shop assistant again

10 and shook his hand on the way out.

11 You and David then also left the shop and waited for a bus.

12 The bus stop was busy and the bus was also full, however it was not uncomfortably full.

13 A man aggressively pushed past you and David, David tutted to himself.

14 This man continued to be aggressive to several others on the bus, he then sat next to a woman who was by herself and he kept looking at her.

15 After a few minutes she seemed upset, got up and moved to another empty seat next to you and David.

16 After three stops you and David got off the bus.

17 David seemed relieved to get off and said "I hate awkward situations".

18 You both walked towards a nearby pub to have lunch.

Test Questions:

Q1. In this story what is your relationship to David?   _____

Q2. What colour was the dress?   _____

Please do not proceed until the researcher has reviewed these questions.

Q1. Was there a social interaction that occurred anywhere in the story that you believe was both

1. positive <u>and</u>
2. something the character did not really have to do in that situation

Yes ☐

No ☐ (Please go to Q2)

If yes which line(s) did it occur in, you can select more than 1 line if you think there was more than one.

_____

Q2. Why did Jane's facial expression change?

Select 1 answer only ☐

1) She was happy to be complimented
2) She was upset
3) Because of what the shop assistant said
4) Because the shop assistant noticed Jane's eye colour matched the dress

Q3. Why did David tut?

Select 1 answer only ☐

1) He was tired
2) He was threatened by the man
3) Because the man pushed past
4) He felt irritated by the man pushing past

Q4. Why did the woman on the bus change seats?

Select 1 answer only ☐

1) Because the bus was getting too full
2) To move away from the man
3) The man was making her feel uncomfortable
4) The seat next to you and David was more comfortable

Q5. Why do you think David described the bus as an awkward situation?

Select 1 answer only   ☐

1) Because the bus was too full
2) Because the woman came and sat next to you both
3) Because the aggressive man made passengers feel uncomfortable
4) Because the man was aggressive

Did you find any of the above questions more difficult than others, please describe which ones you found difficult and explain why?

_____

_____

Story 4

1   Imagine it is Saturday and you and your family are going to your cousin Lucy's wedding.

2   Your immediate family includes yourself, your younger sister Sara and your parents.

3   On the morning of the wedding your mum gets a phone call from her boss, her facial expression does not look happy and you hear her say,

4   "I've got a very busy day, I'll deal with it on Monday".

5   Then the doorbell rings and you answer, it is your neighbour Robert, he wants a drink so asks if you want to go down the pub later, you explain you're off to your cousin's wedding so can't go.

6   You notice his face change as he left.

7   Later that morning, you, Sara and your mum get a taxi to the wedding.

8   At the wedding you are met by your great aunt Eva. She is extremely pleased to see you and Sara.

9   Aunt Eva pats both your heads.

10   The ceremony begins and Lucy is wearing a vintage cream dress. She had two bridesmaids, her best friend Gila and her sister Holly.

11   There were several hiccups during the ceremony and several people who were involved in getting things together were snappy with each other.

12   You all finally made it to the reception. Everyone kept saying "what a lovely ceremony".

13   Later during the reception several people started drinking and dancing.

14   On your way to the toilet you pass a group of women. You overhear one of the women say " I think that's why she opted for the cream love and not the white dress".

15   The women roar with laughter, however Gila didn't laugh and her facial expression looked a little angry.

Test Questions:

Q1. What was your neighbour called in this story?   _____

Q2. What colour was Lucy's dress?   _____

Please do not proceed until the researcher has reviewed these questions.

Q1. Was there a social interaction that occurred anywhere in the story that you believe was both

1. positive <u>and</u>

2. something the character did not really have to do in that situation

Yes ☐

No ☐ (Please go to Q2)

If yes which line(s) did it occur in, you can select more than 1 line if you think there was more than one.

_____

Q2. Why did your mother not look happy when she was speaking on the phone?

Select 1 answer only ☐

1) She was talking to her boss
2) She was stressed out about Monday's work plans
3) She was stressed out by her boss calling during a busy weekend
4) She never looks happy when she speaks on the phone

Q3. Why did Robert's facial expression change?

Select 1 answer only ☐

1) Because you said you couldn't go to the pub with him
2) He was disappointed you couldn't go to the pub with him later
3) He was angry you said you were going to a wedding
4) He was sad

Q4. At the start of the ceremony several people were snapping at each other, why might that have been?

Select 1 answer only

1) Because weddings are very stressful for everyone
2) Because there were several hiccups
3) They were stressed out because things were not going to plan
4) They did not like each other very much

Q5. Why did the all the women laugh when one of them commented on the colour of Lucy's dress?

Select 1 answer only

1) Because they were suggesting she was promiscuous
2) Because the comment was a joke about Lucy's dress
3) Because the comment was funny
4) Because it is tradition for a bride to wear white instead of cream

Did you find any of the above questions more difficult than others, please describe which ones you found difficult and explain why?

Appendix 10: SSSQ – Instrument Development

Draft Version 1

Story 1 DRAFT

1 You and your friend David went to a clothing store one sunny afternoon.

2 David needed to buy a new shirt for an upcoming party.

3 Once inside you overheard a conversation with a customer.

4 The shop assistant went down to the store room to get a reserved dress for the customer called Jane.

5 Jane was trying on a blue dress.

6 When the shop assistant returned with the dress, he said to Jane "that dress suits you, it matches your eyes".

7 Jane's facial expression changed.

8 She then noticed you and David.

9 You and David then left the shop and waited for a bus.

10 The bus stop was busy and the bus was also full, however it was not uncomfortably full.

11 A man pushed past you and David, David tutted to himself.

12 This man continued to be aggressive on the bus, he then sat next to a female lone passenger and kept looking at her.

13 After a few minutes she seemed annoyed, got up and moved to another empty seat next to you and David.

14 After three stops you and David got off.

15 David seemed relieved to get off and said " I hate awkward situations", his expression towards you indicated that he expected a response.

Q1. Was there a positive social interaction that was not entirely necessary? If so which line(s) did it occur in, you can select more than 1 line if you think there was more than one. Please score 0 if you think none occurred _____

Answer: line 6

Q2. When Jane's facial expression changed, what emotion do you think was expressed?

    5) Happiness

    6) Sadness

    7) Anger

    8) Guilt

Answer: 1 (Happiness in response to being given a compliment)

Q3. Why did the woman on the bus change seats?

   5) Because the bus was getting too full
   6) The man on the bus was aggressive
   7) The man was making her feel uncomfortable
   8) The seat next to you and David was more comfortable

Answer: 3 (lone female being looked at on a bus by aggressive man)

Q4. What do you think David was feeling when he tutted?

   5) Tired
   6) Threatened
   7) Irritated
   8) Confused

Answer: 3 (You wouldn't tut if you felt threatened)

Q5. Why do you think David thought the bus atmosphere was awkward?

   5) Because the bus was too full
   6) Because the woman came and sat next to you both
   7) Because the man was aggressive and made passengers feel uncomfortable
   8) Because David wasn't feeling too well

Answer: 3 (Answer 2 is incorrect as the woman sitting next to them would not effect the overall atmosphere on bus)

Q6. David expected you to respond at the end, what might he have expected you to say?
Place a **1** next to the **most desirable** response and a **0** next to the **least desirable** response

1. "Yes, I know what you mean, that man was definitely uncomfortable to be around" ____

2. "Yes, I agree the bus was way too busy" ____

3. "I didn't really notice an awkward atmosphere but I didn't like it when that woman came and sat next to us" ____

4. "Bus journeys are always awkward for me, but I've got used to them now. You shouldn't be so sensitive David" ____

Draft Version 2

Story 1

1   A young mother called Amber and her baby James aged 18 months
     take a brief walk to their local play activity.
2   James is in a pram, as Amber walks by she passes a man who she
     has never met before.
3   James points enthusiastically at him and says "dada"
4   Amber looks a little embarrassed and says "don't be silly"
     to James in a child-friendly voice.
5   The man looks affectionately and pulls a silly smiley face at James.
6   Once they arrive at the play activity they are met by two other
     mothers who both have a child each.
7   They all say hello to each and hug and kiss each other.
8   They each arrange their children to play together in the play area,
     whilst they sit at a nearby table and drink coffee.
9   The children start to play together, a little while passes and one of
     children sneezes splattering James.
10   The child's mother apologises to Amber and quickly gets up to wipe
     her child's nose.
11   Amber also gives James a quick wipe.
     The children resume their play activity.
12   James attempts to wipe the other child's nose mimicking his
13   mother's action. The three women smile at James and laugh.
14   The other mother comments "what a clever boy" in response to
     James's actions
15   Amber tells the other two mother's about the encounter with James
     and the man.
16   They find the story very amusing and laugh out loud.

Q1. Was there a positive social interaction that was not entirely necessary? If so which line(s) did it occur in, you can select more than 1 line if you think there was more than one. Please score 0 if you think none occurred

____

____

Answer: line 5 and 14

Q2. Why did the mother tell the child not to be silly?

   9)   Because she felt embarrassed and did not want the man to also feel embarrassed

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10) Because the man might misunderstand and think he was the father

11) Because the child needed to learn not to be silly

12) Because the child was being silly not knowing the man was not his father

Neurotypical Answer: 1

ASD Answer: Any answer except 1

Q3. Why did the man look affectionately and pull a silly smiley face at James?

9) Because James was his child

10) Because he has a similar aged child at home

11) Because he thought the James was silly

12) Because he wanted to make Amber feel less embarrassed

Neurotypical Answer: 4

ASD Answer: Any answer except 4

Q4. Why did the women laugh when they heard about James interaction with the man?

9) Because the story was funny

10) Because James was funny

11) Because the story was about a child causing his parent some embarrassment

12) Because Amber told the story in a more funny way

Neurotypical Answer: 3

ASD Answer: Any answer except 3

Q5. Why did the other mother apologise to Amber when her child sneezed?

9) Because her child splattered James

10) Because Amber looked upset that James got splattered

11) Because her child did not cover his mouth when he sneezed

12) Because the mother felt bad about her child sneezing over another child

Neurotypical Answer: 4

ASD Answer: Any answer except 4

Story 2

1   In a classroom at school Mr Jones is about to start his science class,

where 28 students are expected to attend.

2   Jessica walked in a little late as she went to the toilet.

3   As she walked in she apologised to Mr Jones for being late and

4   gives her best friend Mandy a wave whilst walking to an empty desk.

5   Mr Jones noticed that one child was missing and looked curious
whilst looking around the class.

6   Matthew shouted out "James is not here today sir, he's off sick"

7   Mr Jones smiled at Matthew.

8   After the science class the students all went to the canteen for lunch

9   After eating her lunch Jessica said she was still a bit hungry.

10   Mandy offered her a chocolate bar. Which Jessica accepted.

11   Mandy and Jessica live on the same road so they often get the bus
to and from school together.

12   On the way home Mandy was holding up the bus by taking too long
to find her purse as her bus pass had just run out.

13   The bus driver was looking inpatient, Mandy looked embarrassed
and Jessica looked a little anxious.

14   Jessica paid for Mandy's bus fare as she had her purse to hand.

15   When they sat down Mandy found her purse and tried to re-pay
Jessica the money. Jessica declined and Mandy insisted.

16   Jessica still declined and smiled saying consider it payment for the
chocolate.

Q1. Was there a positive social interaction that was not entirely necessary? If so which line(s) did it occur in, you can select more than 1 line if you think there was more than one. Please score 0 if you think none occurred

____

____

Answer: line 5 and 9

Q2. Why did Mr Jone's facial expression change?

13) Because he smiled at Matthew
14) Because Matthew helped him work out which child was missing
15) Because Matthew is his favourite student
16) Because Matthew gave him the correct answer

Neurotypical Answer: 2

ASD Answer: 4

Q3. Why did Mandy offer Jessica a chocolate bar?

13) Because Jessica said she was still hungry

14) Because Mandy didn't want to eat her chocolate bar

15) Because Mandy and Jessica are best friends

16) Because a chocolate bar would stop Jessica from feeling hungry

Neurotypical Answer: 3

ASD Answer: Any answer except 3

Q4. Why did Jessica look anxious on the bus?

13) Because Mandy was holding up the bus

14) Because she felt bad for Mandy during a difficult situation

15) Because Mandy was taking too long to find her purse

16) Because other people on the bus were making her feel anxious

Neurotypical Answer: 2

ASD Answer: Any answer except 2

Q5. Why did Jessica decline money from Mandy?

13) Because she forgot to pay for the chocolate earlier

14) Because Mandy had not asked her for payment earlier

15) Because the chocolate and the bus fare cost approximately the same

16) Because Jessica felt this was a way to reimburse Mandy for the chocolate

Neurotypical Answer: 4

ASD Answer: Any answer except 4

Story 3

1   Imagine you and your friend David went to a clothing store one sunny afternoon.

2   David needed to buy a new shirt for an upcoming party.

3   Once inside you overheard a conversation with a customer.

4   The shop assistant went down to the store room to get a reserved dress
     for a customer called Jane.

5   Jane was trying on a blue dress.

6   When the shop assistant returned with the dress, he said to Jane "that

dress suits you, it matches your eyes".

7   Jane's facial expression changed.

8   She then noticed you and David. Jane decided to buy the dress.

9   As she left the shop she thanked the shop assistant again and shook his hand on the way out.

10   You and David then also left the shop and waited for a bus.

11   The bus stop was busy and the bus was also full, however it was not uncomfortably full.

12   A man pushed past you and David, David tutted to himself.

13   This man continued to be aggressive to several others on the bus, he then sat next to a woman who was by herself and he kept looking at her.

14   After a few minutes she seemed upset, got up and moved to another empty seat next to you and David.

15   After three stops you and David got off the bus.

16   David seemed relieved to get off and said " I hate awkward situations".

17   You both walked towards a nearby pub to have lunch.

Q1. Was there a positive social interaction that was not entirely necessary? If so which line(s) did it occur in, you can select more than 1 line if you think there was more than one. Please score 0 if you think none occurred

____

____

Answer: line 6 and 9

Q2. Why did Jane's facial expression change?

    17) She was happy to be complimented

    18) She was upset

    19) Because of what the shop assistant said

    20) Because the shop assistant noticed Jane's eye colour matched the dress

Neurotypical Answer: 1 or 3
ASD Answer: 3

Q3. Why did the woman on the bus change seats?

    17) Because the bus was getting too full

    18) To move away from the man

    19) The man was making her feel uncomfortable

    20) The seat next to you and David was more comfortable

Neurotypical Answer: 3
ASD Answer: 2

Q4. Why did David tut ?

17) He was tired
18) He was threatened by the man
19) He felt Irritated by the man pushing pass
20) Because the man pushed pass

Neurotypical Answer: 3
ASD Answer: 4

Q5. Why do you think David described the bus atmosphere as an awkward situation?

17) Because the bus was too full
18) Because the woman came and sat next to you both
19) Because the aggressive man made passengers feel uncomfortable
20) Because of the man was aggressive

Neurotypical Answer: 3
ASD Answer: 4

Story 4

1 Imagine it is Saturday and you and your family are going to your cousin Lucy's wedding.
2 Your immediate family includes yourself, your younger sister and your mum.
3 Your father passed earlier in the year, he was not very well.
4 It is your father's side of the family that are all expected to attend.
5 Your sister Sara is 17 years old, she didn't want to go to the wedding but had no choice in the matter, as your mum insisted you all went.
6 Sara talked herself into it thinking she might get to flirt with some fit boys.
7 You get on very well with your family and this is the first gathering since your father's death, so you are looking forward to seeing everyone.
8 On the morning of the wedding your mum gets a phone call from her boss, her facial expression does not look happy and you hear her say, "I've got a very busy day, I'll deal with it on Monday".
9 Then the doorbell rings and you answer, it is your neighbour Mohammad, he asks if you want to go down the pub later, you explain you're off to your

cousin's wedding so can't go. You notice his face change as he left.

10   Later that morning, you, Sara and your mum get a taxi to the church.

11   At the church you are met by your great aunt Eva. She is extremely pleased to see you and Sara.

12   Aunt Eva pats both your heads and tells you both "you're a spitting image of your father, God rest his soul".

13   Both you and Sara take after your mother.

14   The ceremony begins and Lucy is wearing a vintage cream dress. She had two bridesmaids, her best friend Gila and her sister Holly.

15   During the exchanges of the vows the groom kept messing up his lines, he seemed really anxious.

16   There were several hiccups during the ceremony and very long waiting periods, several people who were involved in getting things together were snappy with each other.

17   You all finally made it to the reception. Everyone kept saying what a lovely ceremony.

18   Later during the reception several people started drinking heavily and many people were dancing.

19   You hardly saw Lucy and her new husband as they were so busy making their way through all the guests.

20   On your way to the toilet you pass a group of women. You overhear one of the women say " I think that's why she opted for the cream love and not the white dress".

21   The women roar with laughter, however Gila didn't laugh and her facial expression looked a little angry.

22   After a long evening, your mum was pleased you didn't need to get a taxi as another guest offered to give you all a lift home.

23   On the way home the driver suddenly swerves the car to avoid a dead pigeon on the road. Your mum panicked slightly.

Q1. Was there a positive social interaction that was not entirely necessary? If so which line(s) did it occur in, you can select more than 1 line if you think there was more than one. Please score 0 if you think none occurred

____

____

Answer: lines 12 and 17

Q2. Why did your mother not look happy when she was speaking on the phone?

5) She was talking to her boss

6) She was stressed out by her boss calling during a busy weekend

7) She was stressed out about Monday's work plans

8) She never looks happy when she speaks on the phone

Nuerotypical Answer: 2

ASD Answer: 1

Q3. Why did Mohammad's facial expression change?

5) Because you said you couldn't go to the pub with him

6) He was disappointed you couldn't go to the pub with him later

7) He was angry you said you were going to a wedding

8) He was sad

Neurotypical Answer: 2

ASD Answer: 1

Q4. Why did the all the women laugh when one of them commented on the colour of Lucy's dress?

5) Because the comment was a joke about Lucy's dress

6) Because they were suggesting she was promiscuous

7) Because the comment was funny

8) Because it is tradition for a bride to wear white instead of cream

Neurotypical Answer: 2

ASD Answer: 1 or 3

Q5. At the start of the ceremony several people were snapping at each other, why might that have been?

5) Because weddings are very stressful for everyone

6) Because there were several hiccups

7) They did not like each other very much

8) They were stressed out because things were not going to plan

Neurotypical Answer: 4

ASD Answer: 2 or 4

Draft Version 3 – Pilot Alpha Testing Phase

This version was given to 10 people; further changes resulted in final SSSQ used in the current study.

Enter your age _____

Social Situation Stories Questionnaire (SSSQ)

There are four stories below. Please read through each one carefully and then answer the questions. There may not always be an obvious right or wrong answer so pick the answer that you feel is the best response. You may go back to the story as many times as you need to if you have forgotten any specific details.

Story 1

1   A young mother called Amber and her baby Adam aged 18 months take a brief walk to their local play activity.

2   Adam is in a pram, as Amber walks by she passes a man who she has never met before.

3   Adam points enthusiastically at him and says "dada"

4   Amber looks a little embarrassed and says "don't be silly" to Adam in a child-friendly voice.

5   The man looks affectionately at Adam and pulls a silly face.

6   Once they arrive at the play activity they are met by two other mothers who each have a child.

7   They all say hello to each other and hug.

8   The mothers arrange their children to play together in the play area, while they sit at a nearby table and drink coffee.

9   The children start to play together, a little while passes and one of the children sneezes, splattering Adam.

10   The child's mother apologises to Amber and quickly gets up to wipe her child's nose.

11   Amber also gives Adam a quick wipe.

12   The children resume their play activity.

13   Adam attempts to wipe the other child's nose mimicking his mother's action. The three women smile at Adam and laugh.

14   The other mother comments "what a clever boy" in response to Adam's actions.

15   Amber tells the other two mothers about the encounter with Adam and the man.

16   They find the story very amusing and laugh aloud.

Test Questions:

Q1. What was the main child in this story called? _____

Q2. How many other mothers did Amber meet? _____

Please do not proceed until the researcher has reviewed these questions.

Q1. Was there a positive social interaction that occurred anywhere in the story that you believe was not absolutely necessary?

Yes ☐

No ☐ (Please go to Q2)

If yes which line(s) did it occur in, you can select more than 1 line if you think there was more than one.

_____

Q2. Why did the mother tell the child not to be silly?

Select 1 answer only ☐

1) Because she felt embarrassed and did not want the man to also feel embarrassed
2) Because the man might misunderstand and think he was the father
3) Because the man was silly and so pulled a silly face
4) Because the child was being silly not knowing the man was not his father

Q3. Why did the man look affectionately and pull a silly smiley face at Adam?

Select 1 answer only ☐

1) Because Adam was his child
2) Because he has a similar aged child at home
3) Because he thought that Adam was silly
4) Because he wanted to make Amber feel less embarrassed

Q4. Why did the women laugh when they heard what Adam had said to the man?

Select 1 answer only ☐

1) Because the story was funny
2) Because Adam was funny
3) Because a child caused his parent some embarrassment
4) Because Amber told the story in a funny way

Q5. Why did the other mother apologise to Amber when her child sneezed?

Select 1 answer only ☐

1) Because the mother felt bad about her child sneezing over another child
2) Because her child splattered Adam
3) Because Amber looked upset that Adam got splattered
4) Because her child did not cover his mouth when he sneezed

Did you find any of the above questions more difficult than others, Please describe which ones you found difficult and explain why?

_____

Story 2

1   In a classroom at school Mr Ali is about to start his science class, where 28 students are expected to attend.

2   Jessica walked in a little late as she had been to the toilet.

3   As she walked in she apologised to Mr Ali for being late and

4   then gave her best friend Mandy a wave whilst walking to an empty desk.

5   Mr Ali noticed that one child was missing and looked curious whilst looking around the class.

6   Matthew shouted out "Simon is not here today sir, he's off sick"

7   Mr Ali smiled at Matthew.

8   After the science class the students all went to the canteen for lunch.

9   After eating her lunch Jessica said she was still a bit hungry.

10   Mandy offered her a chocolate bar, which Jessica accepted.

11   Mandy and Jessica live on the same road so they often get the bus to and from school together.

12   On the way home Mandy was holding up the bus by taking too long to find her purse as her bus pass had just run out.

13   The bus driver was looking inpatient, Mandy looked embarrassed

and Jessica looked a little anxious.

14   Jessica paid for Mandy's bus fare as she had her purse to hand.

15   When they sat down Mandy found her purse and tried to re-pay
        Jessica the money. Jessica declined but Mandy insisted.

16   Jessica still declined and smiled saying; "consider it payment for the
        chocolate".

Test Questions:

Q1. What was Mandy's best friend called?   _____

Q2. What subject does Mr Ali teach?   _____

Please do not proceed until the researcher has reviewed these questions.

Q1. Was there a positive social interaction that occurred anywhere in the story that you
believe was not absolutely necessary?

Yes   ☐

No   ☐   (Please go to Q2)

If yes which line(s) did it occur in, you can select more than 1 line if you think there was more
than one.

_____

Q2. Why did Mr Ali's facial expression change when he smiled?

Select 1 answer only   ☐

    5)   Because he smiled at Matthew
    6)   Because Matthew helped him work out which child was missing
    7)   Because Matthew is his favourite student
    8)   Because Matthew gave him the correct answer

Q3. Why did Mandy offer Jessica a chocolate bar?

Select 1 answer only   ☐

    5)   Because Jessica said she was still hungry
    6)   Because Mandy didn't want to eat her chocolate bar

7) Because Mandy and Jessica are best friends

8) Because Mandy thought a chocolate bar would stop Jessica from feeling hungry

Q4. Why did Jessica look anxious on the bus?

Select 1 answer only

5) Because Mandy was holding up the bus

6) Because she felt bad for Mandy during a difficult situation

7) Because Mandy was taking too long to find her purse

8) Because other people on the bus were making her feel anxious

Q5. Why did Jessica decline money from Mandy?

Select 1 answer only

5) Because she forgot to pay for the chocolate earlier

6) Because Mandy had not asked her for payment earlier

7) Because the chocolate and the bus fare cost approximately the same

8) Because Jessica felt this was a way to reimburse Mandy for the chocolate

Did you find any of the above questions more difficult than others, Please describe which ones you found difficult and explain why?

_____

_____

Story 3

1   Imagine you and your friend David went to a clothing store one sunny afternoon.

2   David needed to buy a new shirt for an upcoming party.

3   Once inside you overheard a conversation with a customer.

4   The shop assistant had been to the store room to get a reserved dress
     for a customer called Jane which she had already paid for.

5   Jane still wanted to try on her blue dress.

6   When the shop assistant returned with the dress, he said to Jane "that
     dress suits you, it matches your eyes".

7   Jane's facial expression changed.

8   She then noticed you and David. Jane decided to buy the dress.

9 As she left the shop she thanked the shop assistant again

10 and shook his hand on the way out.

11 You and David then also left the shop and waited for a bus.

12 The bus stop was busy and the bus was also full, however it was not uncomfortably full.

13 A man aggressively pushed past you and David, David tutted to himself.

14 This man continued to be aggressive to several others on the bus, he then sat next to a woman who was by herself and he kept looking at her.

15 After a few minutes she seemed upset, got up and moved to another empty seat next to you and David.

16 After three stops you and David got off the bus.

17 David seemed relieved to get off and said "I hate awkward situations".

18 You both walked towards a nearby pub to have lunch.

Test Questions:

Q1. In this story what is your relationship to David?   _____

Q2. What colour was the dress?   _____

Please do not proceed until the researcher has reviewed these questions.

Q1. Was there a positive social interaction that occurred anywhere in the story that you believe was not absolutely necessary?

Yes   ☐

No   ☐   (Please go to Q2)

If yes which line(s) did it occur in, you can select more than 1 line if you think there was more than one.

_____

Q2. Why did Jane's facial expression change?

Select 1 answer only   ☐

5) She was happy to be complimented

6) She was upset

7) Because of what the shop assistant said

8)   Because the shop assistant noticed Jane's eye colour matched the dress

Q3. Why did David tut?

Select 1 answer only   ☐

5)   He was tired
6)   He was threatened by the man
7)   Because the man pushed past
8)   He felt irritated by the man pushing past

Q4. Why did the woman on the bus change seats?

Select 1 answer only   ☐

5)   Because the bus was getting too full
6)   To move away from the man
7)   The man was making her feel uncomfortable
8)   The seat next to you and David was more comfortable

Q5. Why do you think David described the bus as an awkward situation?

Select 1 answer only   ☐

5)   Because the bus was too full
6)   Because the woman came and sat next to you both
7)   Because the aggressive man made passengers feel uncomfortable
8)   Because the man was aggressive

Did you find any of the above questions more difficult than others, Please describe which ones you found difficult and explain why?

_____

_____

Story 4

1 Imagine it is Saturday and you and your family are going to your cousin Lucy's wedding.

2 Your immediate family includes yourself, your younger sister Sara and your parents.

3 On the morning of the wedding your mum gets a phone call from her boss, her facial expression does not look happy and you hear her say,

4 "I've got a very busy day, I'll deal with it on Monday".

5 Then the doorbell rings and you answer, it is your neighbour Robert, he wants a drink so asks if you want to go down the pub later, you explain you're off to your cousin's wedding so can't go.

6 You notice his face change as he left.

7 Later that morning, you, Sara and your mum get a taxi to the wedding.

8 At the wedding you are met by your great aunt Eva. She is extremely pleased to see you and Sara.

9 Aunt Eva pats both your heads and tells you both "you're the spitting image of your father".

10 The ceremony begins and Lucy is wearing a vintage cream dress. She had two bridesmaids, her best friend Gila and her sister Holly.

11 There were several hiccups during the ceremony and several people who were involved in getting things together were snappy with each other.

12 You all finally made it to the reception. Everyone kept saying "what a lovely ceremony".

13 Later during the reception several people started drinking and dancing.

14 On your way to the toilet you pass a group of women. You overhear one of the women say " I think that's why she opted for the cream love and not the white dress".

15 The women roar with laughter, however Gila didn't laugh and her facial expression looked a little angry.

Test Questions:
Q1. What was your neighbor called in this story?   _____
Q2. What colour was Lucy's dress?   _____

Please do not proceed until the researcher has reviewed these questions.

Q1. Was there a positive social interaction that occurred anywhere in the story that you believe was not absolutely necessary?

Yes ☐

No ☐   (Please go to Q2)

If yes which line(s) did it occur in, you can select more than 1 line if you think there was more than one.

_____

Q2. Why did your mother not look happy when she was speaking on the phone?

Select 1 answer only

9) She was talking to her boss
10) She was stressed out about Monday's work plans
11) She was stressed out by her boss calling during a busy weekend
12) She never looks happy when she speaks on the phone

Q3. Why did Robert's facial expression change?

Select 1 answer only

9) Because you said you couldn't go to the pub with him
10) He was disappointed you couldn't go to the pub with him later
11) He was angry you said you were going to a wedding
12) He was sad

Q4. At the start of the ceremony several people were snapping at each other, why might that have been?

Select 1 answer only

9) Because weddings are very stressful for everyone
10) Because there were several hiccups
11) They were stressed out because things were not going to plan
12) They did not like each other very much

Q5. Why did the all the women laugh when one of them commented on the colour of Lucy's dress?

Select 1 answer only

9) Because they were suggesting she was promiscuous
10) Because the comment was a joke about Lucy's dress

11) Because the comment was funny

12) Because it is tradition for a bride to wear white instead of cream

Did you find any of the above questions more difficult than others, Please describe which ones you found difficult and explain why?

_____

_____