

ANGLIA RUSKIN UNIVERSITY

AUTISM SPECTRUM CONDITIONS IN WOMEN: DIAGNOSIS, MENTAL  
HEALTH, AND THE ROLE OF CAMOUFLAGING

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## Abstract

The female phenotype of autism may cause a delay in diagnosis for autistic women. Studies show autistic females may camouflage their autistic traits and may have more mental health difficulties as a result. It has also been hypothesised that autistic women might be misdiagnosed with other conditions. The current investigation aimed to explore social and behavioural factors that might delay or prevent diagnosis, and factors that may influence the mental health pathways to diagnosis for autistic women.

In the first and second study a nationwide survey was conducted to identify potentially autistic individuals, defined as those who score highly for autistic traits on the Autism Quotient (AQ) screening tool but have no formal diagnosis of autism (Study 1  $n = 834$ , Study 2  $n = 88$ ), and comparing them to diagnosed autistic individuals (Study 1  $n = 179$ , Study 2  $n = 121$ ) on a number of questionnaires measuring emotional and social abilities and mental health. In Study 3, eighty participants (40 autistic and 40 non-autistic) completed a self-reported camouflaging measure, a battery of executive functioning tasks, and theory of mind test. They were also video-recorded having a natural conversation with a researcher, which a further 127 non-autistic participants rated using a first-impression scale.

In Studies 1 and 2, potentially autistic women had a significant empathy and social functioning advantage over diagnosed women, and were more likely to be diagnosed with Borderline Personality Disorder. However, they were less likely to have other psychiatric diagnoses, and had similar difficulties in friendship, theory of mind, self-monitoring, anxiety, and depression. Strong correlations were not found between social performance and age of Autism Spectrum Condition (ASC) diagnoses, or with mental health traits. Diagnosed autistic women were more likely than men to have other psychiatric diagnoses, and these were more likely to be received prior to an ASC diagnosis. In Study 3, no differences on self-reported camouflaging were found between autistic men and women, although both groups scored more highly than non-autistic controls, and camouflaging was not associated with theory of mind or executive functioning. However, autistic people were rated less favourably on first-impressions than non-autistic people, and males were rated less favourably than females. Furthermore, male raters were harsher in their judgements of autistic males. These ratings correlated with age of diagnosis, but not with camouflaging scores.

Findings suggest that a combination of factors may delay diagnosis in women. Clinicians may be biased towards diagnosing other psychiatric conditions before ASC is identified. This may be because women present less typically than males and are judged less harshly by peers.

Key words: ASC; female phenotype of autism; late diagnosis; camouflaging; psychiatric comorbidity; misdiagnosis.

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## Abbreviations and Symbols

AAA	Adult Asperger's Assessment
ADDM	Autism and Developmental Disabilities Monitoring
ADHD	Attention Deficit Hyperactivity Disorder
ADI	Autism Diagnostic Interview
ADOS	Autism Diagnostic Observation Schedule
ANOVA	Analysis of Variance
APA	American Psychological Association
APMS	Adult Psychiatric Morbidity Survey
AQ	Autism Quotient
ASC	Autism Spectrum Condition
ASD	Autism Spectrum Disorder
ASD-DC	Autism Spectrum Disorders – Diagnostic – Child Version
ASSQ	Autism Spectrum Screening Questionnaire
BAP	Broader Autism Phenotype
BCST	Bergin Card Sorting Task
BPD	Borderline Personality Disorder
CAST	Childhood Autism Spectrum Test
CAT-Q	Camouflaging Autistic Traits Questionnaire
<i>d</i>	Cohen's D effect size
DASS	Depression, Anxiety and Stress Scale
DSM	Diagnostic Statistical Manual of Mental Disorders
EF	Executive functioning
EMB	Extreme Male Brain Theory
EMG	Electromyography

EQ	Empathy Quotient
<i>F</i>	F-statistic, analysis of variance
FPF	Female Protective Factor
FPT	Female Phenotype Theory
FQ	Friendship Quotient
FQS	Friendship Qualities Scale
fT	Foetal Testosterone
GAD	Generalised Anxiety Disorder
GAD-7	Generalised Anxiety Disorder Scale
GHQ-12	General Health Questionnaire
GP	General Practitioner
HADS-A	Hospital Anxiety and Depression Scale
ICD	International Classification of Diseases and Related Health Problems
IQ	Intelligence Quotient
IRI	Interpersonal Reactivity Index
KDEFT	Karolinska Directed Emotional Faces Tasks
<i>M</i>	Mean
MET	Multifaceted Empathy Test
<i>n</i>	Number of participants
NART	National Adult Reading Test
NAS	National Autistic Society
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
OCD	Obsessive Compulsive Disorder
<i>P</i>	Probability
PD	Personality disorder

PDD-NOS	Pervasive Development Disorder Not Otherwise Specified
PHQ-9	Patient Health Questionnaire
<i>r</i>	Coefficient of correlation
RMET	Reading the Mind in the Eyes' Test
RRBI	Restricted, repetitive behaviours and interests
RQ	Relatives Questionnaire
<i>SD</i>	Standard deviation
SEN	Special Educational Needs
SFS	Social Functioning Scale
SLC	Skin conductance level
SMS	Self-Monitoring Scale
SQ	Systemising Quotient
SQC	Social Communication Questionnaire
SRS	Social Responsiveness Scale
SST	Short Story Task
STEM	Science, technology, engineering and mathematics
ToL	Tower of London task
ToM	Theory of mind
U	Mann-Whitney U
WAIS	Wechsler Adult Intelligence Scale
WASI	Wechsler Abbreviated Scale of Intelligence
WHO	World Health Organization
Z	Z-score
z	z-value for Wilcoxon Signed Ranks

## **Symbols**

$\chi^2$	Chi-square statistic
$\phi$	Cramer's phi effect size
$\eta^2$	Eta squared effect size
$\alpha$	Chronbach's alpha

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# CHAPTER 1

## Introduction: Prevalence, Diagnosis, and Prognosis

### 1.1. Definition of Autism Spectrum Conditions

Autism Spectrum Condition (ASC), clinically referred to as Autism Spectrum Disorder (ASD), is a neurodevelopmental condition describing a collection of social and communication difficulties that typically result in impairments of everyday functioning. Throughout this thesis ‘ASD’ will be referred to as ‘ASC’, and the term ‘autistic person’ will be used rather than ‘person with autism’, except where discussion relates to the wording used in clinical documents. This is in line with recent evidence showing that the autistic community prefers identity-first language rather than person-first language, as ASC is not considered an illness that needs curing but as a different way of operating, and as a collection not only of impairments but also of abilities (Gernsbacher, 2017; Kenny et al., 2015).

Autism was first referred to as a distinct condition in 1943, by Leo Kanner; at the time this was labelled ‘Kanner’s Syndrome’, which later became ‘Early Infantile Autism’. Around the same time Hans Asperger described a similar disorder, which he labelled ‘Asperger’s Syndrome’ (Asperger, 1944); however he identified individuals with no language deficits and a higher IQ than those with ‘Early Infantile Autism’.

The diagnosis and definition of ASC has undergone considerable change since this first identification (Baron-Cohen & Wheelwright, 2003). The Diagnostic and Statistical Manual of Mental Disorders (DSM), which was developed and first published in the USA in 1952 by the American Psychological Association (APA), is the handbook used by many health professionals worldwide to diagnose mental health

disorders (Daniels & Mandell, 2014). The DSM is periodically reviewed and updated in order to ensure that the diagnostic criteria used are consistent with current research and clinical practice. Previously, the DSM IV (APA, 2000) used the term ASD as an umbrella term to describe five sub-disorders, which included Autistic Disorder (divided into high functioning and low functioning), Asperger's Disorder, Rett's Disorder, Childhood Disintegrative Disorder, and Pervasive Development Disorder - Not Otherwise Specified (PDD-NOS). Whilst these disorders shared common symptomology in social and communication difficulties, they were differentiated by other symptoms and developmental trajectories. For example, the difference between a diagnosis of Asperger's and Autistic Disorder was that those with Asperger's would have had no clinically significant delays in language, and the differences between a PDD-NOS and Autistic Disorder diagnosis were that those with PDD-NOS might have a late age onset or atypical or sub-threshold symptomology. In 2013, the DSM IV was updated to DSM 5 by a large team of researchers and clinicians, in order to improve how disorders are characterised and defined (APA, 2013). These changes had large ramifications for the classification of ASC. The DSM 5 combines four of the separate disorders (Autistic Disorder, Asperger's Disorder, Childhood Disintegrative Disorder, and PDD-NOS) recognised by DSM IV and instead refers to a single condition: Autism Spectrum Disorder. This change was made in order to better capture the concept of ASD being a spectrum condition, whereby autistic individuals share common core features but to different levels of severity. The APA found that there was not enough empirical evidence to justify the sub-disorders that were currently being used, namely Asperger's Syndrome and PDD-NOS, and in the USA individuals with these diagnoses were not eligible for some autism related benefits or services (Lord & Jones, 2012). According to the DSM 5, the condition can be characterised better by different levels of



severity of two key symptoms: deficits in social communication and social interaction, and restricted repetitive behaviours, interests, and activities (RRBIs).

Social communication and social interaction difficulties can manifest in social emotional reciprocity deficits, for example, a persistent reduced ability to initiate or respond to various social interactions such as sharing of interests or emotions. They also include nonverbal and communicative behaviour deficits, for example, a reduced ability to integrate verbal and nonverbal communication, abnormalities in making eye contact, a lack of facial expressions, and difficulties interpreting others' gestures. Finally, there are likely to be deficits in developing, maintaining, and understanding relationships, for example, a complete disinterest in peers, sharing imaginative play, making friends, and difficulties adjusting behaviour to different social contexts (APA, 2013).

RRBIs can manifest in stereotyped or repetitive physical movements, use of objects, or speech; for example, lining up objects, repeating phrases, and flapping hands. There is typically an insistence on sameness, with inflexibility to routine changes, or ritualized patterns of verbal or nonverbal behaviour; for example, distress caused by small changes, difficulties with transitioning, rigid thinking, maintaining certain rituals, and sticking to a rigid routine such as eating the same food every day. Other characteristics include restricted fixations on specific interests that are abnormal in intensity and focus, for example, a strong attachment or preoccupation with specific and sometime unusual objects. Finally, hyper- or hypo-reactivity to sensory input or an unusual interest in sensory aspects of the environment can be reflected in a strong aversion to certain sounds or textures, an obsessive need to feel or smell certain objects, or to watch visual activity such as light movement, and apparent indifference to pain and temperature (APA, 2013).

Unlike the DSM IV, which describes separate neurodevelopmental conditions, the DSM-5 categorises these social impairments and RRBIs into three levels of severity, namely: level 1 - “requiring support”, level 2 – “requiring substantial support”, and level 3 – “requiring very substantial support”. Key specifiers, in addition to severity of ASD include: a) with or without accompanying intellectual impairment, and b) with or without accompanying language impairment.

Regardless of these changes to diagnostic criteria, many clinicians in the UK continue to differentiate between the different categories of ASC, particularly between Autistic Disorder and Asperger’s, and such diagnoses are still considered valid and are embraced by the autism community (National Autistic Society [NAS], 2016). This is partly due to professionals in the UK more commonly using the International Classification of Diseases (ICD), which has only recently been updated to reflect changes in the DSM regarding the diagnosis of ASC. The ICD was first developed and published by the World Health Organization (WHO) in 1948. Whilst new versions are released only periodically, the WHO make minor updates annually. The previous version used was the ICD-10, first published in 1990, and most recently updated in 2018. The 2018 version of the ICD-10 uses the umbrella term ‘Pervasive Development Disorders’ to describe “a group of disorders characterized by qualitative abnormalities in reciprocal social interactions and in patterns of communication, and by a restricted, stereotyped, repetitive repertoire of interests and activities. These qualitative abnormalities are a pervasive feature of the individual’s functioning in all situations” (WHO, 2018). Eight sub-disorders are described under this umbrella, including Childhood Autism, Atypical Autism, Rett’s Syndrome, Other Childhood Disintegrative Disorder, Overactive Disorder - associated with learning disability and stereotyped movements, Asperger’s Syndrome, Other Pervasive Developmental Disorders, and Pervasive Developmental Disorder Unspecified. However, the ICD-11, recently

released in 2019, like the DSM collapses sub-disorders of autism into the one disorder: Autism Spectrum Disorder (WHO, 2019). The ICD-11 characterises ASD by impairments in initiating and sustaining reciprocal social interactions and communications, and by RRBIs, acknowledging that these impairments may be present in early childhood but also may not be apparent until later in adolescence when social demands increase; these impairments must also affect the individual across situations and settings. A diagnosis is made either with or without intellectual development disorder and also with mild or no impairment of functional language. Unlike the DSM 5, the ICD-11 does not require that a person must meet certain criteria to meet the threshold for an autism diagnosis. Instead it lists different features which may be present, allowing a clinician to decide whether or not autism is an appropriate diagnosis. As well as this, the ICD-11 provides more detailed guidelines for differentiating between autism with and without intellectual disability, whilst the DSM 5 only acknowledges that there may be differences. These features may prevent individuals from slipping through the net, for example those who previously would have been diagnosed as having Asperger's, whose characteristics and behaviours may not be seen as 'severe' enough to warrant diagnosis under the new DSM-5 criteria.

The changes in both the DSM and the ICD show a move away from conceptualising ASC as a disorder that is either present or not present, and towards conceptualising it as an expression of several neurobiological pathways of development with behavioural dimensions. It is thought that these behavioural dimensions will be better indicators of each individual's needs (Lord & Jones, 2012). However, early evidence has suggested that the sensitivity of the new DSM criteria may be poorer than previous versions, especially for those with Asperger's and PDD-NOS, suggesting that the new criteria may exclude a large proportion of autistic individuals who are less cognitively and intellectually impaired (Kulage et al., 2014; McPartland et al., 2012).

Whilst contributing to this important debate on the classification of diagnosis is outside the realms of this thesis, it is important to note that the present research targeted autistic adults who do *not* have additional intellectual or language impairments, regardless of whether they were diagnosed according to the DSM IV or DSM 5 criteria, or those of the ICD-10 or ICD-11.

## **1.2. Prevalence of Autism Spectrum Conditions**

Early research on the prevalence of ASC suggested that the condition was extremely rare, with 0.02% to 0.05% of children diagnosed with infantile autism (Burd et al., 1987; Steinhausen et al., 1986; Wing et al., 1976). However, by the 1990's these figures had risen, with the prevalence of infantile autism found to be around 0.1% (Gillberg et al., 1991) and Asperger's found to be at its highest around 0.36% (Ehlers & Gillberg, 1993). However, Fombonne (2003) argued that the ratio of Asperger's diagnoses to autism diagnoses is much lower (4:1), this figure may be due to the lack of epidemiological studies on Asperger's around this time, given that it was only officially added to the DSM IV in 1994. Generally, prevalence rates have risen as both the DSM and ICD developed to describe autistic conditions as a syndrome with multiple aetiologies, rather than as a unitary disorder, suggesting that autism was not as rare as had previously been believed (Gillberg & Wing, 1999). Looking at 32 studies on the prevalence rates in autism published between 1966 and 2001, Fombonne (2003) found a significant correlation between the prevalence rates and the year of publication. When dividing these studies into two groups based on their year of publication, the 16 studies published between 1966-1991 had a median prevalence rate of 4.4/10,000 (0.04%), whilst the 16 studies published between 1992-2001 had a median prevalence rate of 12.7/10,000 (0.13%).

Baird et al. (2006) suggested that the prevalence of ASC may be even higher than had previously been recognised. In a population cohort of 56,946 children, who were all born between 1990 and 1991 in South Thames, researchers screened all children with a clinical autism diagnosis and any judged to be at risk. The prevalence for childhood autism, the diagnosis that previous studies had used to calculate prevalence, was 38.9/10,000 (0.39%), and the prevalence for other autism conditions was 77.2/10,000 (0.77%). Combined, the prevalence of all ASCs was 116.1/10,000 (1.16%), which is significantly higher than that previously reported. Similar findings were found by Baron-Cohen et al. (2009) who screened all schools within the UK county of Cambridgeshire. The ratio of known to unknown cases of autism was established as 3:2, with the overall prevalence of both known and unknown ASC estimated to be 1.57%. More recent epidemiological research, looking at larger geographical areas, found similar prevalence figures. For example, Christensen et al. (2016) conducted research using the Autism and Developmental Disabilities Monitoring (ADDM) network, which has an active surveillance system that monitors and evaluates eight-year-old children across 11 different states in the USA. They estimated that in 2012 around 1 in 68 children had an ASC. Amongst those children identified by the network as having an ASC, 82% had a previous ASC diagnosis. Similarly, the 2007 Adult Psychiatric Morbidity Survey (APMS) estimated a prevalence of between 1.1% and 1.2% (National Statistics, 2009). Additionally, Russell et al. (2013) found a prevalence rate of 1.7%, using data from the Millennium Cohort Study (MCS), a UK-representative birth cohort study examining children born between September 2000 and January 2002. Whilst this prevalence rate is slightly higher than others it should be noted that their data was based on parents' reports of whether they had been told by a doctor or healthcare professional that their child had an ASC, meaning that some of these children might not have had an official diagnosis. On the whole these studies point

towards an increase in the prevalence of ASC over the time since autistic conditions were included in the diagnostic manuals. The reason for this increase could be the result of a number of factors, including the broadening of the diagnostic criteria of the condition. For example, the inclusion of Asperger's and PDD-NOS allowed 'higher-functioning' autistic individuals to receive diagnoses. Additionally, greater prevalence is likely due to growing awareness around the condition (Fombonne, 2005; Gillberg & Wing, 1999; Rutter, 2005).

### **1.3. Diagnosis of Autism Spectrum Conditions**

**1.3.1. Diagnostic process.** For diagnosis in under 19 year olds, The National Institute for Health and Care Excellence (NICE) guidelines specify that an autism specific local pathway should be set up, which includes a multi-disciplinary team (NICE, 2011). The core membership of this team should be a paediatrician and/or child and adolescent psychiatrist, a speech and language therapist, and a clinical and/or educational psychologist. After screening for possible autistic traits, a GP or health visitor should refer a child/adolescent to this pathway. The team will consider whether to carry out an autism assessment based on the severity/duration of symptoms, whether these symptoms are present across different environments, the impact they have on the young person and family, the level of concern of the child and parents, any factors increasing the probability of autism, and the likelihood of an alternative diagnosis. If an assessment is followed through, then a report is sought from the child/adolescent's school as well as any other addition health or social care information. A formal diagnosis should include detailed questions about a parent/carer's concerns and those of the child/adolescent, details of their experiences in different environments, a developmental history focussing on the ICD or DSM criteria, an assessment through interaction and observation with the child/adolescent of social and communication skills and behaviours focussing on the

ICD or DSM criteria, a full medical history, a physical examination, the consideration of other diagnoses, systematic assessment for co-morbid conditions, profiling of the child/adolescent's strengths, skills, impairments, and needs, culminating in a written report communicating assessment findings.

For diagnosis in adults, the NICE guidelines recommend GPs or other health professionals use the Autism Quotient (AQ) (Baron-Cohen et al., 2001) to screen for autism if adult patients have persistent difficulties in social interaction, and/or persistent difficulties in social communication, and/or stereotypic behaviours, resistance to change or restricted interests, as well as problems in employment/education, and/or difficulties initiating or sustaining relationships, and/or contact with mental health or learning disability services, and/or a history of a neurodevelopmental condition or mental health problem (NICE, 2012). They should then be referred to an autism diagnostic service, which should involve a team of different professionals, and should be formally assessed by a professional who is trained and competent in autism diagnosis. Where possible this assessment should involve a family member or someone who has known the person being assessed from a young age, in order to determine a full development history. A diagnosis should include assessing the core signs and symptoms of autism, which should have been present since childhood and have continued into adulthood, an early developmental history, any behavioural problems, the person's ability to function in different environments, past and current physical and mental disorders, any other neurodevelopmental conditions, and sensory issues.

There are several recommended formal assessment tools for both children and adults. These include the Adult Asperger's Assessment (AAA) (Woodbury-Smith et al., 2005), which uses the AQ, the Empathy Quotient (EQ), and the Relatives Questionnaire (RQ) self-report measures as well as a clinical assessment of key domains, the Autism

Diagnostic Interview (ADI) (Le Couteur et al., 1989), which is a structured interview focussing on the core three domains (communication, social, and RRBIs), and the Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 1989), which involves several structured and semi-structured social interaction tasks between the assessor and the person being assessed.

**1.3.2. Gender differences in diagnosis.** One striking feature in the diagnosis of ASCs is the prevalence of male cases. Since Kanner's first report of autism where he identified 11 case studies, of which 8 were boys (Kanner, 1943), autism has consistently been found to be more common in males than females. Both early and more recent studies report a male to female prevalence ratio of 3-4.5:1 (Baio, 2012; Bryson & Smith 1998; Christenson et al., 2016; Fombonne, 2003; Russel et al., 2014; Yeargin-Allsopp et al., 2003).

To some extent it appears that this gender ratio can depend on the autism spectrum condition subtype and its severity, with a lower gender ratio in those with intellectual impairments than those without intellectual impairments (Fombonne, 2003; Saemundsen et al., 2003; Wing, 1981). Examining 32 surveys published between 1966 and 2001 on the epidemiology of Pervasive Developmental Disorders, Fombonne (2003) found that the gender ratio was actually much lower in those studies looking at individuals with intellectual impairments (1.9:1 males to females) than studies investigating individuals without intellectual impairments (2.75:1 males to females). More recent studies have also found similar findings (Brugha et al., 2016; Lin et al., 2011). Brugha et al. (2016) suggests that previous research relied on the projections of research on children, or only on adults who had the capacity to consent to take part in prevalence surveys, whereas their research examined adults of all ages and abilities to determine a more representative prevalence rate. Looking at the clinical diagnostic



assessments of 7,274 adults living in private households in the UK and 290 adults registered with intellectual disabilities, they found that being male was only a strong predictor of autism in those with no or mild intellectual disability. The general trends suggest that autism is generally more likely to occur in males, and that when it is unaccompanied by intellectual impairment it is even more likely to occur in males. However, whilst the presence of intellectual disability may influence the gender ratio, there are other important factors that may also affect this, which will be discussed below.

Much of this research into prevalence rates and gender ratios of autism investigates highly probably or already diagnosed cases, and does not account for unidentified cases of autistic individuals. When unidentified cases are taken into account by assessing the general population, not only does the prevalence for ASCs without intellectual disabilities increase, but the gender disparity is also diminished. Kim et al. (2011) found the prevalence of ASC to be 0.75% amongst high-probability of autism children, who were considered more likely to be autistic because they were in special needs schools and/or on the disability register, and 1.89% in the low-probability of autism children, who were considered less likely to be autistic as they had no known disabilities; finding that over two thirds of the ASC cases they identified were actually undiagnosed. Several studies have found that including unidentified cases lowers the male to female ratios that have been reported previously (Kim et al., 2011; Zwaigenbaum et al., 2012). Ehlers and Gillberg (1993) initially found a gender ratio of 4:1 males to females in those diagnosed with ASC; however, when possible and suspected ASC cases were included this ratio dropped to 2.3:1. More recently Loomes et al. (2017) conducted a meta-analysis of 54 studies conducted since the DSM-IV/ICD-10's release, which included 13,784,284 participants, of whom 53,712 had a diagnosed ASC (43,972 males and 9,740 females). They found a general male-to-female ratio of

4.20:1, however in the studies which screened the general population for ASCs regardless of ASC diagnosis, the male-to-female ratio was lower (3.25:1). These findings suggest that there may be many more females without intellectual disability with autism than previous prevalence studies have estimated, and it may be the case that females with the condition are more likely to be detected and diagnosed if they also have intellectual disabilities and potentially missed altogether if they do not.

In support of the hypothesis that autistic females are not being detected at the same rate as autistic males are findings that females are diagnosed with ASC later than males. Calculating the average age of ASC diagnosis across all genders from 42 studies published between January 1990 and March 2012 revealed a mean age of between 38 – 120 months (Daniels & Mandell, 2014). Several large scale studies have identified that this variability is largely due to varying levels of symptom severity, with ‘lower functioning’ and more intellectually impaired individuals being diagnosed earlier than ‘higher functioning’ and less intellectually impaired individuals (Brett et al., 2016; Crane et al., 2015; Daniels & Mandell, 2014; Howlin & Asgharian, 1999; Mandell et al., 2005; Williams et al., 2008). However, there is emerging evidence that being female is also a significant factor in having a later ASC diagnosis.

Shattuck et al. (2009) used data from a 2002 multi-site ongoing autism surveillance programme, which included the data of 2,568 children aged 8 years (491 females and 2,077 males) who were either diagnosed with an ASC or who met criteria for the condition but who had not been classified, to determine the prevalence and age of ASC diagnoses in children. They found that whilst autistic females had a greater likelihood of having a cognitive impairment, they were also diagnosed later than males. Within the group of autistic participants who had an average to above average IQ the median age of diagnosis for females was 7.1 years, compared to 6.5 years for males, and

within the group with below average IQ the median age of diagnosis was 5.5 years for females and 5.1 years for males. Giarelli et al. (2010) investigated the same surveillance data, observing differences between males and females who had been classified versus those who had not. They found that girls with an IQ of 70 or less were significantly less likely to have a diagnosis than boys with an IQ of 70 or less (odds ratio = 0.70), and that a similar odds ratio was observed in girls with an IQ of 70 or more in comparison to boys with an IQ of 70 or more (odds ratio = 0.60). When divided into impairment severity levels (mild, moderate, and severe impairment), these findings did not differ. In the case of boys, by contrast, having a cognitive impairment seemed to increase the likelihood of receiving a diagnosis. These results suggest that girls, regardless of severity of impairment, appear to be less likely to receive a diagnosis than their male counterparts. However, both these studies only looked at children with diagnoses and those likely to have a diagnosis. It is possible that if females are identified later, then many more might not receive a diagnosis until adolescence or even adulthood (Lai & Baron-Cohen, 2015).

Begeer et al. (2013) sampled a non-clinical population of both autistic children and autistic adults ( $n = 2,275$ ) derived from the general population. Generally, autistic females took significantly longer to be diagnosed after initial signs of the condition were identified ( $M = 2.3$  years) compared to autistic males ( $M = 1.9$  years), although the difference appears to be rather small. However, when the sample was divided into adults and children and also by diagnostic group (Asperger's, autistic disorder, and PDD-NOS) a larger difference emerged. For children, girls had on average a 1.8 year delay in diagnosis for Asperger's compared to boys, whilst no differences were found for autistic disorder or PDD-NOS. For adults, women had on average a 4.3 year delay in diagnosis for autistic disorder compared to men, whilst no differences were observed for Asperger's or PDD-NOS. The authors warn readers not to over interpret the differences

in diagnostic categories as these may reflect historical changes in how autism is diagnosed. For example, the majority of adults were diagnosed according to DSM-III criteria, which did not include broader criteria diagnoses.

In support of these findings Baldwin and Costley (2016) analysed data from an Australia-wide self-report survey, which was completed by 82 women with 'high functioning' ASC. They found that the mean age of diagnosis was 25, and 58% did not receive a diagnosis of ASC until after 18 years of age. In 2012, NAS commissioned a large scale survey, which received over 8,000 responses, to better understand what life is like for autistic people in the UK (Bancroft, 2012). They reported that only one fifth of the girls who took part in their study were diagnosed before the age of 11, compared to over half of boys. It is evident from these findings that more research on the age of diagnosis in adult females is required to better understand this gender disparity in ASC diagnosis.

**1.3.3. Psychiatric co-morbidities.** Other psychiatric conditions frequently co-occur with an ASC diagnosis. These include both internalising problems, whereby difficulties are turned inwards and overly-inhibited, manifesting in disorders such as depression and anxiety, and externalising problems, whereby difficulties are expressed outwardly and are disinhibited, manifesting in more overt challenging behaviour and disorders such as Attention Deficit Hyperactive Disorder (ADHD) (Gillberg & Billstedt, 2000; Ghaziuddin et al., 1998; Hofvander et al., 2009; Mazzone et al., 2012; Mukaddes et al., 2010; Tarazi et al., 2015). Russell et al. (2016) retrospectively reviewed co-morbid psychiatric conditions in 859 adults (645 males and 214 females) who were referred for an ASC diagnosis. Of those diagnosed with ASC ( $n = 474$ ), significantly more (17.9%) were diagnosed with Obsessive Compulsive Disorder (OCD) compared to the non-ASC group (13.2%), and whilst not significant there was a trend towards

more diagnosed participants having an anxiety disorder (39.2%) compared to those not diagnosed with an ASC (32.9%). Whilst again not significant, the non-ASC group showed a higher prevalence of Bipolar Affective Disorder and alcohol dependency. No differences were found between the two groups for other conditions such as ADHD and depression. However, because the comparison group was initially referred for an ASC assessment they are not entirely representative of the general population, as they will have exhibited some ASC traits causing them to be put forward for psychiatric assessment. When the diagnosed ASC group was compared to a general population data pool from the UK National Psychiatric Morbidity Survey (McManus et al., 2009), the ASC group more frequently reported phobias (16.8% vs 1.4%), generalised anxiety disorder (GAD) (11.8% vs 4.4%), OCD (17.9% vs 1.1%), depression (15.8% vs 2.3%), ADHD (9.7% vs 2.3%), and psychotic disorders (2.1% vs 0.4%) than the general population.

Internalised symptoms, such as anxiety and depression, may be the result of difficulties with ASC traits, particularly the social stigma and isolation associated with the condition, the need to maintain routines and avoid change, and also sensory sensitivities (Portway & Johnson, 2005; Stewart et al., 2006; Whitehouse et al., 2009; Wood & Gadow, 2010). For example, in one study 43% of 171 autistic children met the screening criteria cut-off for an anxiety disorder. These symptoms appeared to be related to stereotyped behaviours, however they were also related to higher IQ and the presence of functional language use. In another study, 43% of 46 autistic adult participants reported depressive symptoms; however, these symptoms appeared to be worse in those with less social impairment, higher cognitive ability, and with higher rates of other psychiatric symptoms (Sterling et al., 2008). It may be the case that these participants had more insight and were therefore more aware of their difficulties, or alternatively they may be a consequence of less help and support due to ‘milder’

impairments. Barnhill (2001) studied 33 autistic adolescents, finding a significant positive correlation with depressive symptoms and an ability attribution for social failings, meaning attributing social failure to one's own abilities, rather than external factors. The higher the intelligence of these autistic adolescents the more likely they were to attribute social success to their own abilities, rather than to change or task difficulty. The ability to socially compare oneself to others, as well as social perception, understanding, and negative past experiences have also been found to contribute to internalising symptoms (Hedley & Young, 2006; Meyer et al., 2006).

The common occurrence of psychiatric co-morbidities in autism is concerning because of the risk it poses to autistic people's lives. Camm-Crosbie et al. (2018) conducted a qualitative analysis on two hundred autistic adults' (122 females and 77 males) experiences of mental health support, finding common themes of difficulties accessing treatment and support, a lack of understanding and knowledge of autistic people with co-morbid mental health difficulties, and that a lack of appropriate treatments and support contributed not only to low wellbeing but also to suicidal thoughts. Self-harm and suicide are at an elevated risk in autistic people (Cassidy et al., 2014; Chen, et al., 2017; Maddox et al., 2017; Hannon & Taylor, 2013; Segers & Rawana, 2014; Takara & Kondo, 2014; Zahid & Upthegrove, 2017). Cassidy et al. (2018) found that out of 164 autistic adults (99 females and 65 males), 72% scored at or above the cut off for the Suicide Behaviours Questionnaire, which was significantly more than people in the general population (33.7%). Furthermore, on a measure of non-suicidal self-injurious behaviours the autistic participants were significantly more likely to report lifetime symptoms (65%) than those in the general population (29.8%). Whilst there were no differences between autistic males and autistic females in suicidal behaviours, significantly more autistic females (74%) reported self-injurious behaviours than autistic males (53.8%). Key risk factors found to be associated with suicide in

autistic people included autistic traits, self-injurious behaviour, depression, anxiety, satisfaction with living arrangements and employment. When these key factors were controlled for, deliberately hiding autistic traits and unmet needs also significantly predicted suicidal behaviours. Furthermore, in a study by Pelton and Cassidy (2017), which investigated the suicidal behaviours of 163 young autistic adults (106 females and 55 males), feelings of burdensomeness and thwarted belonging significantly interceded the relationship between autistic traits and suicidal behaviours. These studies suggest that greater insight into one's difficulties increases the risks associated with mental health difficulties, putting autistic adults without intellectual impairments at a greater risk.

#### **1.4. Post-Diagnosis and Prognosis**

For young people, under 18 years of age, NICE (2011) guidelines suggest that a report of the findings and an evaluation of these are provided without delay to the person being assessed and their parents/carers. A follow-up appointment should be made within six weeks of the assessment with a member of the autism team to discuss the results.

Advice should also be given on where these young people and their families can access support and advice. Every child/adolescent diagnosed with autism should be given a key worker to manage and co-ordinate their support (NICE, 2013). The local autism team should deliver/co-ordinate specialised care and interventions; advice, training, and support for other professionals involved with the young person; advice and interventions to aid general life functioning skills; assessing and managing challenging behaviour and coexisting conditions; reassess needs throughout childhood and transitioning to adult services; support the young person to access leisure activities, in education, and with housing and employment services; and provide support for families and carers. If local services cannot provide the interventions and support required then

the team should refer the young person instead to national services. Furthermore, anyone working with an autistic child/adolescent should have training in autism awareness and skills in managing autism. Autism teams should prepare to support autistic children/adolescents and their families during times of increased need, such as during major life changes (puberty, changing schools, birth of a new sibling etc.). A collaborative approach should be offered if the young person and their families want to be involved in shared decision-making about their support (NICE, 2013).

For adults obtaining an autism diagnosis, NICE guidelines (2012) state that irrespective of whether further care/support is needed, a follow-up appointment should be made to discuss the diagnosis. Within the assessment report a care plan should be made, which incorporates risk management and the individual and their family's specific needs. Where there are coexisting mental health difficulties a 24-hour crisis management plan should be developed in conjunction with mental health services. A 'health passport' should also be issued which includes information for all staff in contact with the autistic person with their needs. The guidelines go on to suggest a number of individual and group-based psychosocial interventions for the core 'symptoms' of autism, life skills, managing challenging behaviour, and coexisting mental disorders. These should be delivered by the local pathway, who are in turn advised by an autism strategy group who should promote access to services for all autistic adults.

As ASC is a life-long condition with a spectrum of different traits, abilities, and impairments, the prognosis of autism is varied and affected by individual differences. Studies have shown that some autistic adolescents and adults improve significantly and some show a stable course of maturation, however others show a deterioration in functioning. Autism severity, cognitive functioning, language development, co-morbid



psychopathology and access to interventions are thought to affect outcomes in adulthood but there is a lack of research investigating changes in traits from childhood to older adulthood to determine exactly what effect these have (Levy & Perry, 2011). Qualitative evidence indicates that getting a diagnosis is of real benefit, with many autistic people feeling relieved to receive this. However, when diagnosis is gained in adulthood this is often tainted with grief and anger that a diagnosis was not made sooner so support could be accessed (Bancroft, 2012; Baldwin & Costly, 2015; Jones et al., 2014; Stagg & Belcher, 2019).

Whilst ASC is not considered ‘curable’, evidence does show that early diagnosis, and thus early interventions and support, can help autistic people greatly (Elder et al., 2017). Howlin (1997) explored numerous findings on various types of interventions and found that the most effective of these had the following in common: they used behavioural oriented strategies; recognised that many undesirable behaviours were the result of communication impairments; used the autistic child’s rituals and obsessions to help reduce anxiety and as a reward; created structured teaching environments that used visual cues rather than verbal cues; focussed on the development of social-communication and play activities; recognised the importance of early diagnosis and sharing of information and support for the parents; and were family-orientated rather than solely being focussed on the autistic child. Howlin (1997) suggests that such early interventions can have a considerably beneficial effect on the quality of life in adulthood and are more cost effective than managing crises later in life. Fernell et al.’s (2013) review of recent autism interventions in childhood suggests that the most important outcome of an early autism diagnosis is the creation of an autism-friendly environment around an autistic person, in order to help them overcome any barriers they may face due to communication differences and problems with understanding and interacting with others. As autistic people age they may have

different needs and require different support. Elder et al. (2017) highlight the importance of family support, and that families learn to shift the focus of the support needed as their autistic children develop into adults.

The purpose of these post-diagnosis interventions is to ensure support is in place which addresses the complex nature of ASC. However, evidence suggests that autistic people often do not receive the support they should after their diagnoses. Crane et al. (2016) identified 559 services for parents of autistic children in the UK, recruiting from these 1,047 parents who filled in a questionnaire on their experiences of their child's diagnosis and after care. On average there was a delay of 3.6 years between a parent initially registering their concerns with a health professional and their child receiving a diagnosis; children diagnosed with Asperger's waited significantly longer (4.4 years) than those with autistic disorder (3.7 years). Furthermore, despite NICE guidelines stating that parents should receive support and advice, a report, and a follow-up appointment, 15% of parents did not receive a report, 44% received no follow-up appointment, 62% were not signposted to any advice or help, and 35% received no offer of help or assistance.

Studies examining how satisfied autistic adults themselves were with the diagnostic and post-diagnostic services revealed similarly poor outcomes. Bancroft (2012) reported that 64% of the autistic adults who took their survey had to wait between one and three years for a diagnosis after first raising concerns, leading to 55% of their sample reporting that the process was too stressful for them. Furthermore, only 28% reported receiving useful information about further help and support post-diagnosis. Jones et al. (2014) describe how many adults have to endure multiple referrals to different health professionals before receiving their ASC diagnosis. In their sample of 128 autistic adults, 42.2% were referred more than once; of these, 48.1%

received a diagnosis at the third referral, 20.4% at the fourth referral, 13% at the fifth referral, while 18.5% attended six or more referrals before being diagnosed. A large proportion of those diagnosed received no form of post-diagnostic support (41.9%). Despite many scoring highly for anxiety and depression, 78.6% said they did not know where to go to access support to help with these symptoms. Satisfaction with the diagnostic process was most affected by this lack of post-diagnosis information. A longer time taken to get a diagnosis, a greater number of different professionals seen, and a higher frequency of referrals all increased overall dissatisfaction. Finally, there is some evidence that autistic females may be particularly vulnerable to disappointing post-diagnostic support. Bancroft (2012) reported that once diagnosed, 49% of autistic females said their diagnosis made no difference to the support they received, compared to 39% of males who also felt this.

These findings raise concerns about the wellbeing of autistic people in the UK, and point towards a need for earlier identification and the provision of more timely and appropriate support post-diagnosis, in order to ensure a better quality of life for autistic adults. This is especially important for individuals receiving diagnosis only in adulthood, and particularly for females who are more likely to be diagnosed later, and who will therefore not have received early intervention support. Why females are likely to be diagnosed later than males, and the impact this diagnostic delay has on them, will be discussed in the following chapter.



## CHAPTER 2

### Gender-Based Theories of ASC

The consistently higher ratio of males to females in prevalence studies led many to believe that autism was predominantly a ‘male condition’. It was thought that females had a reduced susceptibility to autism (as described by the Female Protective Factor [FPF] theory), and that in order to develop autism they needed a greater ‘genetic hit’ (Lord & Schopler, 1985; Robinson et al., 2013; Skuse, 2000). This was supported by studies demonstrating that autistic females tended to have more autistic relatives than autistic boys, suggesting that the girls had inherited more ‘severe’ autistic traits than boys (Tsai et al., 1981; Werling & Geschwin, 2015), and that autistic girls have a greater resistance to genetic causes of autism (Levy & Perry, 2011). Jacquemont et al. (2014) analysed the DNA samples of just under 24,000 families affected with either autism or other neurodevelopmental disorders, finding that females diagnosed with either of these conditions had a higher number of damaging gene mutations than males. From this theory another theory was born, ‘The Extreme Male Brain’ (EMB) theory (Baron-Cohen, 1999), which has become one of the most prominent theories explaining gender differences in autism. The EMB theory builds on the former FPF theory to suggest that autistic traits are gender specific and are extreme versions of typically male traits/behaviours, and that therefore females need a greater genetic hit than males in order to develop autism. This theory again suggests that when females are affected they may be affected to a greater extent, thus explaining why there is less of a gender disparity in the frequency of autistic individuals with intellectual impairments and comorbid disabilities. However, a newer theory (the Female Phenotype Theory [FPT]) (Kopp & Gillberg, 1992) suggests that there are actually more autistic females than previously thought, and that the gender disparity in diagnosed cases is due to autistic

females manifesting autistic traits in a different way to autistic males. Currently, diagnostic assessments and criteria are based on the pattern of traits observed in autistic males, which may mean clinicians are biased towards looking for these and may miss a different presentation of autistic traits in females.

This chapter will focus on reviewing these two dominant ideas, a) that autism could be an extreme version of the male brain which females are biologically less likely to be susceptible to, and b) the idea that autistic females are not being identified correctly due to having a different presentation of autistic traits.

## **2.1. Extreme Male Brain Theory**

One of the most influential accounts of the gender disparity in autism is the EMB theory. According to the EMB theory, autism is an extreme version of the male brain such that sexually dimorphic traits which are particularly strong or weak in non-autistic males are accentuated in autistic people (Baron-Cohen, 2012). The cause of this is thought to be foetal testosterone (fT). Hormonal influxes during certain critical periods of a foetus's life can significantly alter cognitive development, and testosterone in particular can produce permanent behavioural changes if a foetus is exposed to it during critical periods of gender development (Hines, 2006). For fT, this critical period is thought to be when there is a surge occurring between weeks 8 to 24 of gestation (Baron-Cohen, Knickmeyer, et al., 2005). FT therefore plays an organizational role in the development of masculine and feminine traits, in that it has a permanent effect on early development. Some studies have found fT to be elevated in both autistic males and females (Bejerot et al., 2012; Ingudomnukul et al., 2007; Tordjman et al., 2006) and another study found fT to be correlated with autistic traits in the general population (Auyeung et al., 2010). However, as this review will go on to explain, the evidence supporting the link between fT and autism is highly inconsistent. The theory proposes

that as males already have more testosterone, they are considered to be more vulnerable to elevated levels leading to autism. Females are less susceptible to autism as a result of lower testosterone and, as a consequence, when they are affected it is to a much greater extent. This partly explains why the gender ratio at the lower end of the spectrum, where individuals often have accompanying intellectual impairments, is much lower (Lord & Schopler, 1985; Tsai et al., 1981).

The EMB theory states that the two sexually dimorphic traits that are integral to autism are systemising and empathising. Autistic people are found to show greater abilities to systemise, which is the ability to analyse and construct systems, and reduced ability to empathise, which is the ability to understand and feels others' emotional states. These two dimensions are viewed as distinct, although there is generally a mild negative relationship between them such that higher levels of systemising are associated with lower levels of empathising and vice versa (Greenberg et al., 2018). In fact, some studies have suggested that there may even be a neurobiological link whereby there is a trade-off between the two abilities in non-autistic males and females (Goldenfield et al., 2005), which has been found to be even more pronounced in autistic people (Baron-Cohen et al., 2003; Wheelwright et al., 2006).

**2.1.1. Empathising.** Empathising is the ability to identify and understand another's emotional state (cognitive empathy) and to feel what others may be feeling (affective empathy). Non-autistic females typically demonstrate higher empathy abilities than non-autistic males (Manson & Winterbottom, 2011; McClure, 2000; O'Brien et al., 2013; Reniers et al., 2010; Thompson & Voyer, 2014), and autistic individuals demonstrate a deficit (Baron-Cohen et al., 2003; Hoffman, 1977; Krajmer et al., 2010). Baron-Cohen and Wheelwright (2004) created the Empathy Quotient (EQ) self-assessment questionnaire. A factor analysis has established that it measures both

affective and cognitive aspects of empathy, as well as social skills, in adults (Lawrence, et al., 2004). In a recent large-scale study, which tested the EQ alongside other measures in more than 670,000 people, non-autistic females scored on average higher than non-autistic males, with a medium effect size ( $d = 0.39$ ), and autistic people scored significantly lower than the non-autistic participants, also with a medium effect size ( $d = 0.41$ ). These findings have been replicated in several smaller studies (Auyeung et al., 2009; Baron-Cohen et al., 2003; Baron-Cohen & Wheelwright, 2004; Lawrence et al., 2004; Sucksmith et al., 2012; Wheelwright et al., 2006). In those studies which used a representative sample of autistic females as well as autistic males, no gender differences were found on the EQ, contrary to the previous prediction of the EMB theory (Auyeung et al., 2009; Greenberg et al., 2018; Wheelwright et al., 2006). However, Sucksmith et al. (2012) did find that autistic girls scored higher than autistic males on the Karolinska Directed Emotional Faces Tasks (KDEFT), where participants had to guess what people in photographs were feeling. In another study where teachers rated empathic traits in children, the autistic girls were rated as being more empathic (Peterson, 2014).

When empathy is broken down into its two main components, affective and cognitive empathy, it appears that rather than a global deficit in autistic people, there may be a specific difficulty in cognitive empathy (i.e., interpreting and reading emotion) while affective empathy may remain intact (Mazza et al., 2014; Mul et al., 2018).

Cognitive empathy, the ability to read and understand what others may be thinking and feeling, has been linked to Theory of Mind (ToM), which itself refers to the ability to recognise and attribute mental states to others (perspective taking). Researchers have described how the process of cognitive empathy may rely on ToM, as it requires one to take another's perspective in gauging their current emotion (Stietz et al., 2019). However, it should be noted that ToM comprises different factors also, and



whilst one part of ToM may involve the ability to infer what others may be feeling, a distinct part of ToM is the ability to infer another person's beliefs, thoughts, and intentions. Indeed, studies have found that individuals may perform differently on these distinct elements of ToM, and that different brain regions may be involved (Dvash & Shamay-Tsoory, 2014). ToM is commonly found to be impaired in certain degrees in autistic people, which may contribute to difficulties with empathising, particularly with cognitive empathy (Brewer et al., 2017; Happé, 1994; Joliffe & Baron-Cohen, 1999; Mathersul et al., 2013; Mazza et al., 2014). Baron-Cohen et al. (1997) studied 50 non-autistic adults and sixteen adults with 'high functioning' ASC or Asperger's (13 males and 3 females), using tasks that require the inference of ToM from photographs of a person's eyes (Reading the Mind in the Eyes' Test [RMET]). Their results showed that non-autistic females performed significantly better than non-autistic males and that non-autistic subjects performed significantly better than the autistic subjects, indicating that autistic people performed significantly lower than non-autistic males, which is in line with the EMB theory. Whilst these studies had quite low participant numbers, which reduced their power, Baron-Cohen et al. (2015) tested 395 autistic adults (178 males, and 217 females) and 320 non-autistic controls (152 males, and 168 females) in an online study using the EQ, AQ, and the RMET. As predicted, the autistic participants scored significantly worse than the controls on the RMET. In terms of gender, control males performed significantly worse than control females on this task ( $d = 0.47$ ), but there was no difference between autistic males and autistic females. An interesting finding was that the difference between control females and autistic females had a greater effect size ( $d = 0.69$ ) than between control males and autistic males ( $d = 0.35$ ), which the authors suggest may be because females need to have a higher number of autistic traits to get diagnosed. When assessing the association between RMET scores and self-reported empathy and autistic traits on the EQ and the AQ respectively, only

autistic females' scores showed a significant correlation, which the authors suggest may indicate a heightened self-awareness of cognitive empathy difficulties in autistic females.

Affective empathy on the other hand, appears to remain relatively intact in autistic individuals (Mul et al., 2018). For example, Dziobek et al. (2008) tested 17 autistic adults (13 males and 4 females) using the Multifaceted Empathy Test (MET), and the Interpersonal Reactivity Index (IRI). The MET uses a series of photos of people in emotional states; participants are asked to label the mental state of the person (cognitive empathy) and also to rate their own emotional reaction to the picture (affective empathy). They found that the autistic participants scored significantly lower than non-autistic controls on the cognitive empathy part of the MET and IRI, but scored similarly to non-autistic controls on the affective empathy part of the MET and the IRI. As well as this, measures of the participants' arousal when looking at the stimuli were similar for the two groups. These results, however, may have been due to a response bias in how autistic people rated their own emotional state in response to the images, as between judging the mental state and responding with their own emotional reaction, they were told the correct emotional state in the photograph.

A study which used a comprehensive set of physiological markers to determine affective empathy is that by Trimmer et al. (2017), who evaluated the relationship between self-reported empathic responses and physiological responses, as well as how these related to self-reported trait empathy in ASC. They showed 10 video clips (half emotional and half neutral) to 25 'high-functioning' autistic participants (21 males and 4 females) and 25 non-autistic participants (20 males and 5 females). Whilst participants were watching the clips, the researchers tested their automatic responses using skin conductance level (SCL) and facial electromyography (EMG), which measures muscle

activity in the face for automatic emotional contagion response. Self-rated mood and arousal, and IRI and EQ scores were also assessed. The findings revealed that the autistic participants scored lower on both the cognitive and affective factors of the EQ and IRI, and these participants also reported a reduced emotional response to the clips. However, the autistic and non-autistic participants did not differ in their physiological responses to the emotional stimuli, nor did their ratings of perceived arousal. These findings suggest that the empathy deficit in autism may actually lie in autistic individuals' ability to interpret the emotional salience of the physiological response they have experienced, rather than their ability to experience it.

These empathy differences do not appear to be very strongly related to fT. There is some evidence that in non-autistic populations, scores on the EQ and RMET correlate with levels of fT in the amniotic fluid of mothers (Chapman et al., 2006; Knickmeyer, et al., 2005), but these results could reflect general gender differences rather than fT. Other evidence demonstrates that injecting non-autistic women with testosterone results in a reduction of empathic behaviours (Hermans et al., 2006; van Honk et al., 2011), however, these findings represent temporary changes and not permanent and lifelong developmental changes. In autistic populations evidence indicates that fT is not linked to empathy deficits or other autistic traits (Bakker-Huvenaars et al., 2020; Honekopp, 2012; Krajmer et al., 2011; Kung et al., 2016; Voracek & Dressler, 2006; Whitehouse et al., 2012). This calls into question whether the EMB can claim that empathy impairments or autistic traits in autistic people are the result of an 'extreme male brain' caused by excess fT. Furthermore, it is not yet possible to test the hormonal levels of an unborn foetus, and thus the direction of cause and effect regarding the relation of fT to early development cannot be determined (Fine, 2010). A study by Bejerot et al. (2012) even found an opposite pattern of findings; whilst the sample of 24 autistic females did demonstrate elevated levels of testosterone and masculinised characteristics, such as

less feminine facial features, the sample of 26 autistic males displayed more feminised characteristics, such as less masculine body types and voice quality.

This section has discussed findings which indicate that certain aspects of empathising may be impaired in autistic people. However, the evidence does not strongly support some aspects of the EMB theory of autism and there are some conflicting findings. Furthermore, the empathy deficits observed in autistic people may have different causes to the disadvantage that non-autistic males show on empathy measures compared to non-autistic females (Bird et al., 2010).

**2.1.2. Systemising.** Systemising is the second sexually dimorphic trait in the EMB theory. Systemising involves being able to analyse and construct systems that take in inputs and produce outputs based on their operation and the rules that govern them. This ability shows the opposite pattern to empathising: it is thought to be heightened in non-autistic males relative to non-autistic females, and even more so in autistic individuals (Krajmer et al., 2010; Manson & Winterbottom, 2011). Large scale surveys using the Systemising Quotient (SQ) have indicated that males in the general population score higher than females, and that autistic people score even higher, with no significant difference between autistic males and autistic females (Baron-Cohen et al., 2003; Greenberg et al., 2018; Wheelwright et al., 2006;). Further research has shown that non-autistic males and autistic people perform better than non-autistic females on tasks such as mental rotation and figure disembedding, which require a systemising approach to identify a specific shape from a larger image (Baron-Cohen & Hammer, 1997; Collins & Kimura, 1997; Jolliffe & Baron-Cohen, 1997; Voyer et al., 1995).

Autism has also been found to be associated with STEM fields of study and work, which are typically male-dominated fields thought to involve high levels of systemising (Baron-Cohen, 1999; Beede et al., 2011; Sassler et al., 2017; Wheelwright et

al., 2006). For example, Baron-Cohen (1998) screened families of students studying either maths, physics, and engineering (STEM students) or literature (non-STEM students) for autistic relatives, finding that 6/641 STEM students had autistic relatives, and only 1/652 literature students had an autistic relative. However, it is important to note that the prevalence of autistic relatives in the STEM subjects was only 0.94%, which is no higher than the general prevalence rates discussed previously. As literature was the only non-STEM subject tested, it is difficult to conclude that generally students in non-STEM subjects are less likely to have autistic relatives. Furthermore, it may not be the case that certain subjects involve more systemising than others, particularly as studying all subjects in academia involves some level of systemising (Fine, 2010). For example, Ruzich et al. (2015) found in their large sample of 450,394 adults that careers in STEM areas were associated with increased AQ scores in both non-autistic males and females, and that males scored significantly higher on the AQ than females. However, non-STEM careers included business, sales, transport, finance and banking amongst others, which could be said to require high levels of systemising. Wei et al. (2013) also found a gender difference between males and females in STEM and non-STEM fields. However, this was in autistic participants, with 39% of male autistic students majoring in a STEM field and only 3% of females majoring in a STEM field, compared to 29% of non-autistic male college freshmen and 15% of non-autistic female college freshmen. Furthermore, in the large-scale study on 670,000 autistic and non-autistic people by Greenberg et al. (2018), autistic people were not more likely to enter STEM fields, suggesting that an 'extreme male brain' may not be the cause of some autistic people's preference for STEM subjects. Others have questioned gendering fields and skills as being 'male-minded', as the EMB theory promotes, on the basis that more males are in them or better at them (Ridley, 2016). It may be the case that socialisation and a society's gender norms affect the number of females entering STEM careers (Charles &

Bradley, 2009; Milkman et al., 2012; Moss-Racusin et al., 2012; Xu, 2008), or it may be a combination of both nature and nurture factors.

The evidence that systemising in autism is an ‘extremely male’ trait linked to excess fT is also inconsistent. For example, Falter et al. (2008) found that the aspect of the mental rotation task autistic people seemed to excel at was different to that of non-autistic males, and they did not find a link between testosterone and performance on these tasks. However, Brosnan et al. (2010) did find a correlation between ‘time awake’, which is used as a proxy for circulating testosterone with peak levels occurring in the morning and declining throughout the day, and both systemising and mental rotation in a non-autistic population. Note, though, that the direction of cause and effect between time awake, circulating testosterone, and systemising is unclear. There were no statistically significant differences between non-autistic males and females on time awake, and measuring time awake could introduce many other confounding variables, such as concentration and fatigue levels, as well as exercise, protein intake, and time of reproductive cycle, which are all known to affect levels of circulating testosterone (Hulmi et al., 2008; Schoning et al., 2007).

Whilst the EMB theory does, once again, raise important findings highlighting a difference in both empathising and systemising ability in the autistic population, the evidence that systemising is an example of an ‘extreme male brain’ caused by excess fT is uncertain. Furthermore, there may be other reasons why autistic people systemise, for example, repetitive and restrictive behaviours may favour a systemising approach, and systemising may also help autistic people manage confusing and complicated social structures and systems. As suggested previously, systemising may also be used as a trade-off for impairments in empathising (Goldenfield et al., 2005).

**2.1.3. Additional limitations of the EMB theory.** Based on the evidence discussed in this section it is highly likely that other factors may also be at play in the development of autism. Whilst there do appear to be differences in empathising and systemising ability between those who are autistic and those who are not, these are not core impairments featured in the DSM criteria for ASC (APA, 2013). Ridley (2019) argues that collating empathising with systemising is not justified, likening describing an autistic woman as having an ‘extreme male brain’ because she scores highly on systemising and poorly on empathising is similar to describing an extremely tall female as having ‘extreme male tallness’, because men are more likely to be tall. To take this analogy further, an extremely tall woman may have an abnormality, which has increased her height compared to the average female. It is an essentialistic fallacy to describe this woman as having ‘male-tallness’, particularly as the reason for her height is different to the reason why an average male is generally taller than an average female. In a similar respect, the reason an autistic woman may have a similar cognitive profile to the average non-autistic male may be for very different reasons, and it is limiting to categorise this as an ‘extreme male brain’.

Furthermore, Ridley (2016) stresses the importance of taking into account that no research on gender and brain anatomy has identified exactly what a ‘male brain’ or ‘female brain’ looks like. Instead, research by Daphna et al. (2015) suggests that the human brain is a ‘mosaic’ of different unique features, which cannot be categorised as either ‘male’ or ‘female’. Similarly, Ridley (2016) argues that autistic traits can be the product of any brain, regardless of gender, and that we should broaden our investigation into autism beyond gender. However, Greenberg et al. (2018) have stressed that the EMB theory merely describes averages, and inferences should only be made about males and females as groups rather than for individuals. Whilst this may be true, Krahn and Fenton (2012) warn that an adverse effect of categorising autism as an ‘extreme

male brain' is that it may have led to many autistic girls not being diagnosed, as clinicians may have been biased in looking for 'male' signs of the condition. The following section will address possible differences in how autistic males and autistic females present on a behavioural level, offering an alternative theory that may explain the gender disparity found in autism.

## **2.2. Female Phenotype Theory**

The FPT suggests that rather than males being more likely to develop autism, autistic females are instead going unidentified due to presenting differently with a number of different and disguised observable characteristics (Kopp & Gillberg, 1992). Due to current diagnostic criteria and measures being based primarily on male samples, it is argued that many clinicians are unable to detect the phenotype seen in many autistic females, explaining figures discussed earlier showing later diagnosis in females (Baldwin & Costley, 2016; Shattuck et al., 2009). There could be a number of reasons why autistic women present differently with the same condition, including both biological and environmental causes. These will be discussed in more detail later in this chapter.

**2.2.1. Presentation of autistic characteristics in males and females.** There is conflicting evidence regarding differences in the autistic traits and symptoms displayed by males and females. An early study by McLennan et al. (1992) testing 42 autistic females and males (equally split) with a mean age of 14-15 years, using the Autism Diagnostic Interview (ADI), found that parents of autistic daughters reported that their child was less affected by social and communication behaviour difficulties than parents of autistic sons. This was particularly prominent in the areas of social initiative play and also comfort-seeking and offering. However, when these children became adolescents this pattern was reversed, with autistic females demonstrating more severe social



difficulties, predominantly in peer relationships, compared to autistic males. The authors suggest that this may be due to the greater social demands placed upon adolescent girls, whereby peer activities rely on social communication and interest. However, it should be noted that in this study the autistic girls had spent a significant amount of time in special needs classrooms, which may have hindered their ability to learn socially from non-autistic girls. As well as this, slightly different measures had to be used for different time periods, as the younger and older versions of the ADI did not align at that time, which may have led to some discrepancies.

More recent studies have supported the finding that girls may present with fewer social communication difficulties. For example, Hsiao et al. (2013) evaluated social deficits in autistic children and adolescents. A sample of 1,321 students aged 6-15 years from schools in Taiwan were tested, with an equivalent number of males and females. Generally, the study discovered that autistic children and adolescents were more likely to exhibit social deficits than their non-autistic peers. However, autistic boys of all ages were significantly more impaired than autistic girls on social awareness, with older girls being more impaired on social emotion than younger girls. Likewise, Hiller et al. (2014) found subtle differences in how autistic boys and girls behaved socially. They tested a sample of 69 autistic girls and 69 autistic boys ( $M = 8-9$  years) and measured how the children met the broad social criteria on the DSM-5 using both clinician and teacher reports. Findings showed that autistic girls were 14 times more likely than autistic boys to engage in typical reciprocal conversation; a much larger percentage of girls (35%) than boys (9%) showed virtually no impairments in their ability to integrate nonverbal and verbal communicative behaviours; girls were 3.5 times more likely to engage in imaginative play typical for their developmental level than boys; and finally girls were 6 times more likely than boys to show some adjustment of their behaviours across situations, such as monitoring voice volume, avoiding inappropriate comments, and

hiding emotional meltdowns. In a study of 16 autistic girls and 17 autistic boys aged between 5-10 years, Rynkiewicz et al. (2016) found that the autistic girls also tended to use nonverbal gestures more vividly than autistic boys when assessed using the ADOS-2. Finally, research by Parish-Morris et al. (2017) found that school-aged autistic girls ( $n = 16$ ) used more pragmatic language markers than autistic boys ( $n = 49$ ), and at a level similar to that found in non-autistic children, which may normalise the way autistic girls sound when communicating and thereby disguise communication difficulties. On the whole, autistic girls do appear to show an advantage over autistic boys in social communication skills, which may be part of the female phenotype of autism.

In contrast to these findings, there are many studies which show that for autistic children without intellectual disability, autistic girls appear to experience the same severity of autistic traits on assessments used to diagnose autism as autistic boys (May et al. 2014; McLennan et al. 1993; Postorino et al., 2015). For example, Rivet and Matson (2011) found no gender differences in autism symptomology on the Autism Spectrum Disorders – Diagnostic – Child Version (ASD-DC) or the DSM-IV-TR/ICD-10 Checklist for 37 autistic girls and 37 autistic boys (ages 3-17 years), as rated by parents, caregivers, and teachers on several domains (nonverbal communication/socialisation, verbal communication, social relationships, and insistence on sameness/restricted interests). Similar findings were made by Reinhardt et al. (2015) using 54 young autistic girls and 234 young autistic boys who were recruited from paediatric patient lists, those with older autistic siblings, and those referred because of suspected autism. They used a variety of measures to determine gender differences in early social communication abilities, an infant cognitive functioning measure, and a parent interview to assess different domains of adaptive behaviour (communication, daily living skills, socialisation, and motor skills), finding no differences. These results

were supported by similar studies using smaller numbers of young participants (Postorino et al., 2015). Furthermore, Harrop et al. (2015) found no differences between 40 autistic girls and 40 autistic boys aged 36-48 months in spontaneous play with a stranger and non-verbal and verbal communication.

Whilst these studies predominantly used measures and scales that rely on parental report, other studies have used the Autism Diagnostic Observation Schedule (ADOS). For example, Hartley and Sikora (2009) tested 157 autistic boys and 42 autistic girls between the ages of 1.5-3.9 years using several parent-report measures of adaptive behaviour traits and cognition alongside the ADOS, finding similar patterns of traits and behaviours across girls and boys. Furthermore, in a study by Mussey et al. (2017), for which 113 autistic females and 566 autistic males were tested on the ADOS, the Childhood Rating Scale, and a developmental measure, no gender differences were found in overall scores or in age of diagnosis ( $M = 10-11$  years of age).

These conflicting findings may be due to the young ages of the samples used and also the origin of the samples. Whilst some autistic girls may present typically, others may have the female phenotype and may not present typically. Also this age group is less likely to capture those with the female phenotype as they may have been diagnosed later. Investigating the presentation of autistic characteristics in undiagnosed autistic girls and in autistic adults reveals that autistic females may develop less overt autistic characteristics, as described next.

Lai et al. (2011) tested 45 autistic males and 38 autistic females presenting at a diagnostic clinic for adults in Cambridge on both the ADI-R and the ADOS. Males and females were similar in terms of childhood autistic symptoms, as found previously, although the researchers did select only those participants who had the same behavioural criteria, e.g. reached the same ADI-R cut offs. However, whilst no

differences were found between males and females in empathising, systemising, or mentalising (ToM), females demonstrated less severe socio-communication difficulties on the ADOS and more lifetime sensory issues, and during immediate interpersonal interactions the females also showed fewer autistic behaviours in the socio-communication ( $r = 0.41$ ) and RRBIs domains ( $r = 0.50$ ). A more recent study by Wilson et al. (2016), reported similar findings. They tested 935 adult males and 309 adult females referred for autism assessments by their GPs, finding a pattern of greater social and communication difficulties and RRBIs in males who were subsequently diagnosed with autism compared to females who were subsequently diagnosed with autism. These findings suggest that, compared to autistic females, autistic males present with more overt autistic behaviours, such as RRBIs, and greater social difficulties, which make them stand out more for diagnosis. Indeed, evidence that RRBIs appear to a much greater extent in autistic males than autistic females has been found consistently in a large body of research (Duvekot, 2017; Frazier et al., 2014; Hartley & Sikora, 2009; Hattier et al., 2011; Hiller et al., 2014; Hsiao et al., 2013; Lai et al., 2011; Mandy et al., 2012; May et al. 2014; Park et al., 2012; Ratto et al., 2018; Sipes et al. 2011).

Looking more closely at research investigating the autistic behaviours and traits of males and females it would seem that a key difference lies in externalising and internalising traits. For example, findings cited earlier suggest that males have more RRBIs than females, which includes more visible external traits. Other studies support these findings, showing that generally autistic boys display more externalising challenging and hyperactive behaviours (Giarelli et al., 2010; Levy et al., 2005), and also that higher levels of reported emotional and behavioural problems predict an ASC diagnosis more often in girls than in boys (2.44 times) (Duvekot et al., 2017).

Dworzynski et al. (2012) suggest that in order for girls to be diagnosed with autism they require a greater number of external behavioural problems than boys. Their study drew

on a large data pool of approximately 11,000 families from TEDS, which is a UK based study of twins born between 1994 -1996, and focussed on 189 autistic children who met diagnostic criteria when they were between 10-12 years of age (29 females and 160 males), and a group of 174 children (55 females and 119 males) who scored above the cut-off on the Childhood Autism Spectrum Test (CAST) but who did not meet the full diagnostic criteria; this sample was referred to as the “high-CAST” group. The diagnosis rate for boys with high CAST scores who went on to be diagnosed was found to be 56%, however it was significantly lower for girls at 38%. For both genders, “high-CAST” children had significantly fewer social autistic traits than diagnosed children, demonstrating that better social skills may hinder diagnosis for both genders. However, “high-CAST” girls were significantly more prosocial than “high-CAST” boys. They also had significantly lower reports of hyperactivity and behavioural problems than diagnosed girls, whereas there were no differences between “high-CAST” boys and diagnosed boys in these domains. Furthermore, diagnosed girls were 8.4 times more likely than “high-CAST” girls to show cognitive and behavioural difficulties. This suggests that in order for girls to be diagnosed they require more overt challenging behaviours and problems, and that their internalising of traits may contribute to them missing diagnosis.

These studies stress the importance of investigating undiagnosed females with high levels of autistic traits, who may be undiagnosed due to exhibiting less challenging and external behaviours. The majority of studies investigating differences between autistic males and females rely on already diagnosed individuals, which means that the females will have displayed enough autistic traits to be sent for diagnosis. This may bias the findings as greater differences may be found if females scoring highly on measures of autism but who do not have a diagnosis are investigated as well. Also, it should be noted that there were significantly fewer autistic girls tested in many of these studies

compared to autistic boys (e.g. Parish-Morris et al., 2007; Reinhardt et al., 2015), which affects the overall power of these findings and may lead to incorrect rejection of the null hypothesis (Type 1 error) (Rusticus & Lovato, 2014). Although, other studies have used equal numbers of autistic boys and girls, and therefore support the conclusions made from these more gender-biased studies (e.g. Lai et al., 2011). Due to fewer females being diagnosed with autism, gaining equal numbers of autistic males and females remains a methodological challenge for studies looking at gender differences in autism. It is therefore important that future studies attempt to gain equal sample sizes, and to ensure equal variance between these groups before comparisons are made.

**2.2.2. Gender Socialisation and the presentation of autistic symptoms.** It has been suggested that one of the reasons that autistic girls exhibit better social communication skills and more internalised difficulties than autistic boys is because of gender socialisation pressures (Krahn & Fenton, 2012). In the development of social skills for all children, socialisation plays a key role in gender differences in behaviours (Bem, 1981). Ryle (2011) describes gender socialisation as a learning process of understanding both gender norms and one's own gender identity. Gender norms refer to sets of rules about what society believes is masculine and what is feminine, whilst gender identity refers to how individuals think of themselves as male or female (John et al., 2017). Bandura (1963) developed the theory of social learning, part of which involves the learning of 'sex-typical' behaviours. Children are often rewarded when they conform to the correct sex-typical behaviour for their gender, which reinforces these behaviours. The gender norms in Western cultures have historically stereotyped males as being aggressive, dominant, leaders, independent, decisive, assertive, and self-reliant, amongst other traits (Bem, 1974). In contrast, females have typically been stereotyped as being gentle, sympathetic, shy, sensitive to others' needs, compassionate, soothers of hurt feelings, affectionate, and even childlike, amongst other traits (Bem,

1974). Miller et al. (1981) describes how the female sense of self is often derived from how she is connected to others, whilst the male sense of self is often derived from his independence from others. Although the feminist movement has meant society is becoming more aware of the possible social construct of gender, it remains ingrained in much of our society (Fine, 2010). Therefore, it is likely that just as the general population experiences social learning of gender norms that affect behaviour, autistic males and autistic females also experience this, shaping how their autistic traits manifest themselves at a behavioural level. This may mean that autistic females are motivated to fit in more socially, to behave better, and to be more introverted and empathic towards others than autistic males might be.

Evidence of heightened expectations for autistic girls to behave in a socially acceptable manner comes from studies that have found that parent ratings of their child's social functioning are often lower for autistic girls than autistic boys. Specifically, even in the absence of gender differences detected by the researchers, or with females demonstrating enhanced abilities compared to males, parents of autistic daughters often rate their child as having more severe social problems than parents of autistic sons. For example, Holtmann et al. (2007) did not find any significant differences between 23 autistic girls and 23 autistic boys, with a mean age of 11 years, on the ADI-R, the ADOS, or the Child Behaviours Checklist. However, parents reported significantly more social problems in girls than in boys, suggesting some bias in the level of social competence expected in daughters by their parents. Similarly, in Rynkiewicz et al.'s (2016) study, despite autistic girls performing better than autistic boys on social nonverbal communication aspects of the ADOS-2, in the Social Communication Questionnaire (SCQ) the parents of autistic girls rated them as having significantly poorer social skills than the parents of autistic boys. Ratto et al. (2018) investigated this phenomenon further, comparing gender differences in the ADOS and

ADI-R with parental reports, in 114 school-aged autistic girls and 144 IQ and aged matched autistic boys. Approximately 90% of the girls and 94% of the boys met the cut-off criteria for autism on the ADOS, with similar scores across all domains. The girls and boys also scored similarly on the ADI-R, although fewer numbers of both met the cut-off criteria on this (73% of girls and 76% of boys). However, on the Social Responsiveness Scale (SRS), which was completed by the parents, the girls were rated as being significantly more impaired across all domains, including social awareness, social information processing, capacity for reciprocal social communication, social anxiety/avoidance, and autistic preoccupations and traits. The authors suggest that it may be the case that parents expect girls to be more socially competent than boys, and therefore any impairments may be emphasised more severely. A potentially interesting secondary finding was that the girls who had higher cognitive abilities were more likely not to meet the ADI-R criteria, particularly girls of higher intelligence, once again suggesting that many girls with autism may fail to be diagnosed due to not meeting diagnostic thresholds as they have a different manifestation of autistic traits.

**2.2.3. Camouflaging autistic traits.** A potential consequence of socialisation pressures in autistic girls is that they may feel it is necessary to mask their autistic traits, compensate for them, and act in a more desirable way by camouflaging. An emerging area of research in support of the FPT suggests that one of the primary reasons that females do not appear ‘autistic’ to others, and therefore why they may be undiagnosed or diagnosed much later, is that females camouflage their autistic traits. This can be seen in the masking of autistic characteristics and in the act of camouflaging to fit in with others socially (Attwood & Grandin, 2006). Initially this theory was grounded in a large body of qualitative data and anecdotal evidence from autistic females and their parents, but more recently attempts have been made to measure camouflaging empirically and the characteristics and skills associated with it. Livingston and Happé (2017) have



recently proposed a transdiagnostic framework to conceptualise compensation in ASC, which will help ground further empirical research into the camouflaging effect in autism, of which compensation is a large part. This acknowledges the research finding that the core autistic difficulties are the same for all genders, but suggests that compensation may affect the presentation of these in various situations. Three hypothetical features of compensation are outlined in this framework, namely, compensation may be shallow or deep, it may be modulated by the environment, and it may come at some cost. These features will be discussed later on in the chapter.

Tierney et al. (2016) conducted interviews with ten autistic adolescent females and analysed their responses using Phenomenological Analysis to investigate the girls' experiences of managing social relationships. The majority of the girls mentioned some form of imitation, for example, carefully observing peer interactions to build a social repertoire and rules they could follow. They would often copy facial expressions, postures, tone of voice, topic of conversation, and choice of interests in order to fit in. Masking was reported by many of the girls, describing how they would often ensure they maintained either happy or blank facial expressions when socialising in order to hide how unhappy and anxious they often felt; this mask was maintained even in close friendships out of a fear of losing their friends. These strategies appeared to be so successful in hiding external signs of distress that those around them were surprised to find out they were in fact struggling. Similarly, Bargiela et al. (2016) found a common theme of 'pretending to be normal' from 14 autistic women (aged 22-30) who were diagnosed in late adolescence or adulthood. Many of these women struggled with socialising but had coped by 'wearing a mask', which they described as a conscious effort to hide their autistic traits, as well as reporting social mimicry, which they described as being more automatic. Furthermore, Baldwin and Costley (2016) found in the open comments section of their survey on 82 autistic women that a large number

suggested they had purposefully learned aspects of socialising to enable them to act appropriately. Furthermore, a study by Hull, Petrides, et al. (2017), focussing on adults, examined the qualitative camouflaging experiences of 55 autistic women, 30 autistic men, and 7 autistic individuals identifying as 'other gender', with a mean age of 43. They discovered common themes of motivation to camouflage, which included a need to 'blend in with the 'normals'', which they felt was an expectation of them made by others, as autistic behaviours were viewed as 'unacceptable'. As well as this, many saw camouflaging as a way to overcome social hurdles in forming the relationships they desired with others. In order to mask autistic traits, many reported mimicking the behaviour of others during social situations, some even copying social interactions from television programmes and films. Additionally, many reported developing behaviours to compensate for social communication difficulties, for example, using non-verbal gestures such as maintaining appropriate levels of eye contact, avoiding dominating conversations with details about themselves and interests, and practising conversations beforehand so that they could maintain a social script. Imitation of social behaviours has also been reported in semi-structured interviews by the mothers of autistic adolescents, who believed that they found the process of obtaining diagnoses for their daughters more challenging as a result (Cook et al., 2017; Cridland et al., 2014; Rabbitte et al., 2017). These qualitative reports demonstrate camouflaging as an important aspect of the female phenotype of autism. However, from these studies alone it is difficult to determine if camouflaging is a female specific strategy and whether it does contribute to a delayed diagnosis for women.

Lai et al. (2017) were the first researchers to attempt to quantify camouflaging. They used a sample of 60 age and IQ matched adult autistic males and females to determine the difference between their external behaviours in a social context (as measured with the ADOS) and their internal and self-reported traits (as measured with

the AQ and RMET). Two scores were calculated from this, the first was the difference between self-rated autistic-like traits and external behaviours (AQ – ADOS), and the second the difference between mentalising and external behaviours (RMET – ADOS). The study found that females had a significantly higher score than males, a group difference that had a very large effect size ( $d = 0.98$ ). The authors suggest that this difference is most likely due to gender specific socialisation pressures in girls. However, this study has several limitations; for example, previous research has shown that women generally tend to rate themselves as being higher on the AQ, which could be because they are more self-aware (Lenhardt et al. 2016; Lai et al., 2013; Lai et al., 2011). Finally, as the study does not directly measure camouflaging; there may be other factors responsible for this discrepancy between external and internal scores.

Dean et al. (2017) used an observation method to determine whether 96 autistic and non-autistic elementary school children (48 girls and 48 boys) showed camouflaging type behaviours in the playground. They found that generally both autistic girls and non-autistic girls participated in significantly more ‘joint engagement’ than boys and little time in ‘game’, with talking being the preferred activity for autistic girls. However, autistic girls still spent significantly more time in ‘solitary’ than non-autistic girls, and flitted between activities. This was considered by the authors to be evidence of social compensation; for example, the girls may flit between ‘joint engagement’ and ‘solitary’, demonstrating that they are struggling socially but still attempting to fit in with the ‘normal’ girls’ activity. During ‘game’, they were also witnessed as always having a background role, which meant they were taking part but often from the side-lines. In contrast, autistic boys tended to spend a significantly larger proportion of time in ‘solitary’ and the non-autistic boys spent more time in ‘game’. The social environment provides more opportunity for the girls to fit in, and girls tended to maintain close proximity to where the social groups were forming. This made it difficult

from an outsider's perspective to notice that autistic girls were struggling at all and thus masking their social impairments, whereas autistic boys situated far away from their peers and on their own were much easier to spot. These findings are supported by Sedgewick et al. (2016) who assessed 13 autistic girls, 13 non-autistic girls, 10 autistic boys, and 10 non-autistic boys aged between 12-16 for gender differences in friendship motivation and experience. Key findings included autistic girls having similar scores to non-autistic girls on the social motivation subscale of the Social Responsiveness Scale (SRS-2), whilst autistic boys had significantly lower scores than non-autistic boys ( $d = 1.72$ ) and autistic girls ( $d = 0.89$ ), indicating lower social motivation. This same pattern was observed on the subscale of closeness using the Friendship Qualities Scale (FQS), with autistic boys reporting less intimacy with their best-friends than did autistic girls ( $d = 1.15$ ). Furthermore, in qualitative interviews with the participants, the girls described their friendships as focussing on shared talk significantly more than shared activities, which was not apparent for the autistic boys. It should be noted that this study had quite a low number of participants, though it does show a similar picture to Dean et al.'s (2017) findings.

Moving forward, some researchers are attempting to develop self-assessment measures which will help to better conceptualise camouflaging behaviours and the FPT, and will more directly measure camouflaging behaviours. For example, Kopp and Gillberg (2011) have developed the Autism Spectrum Screening Questionnaire – Revised Extended Version (ASSQ-REV), which uses an additional 18 items (ASSQ-GIRL) reflecting characteristics seen in the female phenotype of autism. When tested on 71 autistic girls, 62 autistic boys, and 58 non-autistic girls (all aged between 6-16 years), the new revised version of the ASSQ reliably discriminated between autistics and non-autistics, although it showed no differences between autistic males and females. When considered in detail, however, some of these items were found to be

more commonly rated highly in autistic girls than autistic boys, for example, the item “Copies you (can be in a very discreet way)”, which demonstrates that these autistic girls may be deliberately copying the behaviours of others to fit in. One of the reasons this study may not have found a significant gender difference overall could be because it tested early-diagnosed girls, whereas many of these specific female phenotype characteristics will only be apparent in later-diagnosed girls and women. The scale was also rated by parents and does not focus solely on camouflaging behaviours, unlike a more recent survey created by Hull, Mandy, et al. (2019) who developed the self-reported adult Camouflaging Autistic Traits Questionnaire (CAT-Q). The CAT-Q is a 25 item scale, with items developed from previous qualitative findings by Hull, Petrides, et al. (2017). The scale was found to measure three factors, which were a) ‘compensation’, for example, the item “When I am interacting with someone, I deliberately copy their body language or facial expressions”; b) ‘masking’, for example, the item “I adjust my body language or facial expressions so that I appear relaxed”; and c) ‘assimilation’, for example, the item “In social situations, I feel like I’m “performing” rather than being myself”. The scale was found to have good reliability and validity when tested on 354 autistic and 478 non-autistic adults, and it significantly correlated with traits of anxiety and depression. In a follow-up study Hull, Lai, et al. (2019) tested gender differences on the CAT-Q between 182 autistic females, 108 autistic males, 16 non-binary autistic people, and 472 non-autistic controls, with a total mean age of 34.56. Autistic participants scored significantly higher on the CAT-Q than non-autistic participants ( $p < .001$ ), and autistic females scored significantly higher than autistic males ( $p < .001$ ,  $d = .65$ ). However, autistic females only scored higher than autistic males on two of the three subscales; ‘assimilation’ ( $p < .001$ ,  $d = 0.51$ ) and ‘masking’ ( $p = 0.001$ ,  $d = 0.43$ ). The authors conclude that autistic females are under more pressure to adapt their behaviours to assimilate with others and to use more masking strategies,

although compensation may be used by both genders to some extent. Whilst the study was limited to adults, as demonstrated by the high mean age, and may have therefore attracted more late diagnosed and higher-camouflaging autistic people, it does offer a unique and novel insight into the act of camouflaging, which has not been captured previously.

It should be noted, however, that there are inconsistencies in the data on whether there are differences between autistic females and males in the presentation of camouflaging. For example, in a study by Cassidy et al. (2018) there was no evidence that 99 autistic females attempted to camouflage more than 65 autistic males on a four-item scale that was developed for the purposes of their study, but there were some gender differences in terms of the quality of camouflaging. The scale asked participants if they had “ever tried to camouflage or mask [their] characteristics of ASC to cope with social situations? For example, have [they] ever tried to copy or mimic other people’s behaviour to try and fit in, or tried to mask or hide [their] symptoms of ASC from other people?” If participants answered yes to this they were then asked to specify in which areas of their life they camouflaged, how frequent this was on a scale of 1 (never) to 6 (always), and lastly the overall amount of the day they spent camouflaging on a scale of 1 (none of my waking time) to 6 (all of my waking time). An overall score was calculated which consisted of the sum of areas where camouflaging took place (maximum 8), the overall frequency (maximum 6), and overall amount (maximum 6). 89.2% of autistic females attempted to camouflage, which was similar to the 90.9% of autistic males. However, the overall scores on the camouflaging scale were significantly higher for autistic females ( $M = 14.7$ ) than autistic males ( $M = 12.95$ ), which had a medium effect size ( $d = .47$ ). This study suggests that whilst both genders may attempt to camouflage, the effort put into camouflaging is higher in autistic females than autistic males.

**2.2.4. Gender-distinctive cognitive strategies for camouflaging.** Several studies have begun to determine the traits and skills necessary for social camouflaging, which may explain why autistic females have a relative advantage; i.e. there may be gender-distinct cognitive strategies which enhance camouflaging abilities in females (Livingston et al., 2018). In particular, there has been interest in the importance of differences between autistic males and females in executive functioning (EF). It has been suggested that better EF skills may enhance camouflaging; that is, in order to camouflage one needs to inhibit inappropriate social responses, play and script social interaction beforehand, and have a certain level of flexibility in order to handle unexpected social situations (Sedgewick et al., 2016). For example, Lenhardt et al. (2016) investigated EF differences between 71 autistic females and 144 autistic males recruited from an adult autism diagnostic centre. They administered the AQ, EQ, SQ, RMET, WAIS, and a battery of EF tasks testing visuospatial and psychomotor speed abilities, multiple conceptual tracking, cognitive flexibility, set-shifting, and verbal fluency. The autistic females had significantly fewer processing speed and cognitive flexibility impairments than autistic males, suggesting that this may enable autistic females to observe and learn social behaviours quicker and adapt better to new social situations. However, females rated themselves higher on autistic traits, which as mentioned previously could reflect better self-awareness that in turn might motivate more camouflaging behaviours. Similar findings were made by Lai et al. (2012), who studied 33 non-autistic men, 35 non-autistic women, 45 autistic men, and 38 autistic women. Whilst both autistic men and women showed similar deficits in ToM (as seen using the RMET), facial emotion perception (as seen using the KDEF), as well as in a battery of EF tasks measuring signal detection and response inhibition, autistic females performed equally well to non-autistic females on attention to detail and dexterity-involved EF, whilst autistic men were impaired on this compared to non-autistic men.

Finally, autistic males had slower reaction times on EF tests for phonological working memory and word generativity than non-autistic males, but autistic females and non-autistic females were comparable, suggesting that visuospatial attention deficits may characterise autistic males but not autistic females. Finally, Bolte et al. (2011) compared visual attention to detail and EF in 35 autistic males and 21 autistic females and their non-autistic siblings ( $n = 58$ ), with a mean age of 14-15. A battery of EF tasks were used including set shifting, planning, cognitive flexibility, speed of attention and multiple conception tracking capacities. The autistic females once again demonstrated better EF skills on the cognitive flexibility task, which was associated with fewer RRBIs.

A recent study by Livingston et al. (2018) found that heightened levels of IQ, EF, and anxiety were all linked to a greater ability to compensate for underlying deficits in ToM. Testing a sample of 136 adolescents (112 males and 24 females) aged between 10-15 years who either had a diagnosis of ASC ( $n = 101$ ) or had the Broader Autism Phenotype (BAP) ( $n = 35$ ), compared with 67 unaffected co-twins, the authors measured autistic symptoms on the ADOS, IQ (using the Wechsler Abbreviated Scale of Intelligence [WASI]), ToM (using the computerised Frith-Happé Animations test), and a battery of EF tasks measuring inhibition, set-shifting, and planning, and anxiety (using the Revised Child Anxiety and Depression Scale). Participants were divided into four groups (Low Compensation, High Compensation, Deep Compensation, and unknown) based on median ToM scores ('Good ToM' versus 'Bad ToM'), and by median social ADOS scores ('Good ADOS' versus 'Poor ADOS'). This meant that those with poor ToM scores but with good ADOS scores could be classified as having high compensation abilities, those with both good ToM and good social ADOS could be classed as having deep compensation abilities, those with poor ToM and poor social ADOS could be classed as having low compensation, whilst those with good ToM but



poor social ADOS were considered unknown. The findings suggested that the High Compensators had higher verbal IQ, better EF scores, and higher levels of anxiety compared to the Low Compensators. However, the Deep Compensation and the Unknown groups showed a similar pattern on these variables, leading the researchers to conclude that the factors involved in compensation were specific to good performances on the ADOS despite poor ToM. Furthermore, all groups were equally likely to have a co-twin who also had ASC, meaning that the genetic ‘hit’ for ASC was not greater in any of the groups. This suggests that the High Compensators did not have a ‘milder’ form of ASC, because they had the same autistic traits as Low Compensators. Whilst the study did not find that females were more likely to be High Compensators, as the FPT would predict, the study included quite a low number of females ( $n = 24$ ). The authors suggest that future studies would benefit from investigating these differences in non-clinical populations using self-assessment methods.

Another skill which may aid in better compensation behaviours is autobiographical memory; this could be considered important for remembering social scripts and learning from previous social interaction. Goddard et al. (2014) assessed autobiographical memory in 12 autistic males, 12 autistic females and 24 non-autistic children aged between 8-16 years on the Social Communication Questionnaire (SCQ), the WASI, the British Picture Vocabulary Scale, the Memory Measures Autobiographical Memory Cueing Task, which required the children to retrieve specific memories in response to 15 word cues, the Recent and Remote Memory Tasks, which included 12 questions designed to provoke memories from the past week and events from early childhood, and finally the Verbal Fluency task, which tests the number of items generated within certain categories. Autistic males tended to generate fewer specific memories than non-autistic males, whereas non-autistic and autistic females performed similarly. Autistic females also demonstrated better recall of recent events,

which were remembered in greater detail than their remote memories; this was not seen in autistic males, and both non-autistic and autistic females described memories with more references to emotional states than all groups of males. The autistic girls also performed better on the SCQ than autistic boys, which when combined with their enhanced ability to recall autobiographical memories suggests that females may be better at compensating for social and communication impairments as a result of better innate cognitive skills.

Finally, there is some evidence for camouflaging and improved sociability in autistic females compared to autistic boys as seen by friendship motivation. For example, Head et al. (2014) compared 25 autistic females to 25 non-autistic females, 25 autistic males, and 26 non-autistic males, aged between 10-16 years, on the Friendship Questionnaire (FQ), which measures how much individuals enjoy close, empathic, supportive, and caring friendships, how interested they are in people, and how much they enjoy interacting with others for its own sake. Generally, autistic participants scored worse than non-autistic participants, although autistic girls performed better than autistic boys, and equivalent to non-autistic boys. However, it should be noted that the original study by Baron-Cohen and Wheelwright (2003) did not find any differences between autistic males ( $n = 51$ ) and females ( $n = 17$ ) on the questionnaire, whilst they did find differences between non-autistic males ( $n = 27$ ) and females ( $n = 49$ ). Head et al. (2014) argue that this could be due to the wide ranges of age seen in the original study (14-64 years), though this study also used a smaller sample of autistic women. In Head et al.'s (2014) study, parents rated their children on the scale, whereas the original measure was intended for adult self-assessment, which may also explain the discrepancy in findings. Future studies should look to examine the FQ further in a larger sample of the autistic adult population.

**2.2.5. Mental health repercussions of camouflaging.** A consequence of camouflaging and/or the subsequent later ASC diagnosis could be an increased risk of mental health difficulties. As described in Chapter 1, autistic individuals are already at an increased risk of mental health concerns. Females in particular seem to be susceptible to co-morbid mental health difficulties as a result of internalising their difficulties. For example, Stewart (2012) reports anxiety in autistic girls, manifesting in chronic insomnia, regular emotional outbursts, self-harm, and school refusal. Similarly, Baldwin and Costley (2015) reported heightened levels of mental illness in autistic females; 73% of their sample were in need of ongoing mental health support. Mandy et al. (2012) found that parents reported their autistic daughters to have worse emotional difficulties than autistic sons. Additionally, mental health difficulties have been found to be prominent in autistic people diagnosed later in life, most of whom previous research has indicated are women, with affective disorders being one of the main reasons for referral of ASC in adults (Lehnhardt et al., 2016). In interviews with fourteen women diagnosed in late adolescence or early adulthood, Bargiela et al. (2016) found that 92.9% of their participants scored above the clinical cut-off on the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A), 21.4% scored within the clinical range for depression on the HADS-D, and 35.7% scored within the ‘distress’ and ‘severe’ range on the General Health Questionnaire (GHQ-12). In their interviews almost all reported experiencing one or more mental health problems, particularly anxiety, depression, and eating disorders.

Camouflaging has been found by several studies to be linked to heightened mental health difficulties. A consequence of camouflaging is increased exhaustion leading to anxiety and depression. Livingston et al. (2018) explained how the process of masking autistic traits and camouflaging to appear ‘normal’ uses up valuable resources, which would otherwise be used elsewhere, resulting in exhaustion and breakdown. For

example, Tierney et al.'s (2016) study found that the ten adolescent autistic women reported emotional consequences of camouflaging, including severe depression and anxiety, with five participants using self-harm to cope. This is supported by qualitative findings by Hull, Petrides, et al. (2017) who found that the most common consequence of camouflaging reported by participants was exhaustion, with many feeling mentally, physically, and emotionally drained as a result. Stress and anxiety were experienced both during and after situations involving camouflaging. As well as exhaustion, acting in ways contrary to one's 'true' self while camouflaging may have a damaging effect on self-esteem and feelings of authenticity (Kernis and Goldman, 2006). Goffman (1969) describes how maintaining a 'show' and behaving in ways incongruent to one's own beliefs can cause feelings of alienation from oneself and others.

Quantitative studies have made similar findings regarding the detrimental effects of camouflaging to mental health. For example, as briefly discussed in Chapter 1, Cassidy et al. (2018) found that camouflaging, as measured using a four item questionnaire with high internal consistency, significantly predicted suicidality in autistic participants (65 males; 99 females). This finding was made after controlling for age, sex, presence of at least one developmental condition, depression, anxiety, employment, and satisfaction with living arrangements. Furthermore, camouflaging explained a significant amount of variance in suicidality above depression and anxiety, suggesting that the association between camouflaging and suicidality may be partially independent of mental health problems. In a recent study by Cassidy et al. (2019), the link between suicidality (measured using the Suicidal Behaviours Questionnaire) and autistic traits (measured with the AQ), was significantly mediated by camouflaging (measured using the CAT-Q) and thwarted belonging (measured using the Interpersonal Needs Questionnaire). Whilst these findings were made in a sample of 160 non-autistic young adults, they highlight the general risk that high levels of camouflaging pose.

In other studies using the CAT-Q, higher camouflaging has been linked with more mental health difficulties. Hull, Mandy, et al. (2019) found that total scores on the CAT-Q, as well as scores on the ‘assimilation’ factor, were significantly negatively correlated with wellbeing in autistic participants, and that total scores on the CAT-Q and all three subscales were positively correlated with depression and generalised anxiety. In addition to these findings, Cage and Troxell-Whitman (2019) investigated the mental health consequences of camouflaging in 262 autistic adults (135 females, 111 males, and 12 non-binary) using the CAT-Q and the Depression, Anxiety and Stress Scale (DASS). They also asked participants to rate 21 reasons for camouflaging on how much they agreed it was a reason for them to camouflage, as well as to rate 22 contexts for camouflaging on how often they camouflaged in that context. They found that those who camouflaged highly in both formal and interpersonal contexts, and those who switched between camouflaging in one context but not in the other, experienced more anxiety and stress than those who reported low levels of camouflaging in both settings. However, no significant differences between high and low camouflagers were found in depression scores. Given the higher rates of suicidality reported in Cassidy et al.’s (2018) study it is vital that this should be investigated further.

In contrast, Lai et al. (2017) found greater camouflaging to be associated with more depressive symptoms in autistic men ( $n = 30$ ) but not in autistic women ( $n = 30$ ), and they also reported no significant relationship between camouflaging and anxiety in either gender, as tested using the 21-item Beck Anxiety/Depression Inventory. The authors concluded that camouflaging may be an ingrained strategy that has perhaps been practised by autistic women for longer over their lifetimes than it has for autistic men, leading to less negative emotional consequences. However, this study had relatively low numbers of autistic participants compared to those that did find that camouflaging has significant negative consequences for mental health. Additionally, as discussed earlier,

this study did not directly measure camouflaging; instead, the camouflaging score was derived from the discrepancy between internal autistic traits and external behavioural traits.

On the whole it would seem that mental wellbeing is a concern in autistic women who use camouflaging to hide autistic traits, as can be seen from the lived experiences of those with the condition reported in qualitative studies, as well as the self-reports of autistic women who have consistently rated themselves as being high camouflagers in several studies. This may be due to the social demands and the subsequent exhaustion experienced from using this strategy and hiding ones true-self, or it may be due to the consequences of later diagnosis in these individuals, which would deny them necessary support and therapeutic intervention growing up.

**2.2.6. Misdiagnosis.** One final important point to discuss when looking at gender differences in the presentation of autism is misdiagnosis. Although no research to date has directly investigated cases of misdiagnosis in autistic women, evidence exists to suggest that it warrants further investigation (Brugha et al.,2016). In their article addressing the ‘lost generation’ of autistic adults, Lai and Baron-Cohen (2015) describe how many psychiatric conditions have overlapping symptoms dimensions to ASC, for example OCD, or overlapping diagnostic criteria, for example personality disorders. They describe how the difficulty in diagnosing adults with ASC is determining which co-morbid mental health issues are differential diagnoses. For example, those with overlapping diagnostic criteria but with key differences to ASC, which are true comorbidities, and those with overlapping behavioural features, which are differential diagnoses. Differential diagnoses appear to be the most likely candidates for misdiagnosis. For example, symptoms of Schizoid Personality Disorder include social-detachment and restricted affectivity, and symptoms of Schizotypal Personality

Disorder include eccentricity, which overlaps with key features and behaviours observed in ASC. The obvious difference between the conditions is that ASC is present in early development, and autistic people will present with RRBI and sometimes language delays in addition to these symptoms. It is therefore important that clinicians investigate this before diagnosing with differential conditions. This might be of particular concern to autistic females, who present with fewer RRBI and who camouflage their autistic traits, thus hiding their impairments. Lai and Baron-Cohen (2015) specifically mention Borderline Personality Disorder (BPD) as a differential diagnosis of particular concern for autistic women, as they may be misdiagnosed with it. This could be due to similarities in secondary features of ASC, such as problems with relationships, identity, affect regulation, and increased self-harm and suicidal behaviours. Fitzgerald (2005) describes further the overlapping features in ASC and BPD, including these and many others, such as impulsivity, gestures or threats, chronic feelings of emptiness, inappropriate intense anger and/or difficulty controlling anger, and stress-related paranoid ideation.

The overlap between BPD and ASC in women has been noted in other research. For example, Bargiela et al. (2016) found in a group of late-diagnosed autistic women that many had been misdiagnosed, and several mentioned that personality disorders were preferred over ASC diagnoses by clinicians. Furthermore, Rabbitte et al. (2017) found that parents of autistic girls frequently reported that it was difficult to get clinicians to believe their daughters might have an ASC, many seeing signs of anxiety and self-harm as the result of mental health conditions rather than a consequence of an undiagnosed ASC. Ryden et al. (2008) investigated adult psychiatric patients in Stockholm attending mentalisation-based therapy, who had been consecutively referred and diagnosed with BPD, for autistic traits. Forty-one participants were assessed, with a mean age of 29, and of these 15% fulfilled the criteria for ASC. Of particular concern

was the heightened rates of suicide attempts in those with BPD and ASC, compared to those with just BPD, which supports research described earlier regarding the consequences and risk of camouflaging and delayed diagnosis in autistic people.

Kreiser and White (2014) warn that there are adverse consequences associated with misdiagnosing autistic women. For example, they may not receive the correct treatment for their condition, or receive treatment that does not accommodate for autistic differences. Furthermore, these women may lack the insight into their difficulties which gaining a diagnosis gives, and as such this may lead to further mental health difficulties. This could present as a vicious cycle; autistic girls camouflage their impairments, they miss a diagnosis in childhood, and they develop mental health difficulties as a result. When they present to clinicians their autistic traits may be ignored and mental health difficulties focussed on, increasing the likelihood of a misdiagnosis with a different condition, further delaying an ASC diagnosis.

### **2.3. Summary and Research Directions**

In summary, autistic females are likely to receive their autism diagnosis later than males, which may partly explain the gender disparity in the prevalence of autism. Whilst the EMB theory does explain a number of traits (primarily systemising and empathising) that seem to occur to a greater/lesser degree in autistic people, the evidence provided does not consistently support the idea that these are extremely male characteristics and that autistic people have an extremely male brain, with girls being less likely to be affected. Much of the early research supporting this idea was focussed on autistic males, and newer research has tended to investigate only those who already have an autism diagnosis, usually given to them in childhood. Therefore, the theory does not adequately account for the many autistic females diagnosed late whose autistic traits may present differently to males. The FPT on the other hand does go some way to



explain why so many autistic females are diagnosed late, and also why the gender disparity in ASC is not as wide as previously thought. Evidence has shown that although many of the core impairments are the same in autistic boys and girls, females appear to show more positive social behaviours and less externalising behaviours, such as RRBIs and hyperactivity, and instead may internalise their difficulties. This may make identification of autism more difficult. There is also evidence that autistic females may have sex-distinctive cognitive skills and socialisation pressures which might facilitate the use of camouflaging as a strategy to hide impairments and to ‘fit in’ socially. However, camouflaging is likely to have mental health consequences, putting those who use this strategy at greater risk of affective disorders and suicidal behaviours. Furthermore, clinicians may interpret internalised emotional difficulties, behaviours resulting from camouflaging, and co-morbid mental health difficulties as other disorders, which have overlapping features; in particular, undiagnosed autistic girls may be at risk of being misdiagnosed with personality disorders. It is therefore important that further research investigate this population of late diagnosed and undiagnosed autistic women, in order to improve identification and the support available to help tackle co-morbid mental health difficulties resulting from camouflaging and missed diagnosis.

Whilst the research is expanding in the area of diagnosis of autism in women and the use of camouflaging strategies, several key gaps in the literature remain, which this thesis will address. These include:

1. Lack of information about differences between undiagnosed autistic women and diagnosed autistic women on ASC screening measures and the number and nature of co-morbid mental health conditions. This will shed light on the current measures for screening autism and the potential consequences for mental health of living with diagnosed- versus undiagnosed autism.

2. Lack of information about differences between undiagnosed autistic women and diagnosed autistic women on standardised self-report measures of social and emotional functioning, including camouflaging. This evidence will help to evaluate the female phenotype theory, which suggests that autistic women often evade diagnosis due to better social skills than autistic men. Currently we only know about those autistic women who have been identified, and it remains to be seen whether as predicted by the theory the phenotype is even more apparent in those who still remain unidentified.
3. Lack of information about which measures best predict the age of ASC diagnosis in autistic women, and how the age of ASC diagnosis compares to the ages of diagnosis of co-morbid mental health conditions. This evidence will help to identify risk factors for late or missed diagnosis of autism in women, such as greater empathy, superior social functioning, or deliberate camouflaging. By documenting the trajectory of mental health diagnoses over time for autistic women, it will also be possible to highlight common misdiagnoses that occur prior to the autism diagnosis.
4. Lack of experimental research that evaluates observable social behaviours in autistic individuals as a function of self-reported camouflaging. This evidence would show for the first time whether self-reported camouflaging is actually predictive of the social skills of autistic individuals as judged by other people.

This thesis refers throughout to ‘potentially autistic’ individuals, which refers to participants who do not currently have an autism diagnosis, but who score above the set criteria for autism traits on autism screening measures. There currently exist only two validated autism screening tests, the Autism Quotient (AQ) and Ritvo Autism Asperger Diagnostic Scale-Revised (RAADS-r). The AQ was chosen for the purpose of the studies conducted in this thesis, as it is recommended for screening under NICE (2012)

guidelines. Furthermore, the authors of the RAADS-R emphasise that whilst the RAADS-R can go beyond the AQ in also being used as a diagnostic tool rather than just for screening, it needs to be administered by a clinician in a clinical setting (Ritvo et al., 2011). Given that the purpose of this thesis is to identify individuals in the general population who may be potentially undiagnosed, and due to resourcing constraints, it would not be possible to conduct the RAADS-R in a clinical setting. Also, the AQ has been tested wide in large samples from the general population, demonstrating good validity with this audience (e.g. Ruzich et al., 2015). Additionally, the AQ has a higher specificity than the RAADS-R (70% vs 58%) (Sizoo et al., 2016). This means that the AQ is more accurate when it comes to non-autistic individuals screening negatively. Additionally, the positive predictive value of the AQ is slightly higher than the RAADS-R (79% vs 77%), and its negative predictive value lower (45% vs 53%) (Sizoo et al., 2016). This means that the AQ may be slightly better at predicting individuals who will go on to receive an ASC diagnosis and those who will not, which will be advantageous for screening a general population. However, there still remain flaws with this measure. By using this screening tool it is likely that a proportion of potentially autistic participants will not be identified correctly, but it will allow for the identification of the majority of potentially autistic individuals sampled.

Another area of concern is the validity of the instrument for autistic females, particularly those diagnosed late. Sizoo et al. (2016) did not explore differences in predictive value between males and females, and 75.7% of their clinical sample were male. Furthermore, the instrument was created and developed on a predominantly male sample (45 males vs 13 females), and a gender difference between non-autistic males and females was found, with men generally scoring higher (Baron-Cohen et al., 2001). Some items could be argued to reflect a more male-typical presentation of autism. For example, item 15 ('I find myself drawn more strongly to people than things') may be

less likely to be endorsed by autistic women who are motivated to socially camouflage and assimilate with others (Sedgewick et al., 2016). Also, item 41 ('I like to collect information about categories of things, e.g. types of car, types of bird, types of train, types of plant, etc') may not reflect autistic female specific interests, which tend to be perceived as more typical of non-autistic female interests, for example fictional characters and psychology (Hull et al., 2020). Murray et al. (2016) tested 557 autistic females and 680 autistic males, as well as 4,462 non-autistic females and 2,894 non-autistic male controls, in order to determine whether the AQ-10 is an accurate screening tool for both genders. Only two items demonstrated significant differential item functioning between the genders, however one of the items favoured males and the other females, balancing the bias out and eliminating any overall differential test functioning between males and females. These findings support the use of the AQ for both genders, and given this is the most accurate tool available for screening autism in the general population, it will be used throughout this thesis to determine potentially autistic participants.

## **2.4. Thesis Overview**

This thesis aims to fill the gaps in the literature, identified above, in three studies.

Chapter 3 describes a nationwide questionnaire study (Study 1) that aimed to identify women with high autistic traits, which may be indicative of potential autism, across the UK, and to compare these women to already diagnosed autistic women. In particular, this study examined differences between potentially autistic and diagnosed autistic women in scores on the EQ and the relation between EQ and age of ASC diagnosis. It also examined group differences in co-morbid mental health diagnoses to see whether certain mental health conditions are more common in potentially autistic women than diagnosed autistic women, which might indicate misdiagnosis or a

prevalent vulnerability. Results from this study showed that potentially autistic women scored significantly higher on the EQ than those with a diagnosis, although they still demonstrated a significant impairment compared to non-autistic women. This pattern was not observed for males, with both diagnosed and potentially autistic men scoring similarly lower than non-autistic men. The study also found different types of psychiatric diagnosis to be more common in diagnosed woman compared with potentially autistic women, and vice versa. For example, potentially autistic women were more likely to be diagnosed with BPD, whilst significantly more diagnosed autistic females were diagnosed with affective disorders, ADHD, and OCD.

Chapter 4 reports an extension of the initial survey study that looks in greater detail at differences in presentation between potentially autistic women and diagnosed autistic women (Study 2). In particular, it investigated whether there are differences in self-reported social behaviours, social relationships, self-monitoring (a proxy measure of camouflaging), ToM, and anxiety and depression symptoms. For the diagnosed autistic women, whose age of ASC diagnosis was known, the study collected information about ages of co-morbid diagnoses in order to shed light on the typical history of mental health diagnoses. Finally, Study 2 examined whether the age of ASC diagnosis was predicted by the measures of social functioning and camouflaging. This study showed that diagnosed and potentially autistic women performed similarly on measures of friendship, self-monitoring, ToM, and traits of anxiety and depression. However, potentially autistic women did score higher on social functioning, although this was significantly impaired compared to non-autistic women. Furthermore, this study found that diagnosed autistic women received significantly more psychiatric diagnoses than diagnosed autistic men prior to their autism diagnosis being made.

Chapter 5 reports an experimental study that investigated differences between autistic females and autistic males in self-reported camouflaging, and whether executive functioning and ToM affect the probability that individuals use camouflaging as a strategy to hide autistic traits (Study 3). This investigation was only made possible by the invention of the CAT-Q (Hull et al., 2019) that was published after Study 2 taking place. Study 3 also explored whether external observers do indeed tend to form a more favourable impression of autistic women than autistic men based on their social skills, and whether this is related to higher levels of self-reported camouflaging among autistic women. Specifically, participants were filmed in ‘everyday’ conversation and, after viewing each video, non-autistic peers rated each videoed participant on their first impressions and their willingness to socialise with that person. Findings from this study demonstrated that autistic people significantly camouflaged more than non-autistic people, however no gender differences were found. No differences between any groups were found on EF or ToM. However, on first-impression ratings autistic people were rated less favourably than non-autistic people, males were rated less favourably than females, and male raters were harsher in their judgements, particularly of autistic men. This meant that autistic women did make significantly more favourable first-impressions than autistic males, and whilst first-impressions did not correlate with camouflaging, they did correlate positively with age of autism diagnosis.

Together these three studies make important and novel contributions to the existing literature by investigating a hidden population of potentially autistic women who have not previously been explored in detail. This will help provide new evidence as to whether autistic women do have a different phenotype of autism, which may make them harder to identify, more likely to be misdiagnosed, and more vulnerable to mental health difficulties. Furthermore, this research will provide specific evidence as to

whether camouflaging is a successful strategy for autistic women, in one of the first quantitative studies of its kind.





## CHAPTER 3

### Study 1: Screening and Identifying Potentially Autistic Women across the UK

#### 3.1. Introduction

The overarching purpose of this thesis is to explore the reasons why autistic females are often diagnosed later than autistic males or fail to receive an autism diagnosis altogether (Bancroft, 2012), with a focus on the Female Phenotype Theory (FPT) of autism. FPT suggests that autism in women is often missed by clinicians due to autistic females displaying behavioural traits which are different from those displayed by autistic males, and are not the typical traits associated with autism (Kopp & Gillberg, 1992). The main aims of Study 1 were, first, to shed light on the prevalence of undiagnosed female autism in the general population using a large-scale online survey, and second, to compare levels of empathy between diagnosed autistic, potentially autistic, and non-autistic women and men. Participants with diagnosed autism were asked to report the age at which they received their diagnosis. Additionally, participants were asked to list whatever other formal psychiatric diagnoses they had ever received (e.g., GAD, Eating Disorder, BPD). This was to see whether potentially autistic women were more likely to report psychiatric problems, as might occur due to the stress of living with an undiagnosed ASC, the stress of attempting to hide ASC traits, or from being misdiagnosed with other conditions by clinicians who misinterpret their autistic traits.

Baron-Cohen et al. (2009) found evidence that current statistics regarding the prevalence of autism may be grossly under-estimated. They suggested that this is due to the majority of investigations only considering those with diagnoses and/or those considered as more likely to have the condition, such as those whose relatives are autistic or who have children with additional needs (Ehlers & Gillberg, 1993; Gillberg

et al., 1991). For example, Baron-Cohen et al. (2009) surveyed the Special Educational Needs (SEN) register for known cases of ASC as well as screening the mainstream primary school population in Cambridgeshire for unknown cases. The screening involved a diagnostic survey, which was sent to all participating schools to be completed by all parents of 5-9 year old children. The CAST, which is a 37-item screening tests to be completed by parents, was used, and suspected cases were followed up with full ASC assessments using the ADI and the ADOS. Results showed that 0.94% of the SEN population and 0.99% of the mainstream population had an ASC. Further analysis revealed that for every three known cases of ASC there were two unknown cases. These findings suggest that there may be quite a significant number of autistic individuals who remain undiagnosed. No differences were found in the number of unknown cases of boys versus girls, despite finding a prevalence rate of 1.53% in male known cases and only 0.42% in female known cases. However, this result may have occurred because only children were tested, and it could be the case that females are more likely to go into adulthood with undiagnosed ASC compared to males.

To date, few studies have been able to provide estimates for the gender difference in undiagnosed cases of ASC in adulthood. This is probably due to the difficulty in identifying these individuals, given that most may not present in a typical way. Self-assessment screening measures, which can be used in the general population, may therefore be of value in identifying missed cases. Baron-Cohen et al. (2001) developed the AQ to screen for autism. In the process of validating their measure, they tested 174 randomly selected non-autistic controls drawn from 500 adults who were sent the AQ by post to fill in, all living in the East Anglia area (mean age = 37). Using the cut off of  $\geq 32$  to determine possible cases of autism, which was derived from testing the measure on autistic participants, the study was able to determine the number of non-autistic adults in the population who were potentially autistic but who were not diagnosed. 40%

of males scored at or above the intermediate point of the scale (20+) compared to 21% of females, and only 1% of the females scored above the clinical cut off points compared to 3.9% of males. These findings would suggest that whilst there is a possibility of a missed diagnosis for both genders, there are likely to be more males that fit this category than females. This conflicts with the FPT, which suggests that females are more likely to be missed for diagnosis. It should be noted that screening with the AQ cannot give a definite answer as to whether a person is autistic or not, and does rely on the person's own awareness of their difficulties. However, Sizzo et al. (2015) found that shortened versions of the AQ (AQ-28 and AQ-10) correctly identified cases of autism 70% – 72% of the time amongst a sample of 285 adults referred for ASC assessments. This demonstrates that the AQ could be used cautiously to estimate incidences of potential autism. Indeed, NICE guidelines recommend the Adult Asperger's Assessment (AAA) (Baron-Cohen, Wheelwright, et al., 2005) for the diagnosis of adults, which uses the AQ as one of its key tools alongside the EQ and RQ. Sizzoo et al. (2015) found a higher number of males referred for assessments in their sample (75.7%), which could indicate a gender bias in referrals. It is unknown whether those females referred for assessment were more or less likely to receive an ASC diagnosis after scoring above the cut-off on the AQ. Dworzynski et al. (2012) have suggested that girls who score above thresholds for autistic traits (according to the CAST) are less likely to receive a diagnosis than their male counterparts.

While the studies by Baron-Cohen et al. (2001; 2009) suggest that autistic females are not more likely to be undiagnosed, results nevertheless indicate that the prevalence of autism may be higher, and the gender ratio of autistic males to females lower, than originally thought. Furthermore, more recent research has provided support for the FPT, demonstrating that autistic females are indeed diagnosed later (Begeer et al., 2013;

Lai & Baron-Cohen, 2015; Shattuck et al., 2009). For example, Baldwin and Costley (2015) found the mean age of diagnosis to be 25 years amongst a sample of 82 autistic women, and Bancroft (2012) found that only one fifth of girls who took their survey were diagnosed before the age of 11 years, compared to over half of boys. However, these latter studies did not aim to determine prevalence rates or use the random participant selection methods used by Baron-Cohen, et al. (2001; 2009). It is possible that there is a gender bias in these studies examining the FPT, such that late diagnosed autistic women are more motivated to seek information and engage with such studies in order to better understand themselves. Regardless, it is clear that there is great variability in the age of diagnosis for autistic individuals, and that females may be particularly susceptible to being missed in early childhood for reasons discussed next.

The FPT suggests that the reason for the frequently later or missed diagnosis of autistic women is the differences in behavioural manifestation of autistic traits (Kopp & Gillberg, 1992). McLennan et al. (1993) reported that autistic girls were less affected by social and communication behaviour difficulties than autistic boys, a finding which has been supported by more recent research on the subtle social behaviour differences between autistic males and females (Hiller et al., 2014; Hsiao et al., 2013; Rynkiewicz et al., 2016). In particular, Lai et al. (2011) found many similarities between 45 autistic males and 38 autistic females in terms of childhood autistic symptoms, and difficulties with empathising and mentalising. However, the autistic girls were less impaired in socio-communication and demonstrated fewer RRBIs, findings which have also been supported by several other studies (Hiller et al., 2014; Mandy et al., 2012; Ratto et al., 2018; Wilson et al., 2016). Superior functioning in social areas may therefore act as a mask for other autistic traits and hinder diagnosis. Additionally, research has suggested that autistic females may deliberately camouflage their social behaviours in order to ‘fit in’ and appear less atypical (Bargiela et al., 2016; Hull, Lai, et al., 2019).

There are two consequences hypothesised to be the result of this atypical ASC presentation in autistic females, namely, increased mental health issues and increased likelihood of misdiagnosis with other psychiatric conditions. Livingston et al. (2018) have suggested that the process of masking and camouflaging autistic traits uses up valuable resources, resulting in exhaustion and breakdown. This is supported by findings by Cassidy et al. (2018) that self-reported camouflaging traits significantly predicted suicidality in 65 autistic males and 99 autistic females. Hull, Mandy, et al. (2019) also found that self-reported camouflaging traits were significantly, negatively correlated with wellbeing and positively correlated with anxiety and depression. In qualitative studies where autistic women were interviewed regarding their camouflaging behaviours, it has been found that such women often report great emotional consequences of attempting to hide their autism, including exhaustion, depression, anxiety, and self-harm (Hull, Petrides, et al., 2017; Tierney et al., 2016;). Additionally, having a late diagnosis presents its own issues in terms of gaining the correct support and having an unknown condition regardless of the presence of camouflaging. For example, Stagg and Belcher (2019) interviewed nine autistic adults between 52 and 54 years of age (5 females and 4 males) who had received a diagnosis later in life. These participants commonly referred to feelings of alienation as a result of living with a condition they had little or no knowledge about. These findings are supported by Jones et al. (2001) who examined written first-person accounts of the emotional experiences of autism, finding that depression could be caused from not understanding one's differences in comparison to others.

Furthermore, Taylor's (1983) cognitive adaptation model could partially help us to understand why a later diagnosis of autism is so detrimental to mental health, as a diagnosis requires the individual to re-evaluate who they are and rebuild their self-esteem. In conflict with these findings are those by Cassidy et al. (2018), who did not

find significant correlations between age of autism diagnosis and camouflaging, depression, or anxiety. However, it is important to note that the participants in this study were all adults and the mean age of ASC diagnosis was 34. Given the conflicting findings, more studies are needed to explore the link between age of ASC diagnosis, camouflaging of ASC, and mental health.

Another consequence of an atypical ASC presentation in autistic females is likely to be misdiagnosis with other psychiatric conditions. Before exploring this possibility, it is important first to understand the issue of co-morbidity and autism in general, as autistic people are thought to be at a heightened risk of psychiatric illness. Russell et al. (2016) retrospectively reviewed 474 autistic people who had received an ASC diagnosis and compared co-morbid psychiatric diagnoses against those seen in the general population from the UK National Psychiatric Morbidity Survey (McManus et al., 2009). The ASC group were more frequently diagnosed with phobias (16.8% vs 1.4%), generalised anxiety disorder (GAD) (11.8% vs 4.4%), OCD (17.9% vs 1.1%), depression (15.8% vs 2.3%), ADHD (9.7% vs 2.3%), and psychotic disorders (2.1% vs 0.4%) than the general population.

Because psychiatric co-morbidity is high and camouflaging can cause mental health issues, it has been hypothesized that late and missed diagnosis may be the result of misdiagnosis. For example, Lai and Baron-Cohen (2015) suggested that difficulties may arise due to overlapping symptom dimensions to ASC and determining which co-morbid mental health issues are differential diagnoses. Differential diagnoses, whereby a condition has overlapping but also distinct features, could lead to misdiagnosis when the typical behavioural characteristics of autism are hidden. A number of conditions which have overlapping features with autism have been discussed in the literature, including schizophrenia, personality disorders, ADHD, OCD, and affective disorders. It

is possible that without obvious signs of the social impairments characteristic of autism, clinicians may mistakenly diagnose other conditions, which are discussed in turn below.

The original diagnostic criteria for Schizophrenia included many of the same features as autism, such as social withdrawal, flattening affect, eccentricity, having a narrow circle of interests, and lacking sympathy (Bleuler, 1911; Kraepelin, 1919). Whilst the criteria have changed, there are still overlapping attributes. For example, Leitman et al. (2014) found deficits in ToM for both autistic and schizophrenic patients, and catatonic behaviour has been found in 17% of adolescent and adult autism referrals (Wing & Shah, 2000). Furthermore, Aggarwal and Angus (2015) found that 12% of their sample of 31 adults referred for ASC assessments presented with psychotic symptoms, and that childhood ASC and autistic traits increased the likelihood of having psychotic symptoms. Both Fitzgerald and Corvin (2001) and Dossetor (2007) suggest, however, that psychotic symptoms may be misinterpreted in autistic patients by clinicians. Due to difficulties in concrete thinking and ToM, autistic patients may answer that they do hear voices, when they are actually referring to background noises or their own internal voices.

Lehnhardt et al. (2013) conducted a literature search of articles on PubMed that discussed autism and differential diagnoses. They found that personality disorders (PDs) were the most common differential diagnoses made in autistic people. Hofvander et al. (2009) found that 19-32% of autistic patients met the criteria for compulsive PD, 21-26% for schizoid PD, 13-25% for avoidant PD, and 3-13% for schizotypal PD. This supports evidence presented in the previous paragraph regarding the overlapping features of schizophrenia, as both schizoid and schizotypal PD are considered to be associated with schizophrenia. Fitzgerald and Corvin (2001) discussed how schizoid symptoms such as solitariness, empathy deficits, lack of attachment to others, paranoia,

and special interests are all also characteristic of autism. Wolff (Chapter 10, 1998) even described autistic children and those with 'cluster A' PDs as belonging to the same group behaviourally.

Another PD which has frequently appeared in the literature on misdiagnosis is BPD. This may be a more common differential diagnosis for girls and women (Bargiela et al., 2016; Lai & Baron-Cohen, 2015), particularly as in the general population the ratio of females to males with BPD is thought to be 3:1 (APA, 2000). Parents of autistic girls have reported that they had a difficult time getting clinicians to believe their daughters may have ASC, as many focussed instead on signs of mental illness, such as anxiety and self-harm (Rabbitte et al., 2017). Bargiela et al. (2016) found in a group of late-diagnosed autistic women that many had been misdiagnosed before getting their diagnosis, with several mentioning BPD diagnoses being preferred by clinicians over ASC diagnoses. Ryden et al. (2008) found that 15% of their sample of women with BPD also fulfilled criteria for ASC. Fitzgerald (2005) described further the overlapping features in ASC and BPD, such as impulsivity, relationship difficulties, gestures or threats, chronic feelings of emptiness, inappropriate intense anger and/or difficulty controlling anger, and stress-related paranoid ideation.

Another differential diagnosis that may result in misdiagnosis is OCD. Between 2.6% and 37.2% of autistic children and adolescents are thought to have OCD (van Steensel et al., 2011). Ivarsson and Melin (2008) investigated 109 children with OCD using the Autistic Symptom/Syndrome Questionnaire and found that they had a significant number of autistic traits, accounting for 40% of the variance in the model. Fitzgerald and Corvin (2001) likened the OCD traits of repetitive obsessions and compulsions to the repetitive routines seen in autism. However, Postorino et al. (2017)



pointed out that autistic individuals find comfort in their repetitive activities and are not usually distressed by them.

Fitzgerald and Corvin (2001) also described ADHD as a differential diagnosis that has many overlapping features with autism. In particular, impulsivity may make individuals with ADHD appear to be lacking in empathy, and distractibility may be found in autistic people who are highly sensitive to sensory information around them or who are fixated on attending to their special interest above all else. Gillberg and Ehlers (1998) wrote that children who meet criteria for ADHD might also meet those for autism, and Russell et al. (2016) found the prevalence of ADHD to be higher in the autistic population than it was in the general population (9.7% vs 2.3%).

Finally, anxiety and depression also present with some overlapping features with autism. As discussed previously, these two disorders are more common in autistic people than in the general population (Russell et al., 2016). Symptoms which may overlap include social withdrawal and anxiety, flattening affect, and a loss of interests and in relationships (Fitzgerald & Corvin, 2001). Lehnhardt et al. (2013) listed social anxiety, in particular, as one of the most common differential diagnoses with autism. This ties in with evidence regarding the camouflaging of autistic traits by girls and women, who say that they want to be able to 'fit in' better socially (Tierney et al., 2016; Hull, Petrides, et al., 2017).

The consequences of misdiagnosis are likely to include a further delay in gaining an autism diagnosis, which as discussed previously may lead to further mental health problems. Kreiser and White (2014) highlighted the lack of correct treatment and support that individuals with a misdiagnosis will experience. However, no studies to date have explored whether misdiagnosis is indeed common in autistic females, presumably because of the difficult nature of identifying those who might have a

misdiagnosis and in determining whether the misdiagnosis is really a misdiagnosis or, alternatively, a co-morbid diagnosis.

**3.1.1. Aims and hypotheses.** Currently research into autistic women has focussed on individuals with a clinical diagnosis of ASC and little is known about women who meet criteria for ASC but have not received a diagnosis. In a paper addressing evidence gaps and emerging areas of priority in the research of sex differences in autism, Halladay et al. (2015) stressed the need for studies to look at non-clinical samples of undiagnosed autistic females.

In the first instance it would be useful to attempt to replicate those findings made previously by Baron-Cohen et al. (2009), in order to examine whether in the last decade there have been any changes in the number of potentially autistic women compared to potentially autistic men amongst a non-clinical sample. Furthermore, very few studies to date have explored the characteristics of this hidden population, which might explain why they are undiagnosed. Evidence supporting the FPT has largely looked at diagnosed autistic women; but it is important that we understand the profile of potentially autistic women too. If the FPT is accurate then we would expect to see differences in the behavioural manifestations of autism between undiagnosed women and diagnosed men and women, as well as in differential mental health diagnoses that could indicate misdiagnosis.

Study 1 therefore represents a novel attempt to identify a large group of potentially autistic females through a nationally distributed online survey advertised to women and men aged 16-40 years in the general population, and to begin to build a psychological profile of such women, which may lead to this group's earlier identification. This age range was chosen to ensure that findings were not reflective of

historical biases but rather current issues in the identification and diagnosis of autism. Given that Asperger's Syndrome was only introduced by the APA in 1994, and further autism subtypes in 2000, it is reasonable to expect that autistic adults aged 16-40 years would have been able to be identified with an ASC at some point in their childhood or adolescence.

Specifically, Study 1 addressed the following questions and hypotheses:

1. What proportion of women in the sample have high autistic traits, which could be indicative of potential autism but who have not have received a diagnosis? It was predicted that there would be a higher proportion of women than men with a potential ASC.
2. Can this study replicate findings that autistic women tend to be diagnosed with an ASC at an older age than autistic men? It was predicted that autistic females would be diagnosed later than autistic males.
3. Do potentially autistic women have impairments similar to those of diagnosed autistic women on measures used for screening and assessment of ASC? It was predicted that potentially autistic women would demonstrate less impairment than diagnosed autistic women on the EQ and that, among diagnosed autistic women, age of diagnosis would correlate positively with EQ scores. In particular, it was predicted that cognitive empathy (as measured using the 'cognitive empathy' subscale of the EQ) would be less impaired in potentially autistic women, whilst no differences between groups would be found in affective empathy (as measured using the 'emotional reactivity' subscale of the EQ).
4. Are potentially autistic women more prone than diagnosed autistic women to receive other mental health diagnoses? It was predicted that potentially autistic

women would be more likely to report other psychiatric diagnoses, perhaps due to the difficulties of coping with an undiagnosed ASC, the stress of camouflaging ASC traits, or from being misdiagnosed by clinicians. In particular, it was expected that they may have more differential psychiatric diagnoses, which have overlapping features with ASC.

### **3.2. Methods**

The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (Eysenbach, 2012) was used, which has been established to ensure the quality of reports in the medical literature that use online surveys to collect data.

**3.2.1. Participants.** The target population was young adults (aged 16-40) from the UK without a diagnosis of ASC, and a comparison group of young adults with a diagnosed ASC. Due to the nature and novelty of the research (our target group was undiagnosed individuals) the required sample size could not be calculated. Initially, UK universities were targeted for participants, as young adults make up the majority of their populations. Heads of Department (or administrators) from every department in every UK university were contacted requesting them to send the link to the survey and a description of the study to their students. The study was also advertised with the same description on social media via Students' Union pages, and through Facebook advertisements targeted at students aged 16+. Participants with diagnosed ASCs were recruited via university disability services, autism Facebook pages, and through the organisation 'Research Autism'. Non-student participants were also recruited through various media outlets, including in local newspapers. To ensure that a representative sample of the general population was obtained, the adverts used for participant recruitment purposefully did not mention autism, but instead called for participants to

take part in a ‘student screening study’ (see Appendix 1). This made it possible to fairly assess the rates of potentially undiagnosed autism, rather than attracting only respondents with autism or who thought they may be autistic.

In the demographic section of the survey, participants were asked to confirm their age, any psychiatric diagnoses, and their country of birth in order to confirm that they met the criteria for the study.

There were 8,731 responses recorded in total for the first question, which asked participants for their age. Of these, 5,165 individuals completed the whole survey giving a completion rate of 59.16%. Due to the nature of the web-based research, it was impossible to ascertain the total number of individuals that the advertisements for the survey reached, and therefore the response rate is unknown.

Of the participants who completed the survey, 1,324 (25.6%) were male, and 3,841 (74.4%) were female. Of those who reported having an ASC, 27 were male and 153 were female. The average age of diagnosed autistic females was 27.37 ( $SD = 7.193$ ) and for diagnosed autistic males it was 25.19 ( $SD = 6.027$ ). Of those in the potential ASC group, who scored above the clinical criteria on the AQ ( $\geq 32$ ) but who did not have a diagnosis (690 females and 144 males), the average age of females was 29.17 ( $SD = 6.759$ ) and the average age of males was 27.58 ( $SD = 7.210$ ). Of those with no ASC (2,998 females and 1,154 males), the average age of females was 24.46 ( $SD = 6.451$ ) and the average age of males was 22.93 ( $SD = 5.428$ ).

Across the whole sample, 70.3% were students (college, undergraduate, and postgraduate), whilst 24.6% were in employment, and 5.1% were unemployed. Participants were recruited from across the UK and lived in over 70 different counties, with the majority living in London (10.7%), Cambridgeshire (4.6%), West Midlands (3.7%), Essex (3.3%), Strathclyde (3.2%), and Devon (3.1%).

### 3.2.2. Measures

*Mental Health:* Participants were given a checklist containing the common mental health conditions according to the DSM 5 (APA, 2013), including ADHD, Alcohol/Substance Abuse, Anxiety disorders, Bipolar Disorder, Depression, Eating Disorder, OCD, Personality Disorders, and Schizophrenia. They were asked to select any that they had been formally diagnosed with by a clinician, and given the opportunity to select 'other' if they had any condition not listed. Participants were also asked to select whether they had been clinically diagnosed with ASC and, if so, at what age.

*Autism Quotient:* The full 50 item Autism Quotient (AQ) (Baron-Cohen, et al., 2001) was used to screen participants for a potential ASC. The AQ is reported to have good internal consistency and good test-retest reliability ( $r = .7, p = .002$ ) and a cut off score of  $\geq 32$  has been found to be accurate in identifying possible cases of ASC (Baron-Cohen et al., 2001). Sizoo et al. (2016) recently reported 80% accuracy in an undiagnosed population referred for diagnosis, and previously it has been used successfully in large epidemiological studies in non-clinical samples to determine autistic traits in the general population (Lai, et al., 2011; Ruzich et al., 2015).

*Empathy Quotient:* The 40 item version of the Empathy Quotient (EQ) (Baron-Cohen & Wheelwright, 2004) was used to see whether potentially autistic women possess similar impairments as diagnosed autistic women on another measure used for screening and assessment of ASC. The EQ is included alongside the AQ when assessing for ASC (Baron-Cohen, Wheelwright, et al., 2005). The EQ is reported to have excellent test-retest reliability ( $r = .97, p < .001$ ). A cut off score of  $< 30$  has been found useful in identifying those with empathy difficulties; 81.1% of adults with an ASC score

below this cut off. In adults without ASC, females typically score higher than males, indicating less susceptibility to empathy impairments (Baron-Cohen & Wheelwright, 2004). The survey has excellent test-retest reliability in both clinical and non-clinical populations (Lawrence et al., 2004). Lawrence et al. (2004) also established reliable subscales for the EQ, using 79 male and 93 females to factor analyse the scale. Three factors were identified: “cognitive empathy”, which contains 11 items and pertains to an appreciation of emotional states; “emotional reactivity”, which contains 11 items also and pertains to the tendency to experience emotional states in response to others’; and “social skills”, which contains 6 items. Significant gender differences on both empathy subscales were identified but not on social skills. Different factors of the IRI showed concurrent validity with some of the subscales of the EQ, so that ‘emotional reactivity’ significantly correlated with ‘empathic concern’ and ‘perspective taking’ on the IRI, and ‘social skills’ correlated with ‘perspective taking’ also, but none correlated with ‘cognitive empathy’. For the purpose of this study only the two emotional factors were explored separately.

**3.2.3. Design** Participants were grouped by gender and autism status to generate six groups: males versus females diagnosed with an ASC (‘diagnosed autistic/diagnosed ASC’), males versus females without an ASC diagnosis who scored above the criteria on the AQ ( $\geq 32$ ) (‘potentially autistic/potential ASC’), and males versus females without an ASC diagnosis who scored below the criteria on the AQ ( $< 32$ ) (‘non-autistic/no ASC’). A between-subjects analysis was conducted on scores from the questionnaires.

**3.2.4. Procedure.** The survey was designed online using Qualtrics, and tested prior to distribution by three members of the research team who went through the survey as though they were participants. The survey was set to open access allowing

anyone to take the survey. However, it allowed for only one response per participant; this was achieved through the monitoring of cookies. All items were set to forced response, and progression through the survey was dependent on all items being answered (non-response options were provided throughout).

Full ethical approval for the survey and its contents was granted under the terms of Anglia Ruskin University's Policy and Code of Practice for Conduct on Research with Human Participants. Participants were presented with an information page before beginning the survey, which purposefully did not mention autism but instead described the study as an investigation into a gender bias in empathy and behavioural responses; this was to avoid demand characteristics and also to ensure we did not receive a biased sample of only individuals who suspected that they may have autism. Participants were informed that the survey would take around 20 minutes to complete, that an iPad prize was being offered for completion of the survey, and they were also given the contact details of the lead researcher. The first section of the survey collected demographic information, any mental health information, and information about ASC diagnoses. This was followed by two further sections measuring autistic traits and empathy. Finally, participants were fully debriefed. They were informed that the study was specifically looking at ASC and that the questionnaires they had filled out were commonly used as preliminary screening tools, but that scores on these would not be sufficient for a clinical diagnosis. For ethical reasons it was decided that individual scores would not be released to individuals. This was to ensure the data remained anonymous and to avoid causing distress. However, contact details of the National Autism Society were provided. Finally, participants were given the opportunity to leave their email addresses to be entered into the prize draw.



### 3.3. Results

**3.3.1. Data checks and descriptive statistics.** Inspection revealed some departure from normality in the data. This was expected as the participants were assigned to groups according to their questionnaire scores, which necessarily skewed the distribution of their scores across the groups. Additionally, as the study could not control for the number of participants in each group, uneven numbers can be seen across the six groups. Non-parametric tests were therefore employed to analyse the data.

One-way ANOVAs using a Kruskal-Wallis H explored differences between all groups on age and on the EQ, and Mann-Whitney U tests explored pairwise comparisons of these. Mann-Whitney U was also used to explore differences between males and females on age of ASC diagnosis. Bonferroni corrections were applied with comparisons of more than three groups. Spearman's correlation tests were performed to determine correlations between AQ, EQ and age of diagnosis. Finally, Chi-Square tests were used to explore differences in the frequency of other mental health diagnoses across groups, and which specific diagnoses were more prevalent; for this latter analysis particular attention was paid to the differential diagnoses types mentioned in the introduction (Schizophrenia, Schizoid Personality Disorder, BPD, OCD, ADHD, and affective disorders). Where cell counts were less than five, Chi-Squares could not be performed due to problems with accuracy.

Table 3.1 shows group means (and standard deviations) for the AQ and EQ. For the ASC group, the mean age of diagnosis is also presented.

**Table 3.1**

*Descriptive statistics of each group stratified by gender and means for AQ and EQ*

Diagnostic Group	N	Age of	AQ	EQ		
		ASC		Total	Cognitive	Emotional
		diagnosis			Empathy	Reactivity
Females						
ASC	153	23.57	39.75	19.13	2.48	7.03
		(9.34)	(4.38)	(8.56)	(3.00)	(4.16)
Potential ASC	690	-	36.52	23.19	4.48	7.84
			(3.79)	(10.25)	(4.15)	(4.61)
No ASC	2,998	-	18.89	44.37	12.40	12.40
			(6.89)	(12.93)	(5.11)	(5.11)
Males						
ASC	26	16.92	39.50	16.54	2.00	5.38
		(10.14)	(4.22)	(6.94)	(1.98)	(3.70)
Potential ASC	144	-	36.05	19.55	4.08	5.64
			(3.39)	(9.05)	(3.99)	(3.92)
No ASC	1,154	-	19.00	38.17	11.70	9.57
			(6.11)	(12.02)	(4.98)	(4.45)

**3.3.2. Proportion of potential ASC participants.** Of the 3,841 females who took the survey, 17.96% (690) scored above the clinical cut off on the AQ ( $\geq 32$ ) and were classed as being potentially autistic, whilst 3.98% (153) were already diagnosed with ASC. Of the 1,324 males who took the survey, 10.88% (144) scored above the clinical cut off on the AQ and were classed as being potentially autistic, whilst 1.96% (26) were already diagnosed with ASC. Chi-Square analysis revealed that there was a significant difference in the frequency of participants in each group,  $\chi^2(2) = 52.382$ ,  $p < .001$ ,  $\phi = .101$ . Odds ratios revealed that females were 2.3 times more likely than

males to be in the diagnosed ASC group and 1.8 times more likely to be in the potential ASC group.

**3.3.3. Age of diagnosis.** As can be seen from Table 3.1 females were diagnosed later than males. Using a Mann-Whitney U this was found to be significant with a medium effect size:  $U = 1195.00$ ,  $p = .003$ ,  $d = 0.68$ .

Age of diagnosis was categorised as being made either in childhood/adolescence (1-17 years of age) or in adulthood (18+ years of age) for each participant. 73.9% of females were diagnosed at the age of 18 or later ( $n = 113$ ) compared to 44% of males ( $n = 11$ ). This difference was found to be significant:  $\chi^2(1) = 9.064$ ,  $p = .003$ ,  $\phi = .226$ . Autistic women were 3.6 times more likely be diagnosed in adulthood than autistic men.

**3.3.4. Group differences in EQ scores.** For both males and females, the diagnosed ASC and potential ASC participant groups scored on average below the cut-off on the EQ ( $< 30$ ), indicating empathy impairments.

For females, the differences between the three groups on EQ were significant:  $\chi^2(2) = 1296.589$ ,  $p < .001$ . Diagnosed ASC participants scored lowest, followed by potential ASC participants, and no ASC participants. A Bonferroni corrected  $p$  value of 0.02 was established for pairwise comparisons, which found a significant difference with large effect sizes between the diagnosed ASC and no ASC groups ( $U = 25660.00$ ,  $p < .001$ ,  $d = 2.30$ ), the potential ASC and no ASC groups ( $U = 216368.00$ ,  $p < .001$ ,  $d = 1.82$ ), and a significant difference but with a smaller effect size between the diagnosed ASC and potential ASC groups ( $U = 40045.50$ ,  $p < .001$ ,  $d = 0.43$ ). A significant difference was found between all three female groups on the ‘cognitive empathy’ scale:  $\chi^2(2) = 1235.11$ ,  $p < .001$ . Diagnosed ASC participants scored lowest, followed by potential ASC participants, and no ASC participants. Applying Bonferroni corrections, a significant difference with large effect sizes was found between the diagnosed ASC

and no ASC groups ( $U = 23987.00, p < .001, d = 2.37$ ), the potential ASC and no ASC groups ( $U = 245633.00, p < .001, d = 1.70$ ), and a significant difference but with a medium effect size between the diagnosed ASC and potential ASC groups ( $U = 36615.00, p = .001, d = 0.55$ ). A significant difference was found between all three female groups on the ‘cognitive empathy’ scale:  $\chi^2(2) = 671.409, p < .001$ . Diagnosed ASC participants scored lowest, followed by potential ASC participants, and no ASC participants. Applying Bonferroni corrections, significant differences with large effect sizes were found between the diagnosed ASC and no ASC groups ( $U = 78200.50, p < .001, d = 2.15$ ), and between the potential ASC and no ASC groups ( $U = 451474.500, p < .001, d = 0.94$ ), but no significant differences were found between the diagnosed ASC and potential ASC groups ( $U = 47663.500, p = .060$ ).

A similar pattern was observed for the males, with a significant difference found between the three groups:  $\chi^2(2) = 286.995, p < .001$ . The ASC participant group scored lowest, followed by the potential ASC participant group, and the no ASC participant group. Applying Bonferroni corrections, significant difference with large effect sizes were found between the ASC and no ASC groups ( $U = 1661.50, p < .001, d = 2.20$ ), and the potential ASC and no ASC groups ( $U = 17719.50, p < .001, d = 1.75$ ), but no significant differences were found between the ASC and potential ASC groups ( $U = 1527.50, p = .136$ ). A significant difference was found between all three male groups on the ‘cognitive empathy’ scale:  $\chi^2(2) = 283.025, p < .001$ . The diagnosed ASC group scored lowest, followed by the potential ASC group, and the no ASC group. After Bonferroni corrections, significant differences with large effect sizes were found between the diagnosed ASC and no ASC groups ( $U = 1048.500, p < .001, d = 2.56$ ), and the potential ASC and no ASC groups ( $U = 19167.500, p < .001, d = 1.69$ ), and a significant difference but with a medium effect size was found between the diagnosed ASC and potential ASC groups ( $U = 1251.00, p = .007, d = 0.66$ ). A significant

difference was found between all three male groups on the ‘emotional reactivity’ scale:  $\chi^2(2) = 107.929, p < .001$ . The diagnosed ASC group and potential ASC group scored similarly, and lower than the no ASC group. After Bonferroni corrections, significant differences with large effect sizes were found between the diagnosed ASC and no ASC groups ( $U = 7183.00, p < .001, d = 1.02$ ), and the potential ASC and no ASC groups ( $U = 42672.00, p < .001, d = 0.96$ ), but no significant difference were found between the diagnosed ASC and potential ASC groups ( $U = 1824.00, p = .835$ ).

A Bonferroni corrected  $p$  value of 0.02 was established for pairwise comparisons between males and females per group, revealing a non-significant difference in the EQ scores for ASC participants ( $U = 1651.00, p = .166$ ). However, a significant difference with a small effect size was found between the potentially autistic males and females ( $U = 3964.30, p < .001, d = 0.38$ ), with potentially autistic females scoring higher than potentially autistic males. Similarly, there was a significant difference between non-autistic males and females ( $U = 1244328.00, p < .001, d = 0.50$ ), with non-autistic females scoring higher than non-autistic males. For the cognitive empathy subscale there was no significant differences between males and females for the diagnosed ASC group ( $U = 1953.50, p = .882$ ) or the potential ASC group ( $U = 47137.50, p = .331$ ), but there was a significant difference with a small effect size between non-autistic males and females ( $U = 1589362, p < .001, d = 0.14$ ). On the emotional reactivity subscale there was no significant differences between males and females in the ASC group ( $U = 1551.00, p = .072$ ), but there was in the potential ASC group ( $U = 36179.50, p < .001, d = 0.51$ ) and the no ASC group ( $U = 1022391.00, p < .001, d = .59$ ).

**3.3.5. Exploring the age of autism diagnosis.** Correlations were performed to determine whether later diagnosis was associated with higher EQ scores amongst males

and females in the diagnosed ASC group. Because age of diagnosis was significantly, positively correlated with current chronological age for both genders,  $p$  values  $< .001$ , age was entered as a control variable. Results were not significant when both males and females in the ASC group were analysed together: partial  $r(175) = .033, p = .660$ . Likewise, when considered separately, results were not significant for either females, partial  $r(150) = .053, p = .519$ , or males, partial  $r(22) = -.250, p = .240$ . Furthermore, age of diagnosis did not show a significant correlation for the cognitive empathy subscale (partial  $r(175) = -.016, p = .832$ ) or the emotional reactivity subscale (partial  $r(178) = .074, p = .326$ ). Likewise, when considered separately, results were not significant for either females, partial  $r(150) = .036, p = .656$  and partial  $r(150) = .079, p = .33$ , or males, partial  $r(22) = -.360, p = .077$  and partial  $r(22) = -.159, p = .449$ .

**3.3.6. Group differences in mental health diagnoses.** As can be seen from Table 3.2 a higher frequency of females in the diagnosed ASC group had one or more ‘other’ psychiatric diagnoses than females in the potential ASC and no ASC group, whilst a higher frequency in the potential ASC group had one or more other psychiatric diagnoses than females in the no ASC group. The difference between groups was found to be significant,  $X^2(2) = 246.686, p < .001, \phi = .253$ . Females in the diagnosed ASC group were 1.6 times more likely than those in the potential ASC group and 4.9 times more likely than those in the no ASC group to have one or more other psychiatric diagnoses. Females in the potential ASC group were 3.1 times more likely than those in the no ASC group to have one or more other psychiatric diagnoses.

**Table 3.2**

*Frequency of individuals in each diagnostic group diagnosed with one or more psychiatric disorders other than ASC*

Diagnostic Group	1 + Other Psychiatric Diagnosis	No Other Psychiatric Diagnoses
Females		
ASC	102 (66.7%)	51 (33.3%)
Potential ASC	387 (56.1%)	303 (43.9%)
No ASC	872 (29.1%)	2126 (70.9%)
Males		
ASC	14 (53.8%)	12 (46.2%)
Potential ASC	49 (34.0%)	95 (66.0%)
No ASC	189 (16.4%)	965 (83.6%)

A similar pattern can be observed for male participants, with a higher frequency of males in the diagnosed ASC group having one or more other psychiatric diagnoses than males in the potential ASC and no ASC group, whilst a higher frequency in the potential ASC group had one or more other psychiatric diagnoses than males in the no ASC group. The difference between groups was found to be significant,  $\chi^2(2) = 46.737$ ,  $p < .001$ ,  $\phi = .188$ . Males in the diagnosed ASC group were 2.3 times more likely than those in the potential ASC group and 6 times more likely than those in the no ASC group to have one or more other psychiatric diagnoses. Males in the potential ASC group were 2.6 times more likely than those in the no ASC group to have one or more other psychiatric diagnoses.

Comparing males with females in each group, there were no significant differences between males and females in the diagnosed ASC group,  $\chi^2(1) = 1.602$ ,  $p = .206$ ,  $\phi = .095$ . However, a significant difference between males and females was found in the potential ASC group,  $\chi^2(1) = 23.237$ ,  $p < .001$ ,  $\phi = .167$ . Females in the potential

ASC group were 2.5 times more likely than males in this group to have one or more other psychiatric diagnoses. A significant difference was also found between males and females with no ASC,  $\chi^2(1) = 70.738, p < .001, \phi = .131$ . Females in the no ASC group were 2.1 times more likely than males in this group to have one or more other psychiatric diagnoses.

**3.3.7. Differential psychiatric diagnoses in diagnosed ASC and potential ASC.** As can be seen from Table 3.3 a higher frequency of females in the potential ASC group had a diagnosis of BPD compared to those in the diagnosed ASC group and the no ASC group. Females in the diagnosed ASC group also had a higher frequency of BPD diagnoses than those with no ASC. The difference between groups was found to be significant,  $\chi^2(2) = 47.719, p < .001, \phi = .111$ . Females in the potential ASC group were 1.3 times more likely than those in the diagnosed ASC group and 5.7 times more likely than those in the no ASC group to have a BPD diagnosis. Females in the diagnosed ASC group were 4.6 times more likely than those with no ASC to have a BPD diagnosis.



**Table 3.3**

*Frequency of autistic individuals versus potentially autistic individuals reporting specific psychiatric diagnoses*

Diagnosis	Females			Males		
	ASC	Potential	No ASC	ASC	Potential	No ASC
	ASC			ASC		
Schizophrenia	1 (0.7%)	3 (0.4%)	2 (0.1%)	0 (0.0%)	1 (0.7%)	2 (0.2%)
Schizoid PD	0 (0.0%)	1 (0.1%)	2 (0.1%)	1 (3.8%)	1 (0.7%)	3 (0.3%)
BPD	5 (3.3%)	28 (4.1%)	22 (0.7%)	1 (3.8%)	0 (0.0%)	5 (0.4%)
OCD	13 (8.5%)	42 (6.1%)	53 (1.8%)	4 (15.4%)	3 (2.1%)	19 (1.6%)
ADHD	12 (7.8%)	13 (1.9%)	25 (0.8%)	2 (7.7%)	2 (1.4%)	14 (1.2%)
Affective Disorder	97 (63.4%)	358 (51.9%)	756 (25.2%)	12 (46.2%)	38 (26.4%)	149 (12.9%)

A higher frequency of females in the diagnosed ASC group had an OCD diagnosis than females in the potential ASC and no ASC groups, and those in the potential ASC groups had a higher frequency than those in the no ASC group. The difference between groups was found to be significant,  $\chi^2(2) = 57.135, p < .001, \phi = .122$ . Females in the diagnosed ASC group were 1.4 times more likely than those in the potential ASC group and 5.2 times more likely than those in the no ASC group to have

an ASC diagnosis. Females in the potential ASC group were 3.6 times more likely than those in the no ASC group to have an OCD diagnosis.

A higher frequency of females in the diagnosed ASC group had an ADHD diagnosis than females in the potential ASC and no ASC groups, and those in the potential ASC groups had a higher frequency than those in the no ASC group. The difference between groups was found to be significant,  $\chi^2(2) = 57.885, p < .001, \phi = .123$ . Females in the diagnosed ASC group was 4.4 times more likely than those in the potential ASC group and 10.1 times more likely than those in the no ASC group to have an ADHD diagnosis. Females in the potential ASC group were 2.3 times more likely than those in the no ASC group to have an ADHD diagnosis.

Lastly, a higher frequency of females in the diagnosed ASC group had an affective disorder diagnosis than females in the potential ASC and no ASC groups, and those in the potential ASC groups had a higher frequency than those in the no ASC group. The difference between groups was found to be significant,  $\chi^2(2) = 259.745, p < .001, \phi = .260$ . Females in the diagnosed ASC group were 1.6 times more likely than those in the potential ASC group and 5.1 times more likely than those in the no ASC group to have an affective disorder. Females in the potential ASC group were 3.2 times more likely than those with no ASC to have an affective disorder.

Chi- Squares could not be calculated for Schizophrenia and Schizoid PD as the frequency count was too low. Likewise, results for other psychiatric diagnoses for males were not analysed as the frequency count was too low.

### **3.4. Discussion**

Previous literature has suggested that autistic women may miss being diagnosed or be misdiagnosed with other conditions. The FPT suggests that this is because autistic females show fewer autistic characteristics than autistic males (Kopp & Gillberg, 1992).

However, very few studies examining this theory have explored non-clinical samples of autistic women who do not have a diagnosis. It is vital that this population is explored, as research is unable to confirm the FPT when only knowledge of those who have received a diagnosis is available. Therefore, the aim of this study was to try to identify a sample of women with high autistic traits indicative of a potential ASC diagnosis and to compare them with women who had received a formal ASC diagnosis. As well as this, the study aimed to examine the possible mental health implications of being undiagnosed, and whether women with a potential ASC are more likely to report psychiatric problems, which might occur due to the stress of living with an unknown condition, the exhaustion of attempting to hide traits, or as a result of clinicians misinterpreting symptoms.

Firstly, it was predicted that a larger number of women than men would be identified as being potentially autistic. This hypothesis was supported, as it was found that almost 18% of women and 11% of men were potentially autistic according to the AQ screening tool. This is a much larger proportion than expected. Baron-Cohen et al. (2009) discovered that 1% of the general population of children in their sample were potentially autistic, and although it may be argued that parental assessments are less accurate, Baron-Cohen et al. (2001) used the AQ on adults and found 1% of females and 3.9% of males in the general population were potentially autistic without a diagnosis. Taking into account the identification accuracy percentage put forward by Sizzo et al. (2015) of around 70%, these figures still remain high. It may be the case that with growing autism awareness individuals now have more insight into their own autistic traits. However, it is probable that the sample collected in the present study was heavily biased given that a higher prevalence of diagnosed autistic women took part in the survey than previous prevalence surveys on the general rates of autism diagnosis had estimated (3.98% vs 1.7%) (Russell, 2014). This suggests that whilst measures were

taken to avoid sharing the wider aims of the research initially, the true purpose of the survey was likely to be discovered by participants. This may have happened as result of the debrief being given out prior to all participants completing the study, and the subsequent media attention the study received. Thus the study may have attracted more late-diagnosed women and women who might have been aware of their high autistic traits but who may have not yet received a diagnosis. This limitation is discussed in more detail in the General Discussion (Chapter 6). Regardless of concerns around estimating the prevalence rates in this cohort, the aim of the study was to identify a group of potentially autistic women, which this study has achieved.

As predicted, the diagnosed autistic women in this sample were diagnosed significantly later than autistic men, around the age of 23.57 compared to 16.92. These results confirm those made previously; for example, Bancroft (2012) found that 58% of their sample did not receive a diagnosis until after the age of 18, with a mean age of diagnosis around 25. It should be noted that the autistic men in this sample were also diagnosed significantly later than previous studies have estimated. The average age of diagnosis for autism has been found to be between the ages of 3 to 10 years (Brett et al., 2016; Crane et al., 2016; Daniels & Mandell; 2014; Williams et al., 2008). It is likely that due to the small sample size of autistic men, this figure has been skewed by several late-diagnosed participants. However, findings from the current study, that the majority of autistic women were diagnosed in adulthood and the majority of autistic men were diagnosed in childhood, with autistic women being 3.6 times more likely to have received their diagnosis in adulthood compared to autistic men, are clearly in line with previous research.

In terms of the EQ scores, it was hypothesized that females in the potential ASC group would demonstrate less impairment on the EQ than females in the diagnosed

ASC group, and that for females in the diagnosed ASC group, the age of diagnosis would correlate positively with the EQ score. Findings only partially supported these predictions; whilst age of diagnosis did not correlate with EQ score, a slight empathy advantage was found for women in the potential ASC group. This was not the case for males in the potential ASC group, who scored similarly to diagnosed autistic males. Regardless of this slight advantage, both males and females in the potential ASC group demonstrated empathy impairments relative to participants without an ASC. However, both males and females in the potential ASC group showed a significant advantage on the cognitive empathy subscale over participants in the diagnosed ASC group, but similar levels of emotional reactivity. This is in line with previous findings, which have suggested that it is cognitive empathy rather than affective empathy that is affected in diagnosed autistic individuals (Mul et al., 2018). Nevertheless, it should be noted that the emotional reactivity subscale does not fully measure affective empathy, as it fails to take into account levels of personal distress, and therefore cannot determine whether the reaction is self-orientated or a reflection of affective empathy for others (Lawrence et al., 2004). It was argued earlier that empathy might be able to assist in improved socialisation and help autistic individuals to mask their traits and ‘fit in’ with others, which autistic females have been found to be better at than autistic males (Hiller et al., 2014; McLennan et al., 1992). The current finding that there was no difference in empathy between females and males in the ASC group are in line with those by Lai et al. (2011), who also failed to uncover differences between autistic males and autistic females on impairments in empathising. Despite this, their study still found less socio-communicative difficulties in autistic women, suggesting that other factors are at play in the later diagnosis of autistic women. It would appear that those with a potential ASC are impaired on screening questionnaires relative to those without an ASC but may demonstrate slight advantages relative to those with a diagnosed ASC.

In terms of mental health diagnoses other than ASC, it was predicted that more females in the potential ASC group would have one or more psychiatric diagnoses than those in either the diagnosed ASC group or the no ASC group. This was not found to be the case. Whilst the potential ASC group reported more psychiatric diagnoses than those in the no ASC group, those in the diagnosed ASC group were the most likely to have other psychiatric diagnoses. Nevertheless, whilst there was no difference in the frequency of psychiatric diagnoses between males and females in the diagnosed ASC group, females in the potential ASC group were 2.5 times more likely than males in the same group to have one or more psychiatric diagnoses. The same pattern was observed when comparing males and females in the no ASC group. These findings appear to conflict with previous literature suggesting that undiagnosed autistic females may be at a raised risk of mental health problems due to the stress of camouflaging and masking autistic traits (Hull, Mandy, et al., 2019; Livingston et al., 2018; Stagg & Belcher, 2019), although it is important to note that the current study is the first to compare potentially autistic females with diagnosed autistic females. Possibly, women with an ASC diagnosis had tended to collect other formal psychiatric diagnoses because they are known to mental health services and may even have received other diagnoses at the time of their ASC diagnosis. This suggestion is supported by the finding that autistic females were not more likely than autistic males to have other psychiatric diagnoses, despite females generally being more likely to have one or more psychiatric diagnoses in the general population. Alternatively, it is possible that those with a diagnosed ASC may be more vulnerable to mental health problems as a result of the stigma associated with diagnosis, or due to more severe impairments.

In contrast, the prediction that females in the potential ASC group would be more likely to have diagnoses that could be classed as differential diagnoses due to overlapping features with ASC, in particular BPD, *was* supported. Females in the

potential ASC group were found to be 1.3 times more likely than females in the diagnosed ASC group and 5.7 times more likely than females in the no ASC group to have a diagnosis of BPD. This supports previous literature which has suggested that clinicians may diagnose BPD over ASC due to a similarity in symptoms (Bargiela et al., 2016; Lai & Baron-Cohen, 2015; Ryden et al., 2008; Rabbitte et al., 2017). For example, both autistic women and women with BPD may demonstrate difficulties in relationships, regulating their emotions, impulsivity, and stress-related paranoid ideation (Fitzgerald, 2005). With classic signs of autism masked, such as RRBIs and socio-communication problems, clinicians may favour diagnosing BPD, which is more commonly seen in females in the general population (APA, 2000). However, without a full ASC assessment of these potentially autistic women, we cannot determine for sure if they have been misdiagnosed with BPD or whether this is a co-morbid condition.

All other differential psychiatric diagnoses (OCD, ADHD, and affective disorders), were found to be more prevalent in women in the diagnosed ASC group. There appeared to be no differences between groups for Schizophrenia or Schizoid PD diagnoses, although numbers were too small to calculate significant differences. Rates of OCD in the female diagnosed ASC group were slightly lower than those found by Russell et al. (2016) (8.5% vs 17.9%), although higher than those found in this study in the general population (4.4%). ADHD rates were more similar (7.8% vs 9.7%), and again higher than found in the general population (2.3%). Affective disorders were grouped together in the current study, making it difficult to compare to Russell et al.'s (2016) figures, although when grouped together the current study's appeared to be higher (63.4% vs 44.4%). It should be noted that Russell et al.'s (2016) study was based on both autistic males and females, whereas the current study has only been able to examine the female data. This may explain some of the slight discrepancies in figures.

Higher rates of ADHD and OCD among those women who were diagnosed than those who are were potentially undiagnosed are in line with arguments put forward by Dworzynski et al. (2012), who suggest that in order for girls to be diagnosed with autism they require a greater number of external behavioural problems than boys. In their study, females who scored high on the CAST but who had less hyperactivity and behavioural problems, possibly due to internalising of traits, were less likely to receive a diagnosis than females and males with these presenting issues. This may explain why diagnosed women in the current study were more likely to have ADHD and OCD than potentially autistic women, as they possess some external behavioural symptoms.

Taken together, results of Study 1 provide some support for the FPT. In particular, the types of other psychiatric diagnoses seen in females in the potential ASC group compared to those seen in the diagnosed ASC group suggest different behavioural manifestations of symptoms. However, further examination of potentially autistic women is required to fully understand their profile. For example, the current study has not tested whether those females in the potentially autistic group present with less social impairments than those who are diagnosed, as the FPT would suggest, especially given their slight empathy advantage. Accordingly, Study 2 explores differences in social functioning between diagnosed autistic females and potentially autistic females, as well as the association between social functioning and self-monitoring (a proxy for camouflaging). Secondly, Study 1 only looked at diagnosed psychiatric conditions. As already discussed, it is possible that those with an autism diagnosis are better known to services and therefore more likely to receive other psychiatric diagnoses from clinicians. Therefore, Study 2 compared diagnosed autistic and potentially autistic women for undiagnosed mental health problems by administering self-report measures of depression and anxiety. Finally, for diagnosed autistic women, information was collected not only about the age of ASC diagnosis but



the ages of all other psychiatric diagnoses. In this way, Study 2 aimed to build a typical timeline of mental health diagnoses among women with autism.



## CHAPTER 4

### **Study 2: A Comparison of Social, Emotional, and Behavioural Traits between Potentially Autistic Females and Diagnosed Autistic Females**

#### **4.1. Introduction**

In Chapter 3 a large number of potentially autistic women without diagnoses were identified. These women had a slight but significant empathy advantage relative to diagnosed autistic females, specifically in cognitive empathy, were more likely to be diagnosed with BPD than diagnosed autistic females, and were more likely to have one or more other psychiatric diagnoses than their male counterparts. However, diagnosed autistic females were equally as likely as diagnosed autistic males, and more likely than potentially autistic women, to have one or more psychiatric diagnoses. Additionally, they were more likely to be diagnosed with ADHD, OCD, and affective disorders than potentially autistic women. This study left several key questions unanswered, which this chapter aims to address. The first question is why might these potentially autistic women be undiagnosed? More specifically, as well as a slight empathy advantage, do these women also have better social skills and do they use camouflaging strategies to mask autistic traits? Secondly, whilst potentially autistic women may have fewer mental health diagnoses than diagnosed autistic women, might they still have higher traits of anxiety and depression that have not been diagnosed? Finally, do diagnosed autistic women tend to receive their other psychiatric diagnoses before or after their ASC diagnosis?

The FPT (Kopp & Gillberg, 1992) suggests that one of the reasons why autistic females may have a missed or late diagnosis is because they often have a different manifestation of autistic traits, which acts as a mask. For example, Dworzynski et al.

(2012) suggest that in order for girls to be diagnosed with autism they require a greater number of external behavioural problems than boys. Girls who scored above the cut-off on the CAST, which was filled in by parents, but who did not meet the full diagnostic criteria, were less likely to be diagnosed as autistic than their male equivalents (38% vs 56%). Additionally, these girls had fewer social autistic traits than diagnosed girls (partial  $\eta^2 = .09$ ). This study stresses the importance of investigating undiagnosed yet high autistic trait scoring females, who may be undiagnosed due to exhibiting less challenging and observable behaviours. The majority of studies investigating differences between autistic males and females rely on already diagnosed individuals, which means the females will have displayed enough autistic traits to be sent for diagnosis (Halladay et al., 2015).

Women who are potentially autistic but undiagnosed may be more motivated to intentionally camouflage in social situations to disguise their autism. Research investigating the social behaviours of autistic females, has found that they show some advantages over autistic males, which may support the FPT. For example, Hiller et al. (2014) compared 69 autistic girls with 69 autistic boys (mean age 8-9 years) on clinician and teacher reports about social functioning. The autistic girls were 14 times more likely than the autistic boys to engage in typical reciprocal conversation, 3.5 times more likely to engage in imaginative play typical for their developmental age, and 6 times more likely to show some adjustment of their behaviours across situations. This included the ability to monitor voice volume and avoid inappropriate comments and public meltdowns. This may mean that the behaviour of autistic girls appears less atypical than that of autistic boys to others observing them.

The ability to monitor social behaviours can be referred to as ‘self-monitoring’, which Snyder (1974) developed a scale to measure. The Self-Monitoring Scale (SMS)

looks at individuals' ability to monitor their own inner state, the social situations they are in, and to change and monitor their own behaviour accordingly to fit into different social contexts. Whilst the measure has not previously been used with autistic people, it seems reasonable to suppose that it might be a useful tool to examine whether autistic females try harder than autistic males to camouflage their autistic traits. For example, Ickes and Barnes (1977) found that non-autistic females scored higher on self-monitoring than non-autistic males, which therefore may indicate a general female advantage. Furthermore, Snyder (1974) found that peers of individuals with high SMS scores thought that they were good at learning how to behave in socially acceptable ways in new situations and were good impression makers, and that high self-monitoring scorers were more likely than low self-monitoring scorers to seek out social comparison information about their peers. Estow et al. (2007) reported that students mimicked videotaped individuals more if they were high self-monitors, and Schaffer et al. (1982) found that high self-monitoring individuals were more likely than low self-monitors to mimic a confederate. Given that social mimicking is thought to be a key strategy in camouflaging by autistic females, who have been found to closely observe the behaviour of others to copy in different social contexts (Atwood & Grandin, 2006; Baldwin & Costley, 2016; Hull, Petrides, et al., 2017; Tierney et al., 2016), the SMS could give some indication as to whether potentially autistic women are using social strategies that mask their autistic traits.

Some studies have found that autistic girls also have an advantage over autistic boys on measures of friendship, which may be related to a better ability to adapt in different social settings, and reduced atypical behaviours. For example, Sedgewick et al. (2016) compared 13 autistic girls with 10 autistic boys, 13 non-autistic girls, and 10 non-autistic boys on friendship motivation and experience using the Social Responsiveness Scale (SRS-2) and Friendship Qualities Scale (FQS). Autistic girls were

found to score similarly to non-autistic girls on the social motivation (SRS-2) and closeness (FQS) subscales, which was significantly higher than autistic males ( $d = 0.89$  and  $1.15$  respectively). In addition to these findings, Dean et al. (2017) found that autistic girls participated in more ‘joint engagement’ with other groups of girls during play at school, whilst the autistic boys spent more time by themselves in ‘solitary’ play. However, these autistic girls often appeared to take a background role, flitting between activities to appear to be engaged, when actually they were spending more time than non-autistic girls by themselves. These findings suggest that autistic girls have some awareness of the social environment around them, and that they are more motivated to try and ‘fit in’ than autistic males. This could again hide autistic girls’ social impairments. However, in a previous study where autistic adults were tested using the Friendship Quotient (FQ) (Baron-Cohen & Wheelwright, 2003), whilst autistic participants were found to score significantly worse than non-autistic participants, no gender differences were found between autistic males ( $n = 51$ ) and autistic females ( $n = 17$ ). Autistic females scored on average  $59.8$  ( $SD = 25.1$ ) compared to autistic males who scored on average  $53.2$  ( $SD = 18.3$ ). This null finding could reflect the small number of autistic females tested in comparison to autistic males, resulting in low power to detect a group difference, or it may be the case that when this study was conducted in 2003, many autistic females with heightened social skills and better friendships were not yet diagnosed. It would be useful, therefore, to investigate whether potentially autistic women perform better on the FQ than diagnosed autistic women.

As discussed in previous chapters, a probable consequence of autistic females camouflaging and masking their autism is greater mental health problems (Cassidy et al., 2018; Hull, Mandy, et al., 2019). Livingston et al. (2018) suggested that this was because techniques which mask autism use up valuable cognitive resources. Whilst Study 1 looked at incidences of different types of mental health diagnosis in potentially

autistic women compared to diagnosed autistic women, as yet research has not investigated whether potentially autistic females suffer more depressive and anxiety related symptoms than diagnosed autistic women. If their autism is undiagnosed because of greater camouflaging ability then we might expect better social functioning at the expense of mental health, due to the increased stress of maintaining this mask.

There is currently a gap in the literature on the topic of the FPT. Several studies have explored social behaviour differences between autistic males and autistic females, but only one has considered the large number of potentially autistic females (Dworzynski et al., 2012), who could be expected to be even better at hiding their autistic traits than their diagnosed peers. However, this study looked at children only. This chapter therefore aims to once again explore a group of potentially autistic women, looking in more detail at what subtle differences in social behaviours they show compared to diagnosed autistic females.

**4.1.1. Aims and hypotheses.** Previous literature has suggested that autistic women may be diagnosed later due to a lack of social impairments and increased social camouflaging. Furthermore, Study 1 uncovered a large number of potentially autistic women who had a significant empathy advantage over those with a diagnosis. Several key questions remain unanswered about this population, which Study 2 aims to address. These include the following:

1. Do potentially autistic women demonstrate an advantage in social abilities relative to diagnosed autistic women? It was predicted that potentially autistic women would demonstrate better self-monitoring, friendship quality, social functioning, and ToM.
2. Is greater empathy associated with better social abilities? It was predicted that all three groups of female participants would show positive correlations between

empathy, particularly cognitive empathy, self-monitoring, friendship quality, social functioning and ToM.

3. Is the age of autism diagnosis for autistic women predicted by social abilities? It was predicted that age of autism diagnosis would be correlated positively with measures of self-monitoring, friendship quality, social functioning, and ToM.
4. Study 1 found that autistic women were more likely to have other mental health diagnoses than potentially autistic women, but might potentially autistic women still demonstrate more depressive and anxiety symptoms? It was predicted that potentially autistic women would score higher on self-report measures of depression and anxiety.
5. In women with a diagnosed ASC, what is the typical timeline on which they receive their additional mental health diagnoses? It was predicted that for most such women, their other mental health diagnoses would tend to be received at a younger age than their ASC diagnosis.

Although the main objective of Study 2 was to compare results for potentially autistic and diagnosed autistic women, male participants and non-autistic women were also included in the sample. Where numbers permitted, these groups were included in the analyses.

## **4.2. Method**

**4.2.1. Participants.** The current study had the same 2 (gender) x 3 (group) design as used in Study 1, with a target population of young adults (aged 16-40) from the UK. Some of the sample was derived from the previous study; all participants who left their email addresses and gave consent to be re-contacted were sent the second survey. As the number of males in the previous sample was quite low and numbers could be expected to drop for the follow-up study, the new survey was also re-advertised through social



media and through autism groups and autism research centres in the hope of increasing the number of males participating. Using G Power 3.1.9.2 with an alpha level of 0.05, a power level of 0.95, and an effect size of 0.3, which was based on Study 1's findings, a minimum of 226 participants was required for conducting an ANOVA with six groups. Again, the adverts used for participant recruitment purposefully did not mention autism, but instead called for participants to take part in a study looking at 'gender differences in social awareness and motivation'.

1,005 individuals who met the criteria began taking the survey, 390 of these responses came from participants emailed from the previous survey (10.14% of previous participants re-contacted). A total of 513 people completed the entire survey, of whom 372 were previous participants re-contacted and 141 were new participants.

Of the participants who completed the survey, 103 were males, 402 were females, and 8 identified as 'other' or preferred not to say. Of all participants, 41 claimed the gender they now identified with was different to the gender they were assigned at birth. Of those who reported having a diagnosed ASC, 90 were female and 27 were male. The average age of diagnosed autistic females was 28.84 ( $SD = 6.193$ ), and 26.56 ( $SD = 6.216$ ) for diagnosed autistic males. Of those in the potential ASC group, who scored above the clinical criteria on the AQ ( $\geq 32$ ) but who did not have a diagnosis (77 females and 9 males), the average age of females was 30.56 ( $SD = 5.819$ ) and the average age of males was 26.67 ( $SD = 7.517$ ). Of those with no ASC (235 females and 67 males), the average age of females was 26.24 ( $SD = 5.574$ ) and the average age of males was 25.42 ( $SD = 5.252$ ).

56.9% were either in full-time or part-time employment, 31.7% were in higher education, and 11.5% were unemployed and not students. Participants were spread across the UK and lived in over 60 different counties, with the majority residing in

Cambridgeshire (10.3%), Greater London (8.7%), Essex (4.5%), Surrey (4.3%), West Yorkshire (4.1%), and Greater Manchester (3.7%).

#### **4.2.2. Measures**

*AQ*: The full 50-item Autism Quotient (AQ) (Baron-Cohen et al., 2001) was used to evaluate autistic traits. A more detailed description of the measure can be found in Chapter 3, section 3.2.2.

*EQ*: The 40-item version of the Empathy Quotient (EQ) (Baron-Cohen & Wheelwright, 2004) was used to evaluate empathising. A more detailed description of the measure can be found in Chapter 3, section 3.2.2. The EQ scores were again split into two subscales reflecting cognitive empathy and emotional reactivity.

*Self-Monitoring Scale*: The Self-Monitoring Scale (SMS) was used, which is a 25-item scale yielding ‘yes’ or ‘no’ responses from participants on each item (Snyder, 1974). This scale looks at the self-control of expressive behaviours, which requires the ability to monitor one’s own inner state and the social situations one is in, and to change and monitor one’s own behaviour accordingly. Ickes and Barnes (1977) established a set of norms for the scores, with 15-22 indicating a high score, 9-14 indicating an intermediate score, and 0-8 indicating a low score. The scale has good reliability ( $r = .70$ ) and test-retest reliability (0.83) (Snyder, 1974). However, Briggs et al. (1980) have suggested that rather than being one dimension, the SMS is made up of three distinct dimensions (acting, extraversion, and other-directedness), which may conflict with each other. For example, other-directedness correlates positively with shyness and neuroticism, whereas extraversion correlates negatively with shyness and positively with self-esteem and sociability. Therefore, as recommended by these authors, the current study will consider scores on the full scale as well as those that could be

hypothesised to relate to social camouflaging separately (namely, other-directedness and acting).

*The Friendship Questionnaire:* The Friendship Questionnaire (FQ) is a 35-item scale (27 of which are scored) measuring an important part of normal social functioning, the quality of participants' friendships and relationships (Baron-Cohen & Wheelwright, 2003). There are a number of different response styles used within the survey, ranging from Likert scales to rankings, with a maximum possible score of 135 in total. Higher scores on the FQ indicate that the respondent values close, empathic, supportive, and caring friendships, and that they enjoy the company of people, and interacting with others for its own sake rather than for another purpose. Baron-Cohen and Wheelwright (2003) found that generally non-autistic women score higher on the scale than non-autistic men, and that autistic people without intellectual disabilities score lower than non-autistic people. They found that the internal consistency of the scale was excellent, with Chronbach's alpha ranging from 0.75 – 0.84. Convergent validity has been found with other scales related to the FQ, for example Lyons and Aitken (2010) found that Machiavellianism was negatively related to the FQ.

*Social Functioning Scale:* Birchwood et al.'s (1990) Social Functioning Scale (SFS) is a 79-item, 7 factor self-report assessment initially developed to assess social functioning relevant to the needs and impairments of individuals with schizophrenia. The questionnaire has been designed to be taken by both the person to whom it applies and by a relative or someone in daily contact with the person. However, due to accessibility of the online survey the current study only used the first part of the assessment. In the initial validation of the scale by the authors, no differences in the scores between the relative and the self-report were observed (inter-rater reliability,  $r = 0.94$ ), suggesting that the scale is valid to be used on just the participant alone.

The SFS has good reliability ( $r = .80$ ) and good internal consistency, as demonstrated by item-total correlations ( $r = 0.71$ ). Factor analyses revealed that it was appropriate to obtain a mean score for the whole SFS scale, as well as on individual factors. Birchwood et al. (1990) found that around 50% of participants in their study with schizophrenia scored between 86-105, whereas those participants without schizophrenia scored between 116-135, with none scoring below 86.

The 7 factors were based on the impairments and disability assessed by the Disability Assessment Schedule (Ustan et al., 2010). They included social engagement/withdrawal; interpersonal behaviour; pro-social activities; recreation; independence-competence; independence-performance; and employment/occupation. Whilst these factors are based on the defining characteristics observed in schizophrenia, many of these can be seen to overlap with those experienced by individuals with autism; for example, difficulties in interpersonal relationships and impairment in life-role functioning (social activities and independence skills). Other available scales, such as the Weiss Functional Impairment Rating Scale Self-Report (WFIRS-S), did not appear to be as specific to the types of social impairment found in autistic individuals. Moreover, Canty et al. (2017) further validated the survey in their study on ‘healthy’ participants, to test a new measure of ToM.

*Reading the Mind in the Eyes Test (brief version):* The current study used the brief version of the Reading the Mind in the Eyes Test (RMET) (Olderbak et al., 2015), which was initially developed by Baron-Cohen et al. (2001), in order to measure ToM. The original RMET was designed to identify different clinical populations (mainly autistic people) from non-autistic controls in ToM capabilities. The original RMET presents subjects with 36 images of other peoples’ eyes and gives them a choice of four terms to choose from, which could describe the person’s mental state. Whilst the full

revised version of the test reported adequate reliability, the new brief version of the test, which includes just 10 of the items of the original test, reported better internal consistency ( $\alpha = 0.73$ ). It is therefore a more precise measure of ToM and shorter to administer.

*The Patient Health Questionnaire – 9:* The 9 item version of the Patient Health Questionnaire was used (PHQ-9), which specifically measures depression using the 9 DSM-IV criteria (Kroenke et al., 2001). Participants rate each item as to how often they experience the symptom from ‘not at all’ to ‘every day’. Scores ranging from 5-9 represent mild depression, 10-14 represent moderate depression, 15-19 represent moderately severe depression, and 20 + represent severe depression. The internal reliability of the scale is excellent, with Chronbach’s alpha ranging from 0.84 – 0.89. The PHQ-9 also has excellent test-retest reliability ( $r = 0.84$ ) and good construct validity, with scores on the scale strongly associated with functional status, disability days, and symptom-related difficulty. Furthermore, good external validity for the scale was found by replicating the initial findings to a second sample, suggesting that the PHQ-9 may be generalizable to outpatients in a variety of clinic settings (Kroenke et al., 2001).

*Generalized Anxiety Disorder – 7:* The Generalized Anxiety Disorder – 7 (GAD-7) scale has 7 items derived from the DSM-IV symptom criteria for GAD and from other existing anxiety scales (Spitzer et al., 2006). Similarly to the PHQ-9, participants rate each item as to how often they experience the symptom from ‘not at all’ to ‘every day’. Scores ranging from 5-9 represent mild anxiety, 10-14 represent moderate anxiety, and 15+ represent severe anxiety. The GAD-7 has excellent reliability ( $\alpha = .92$ ) and test-retest ( $r = 0.83$ ). The scale also has strong construct validity, with scores associating strongly with scores from a functioning scale, and

convergent validity, with scores on the scale correlating strongly with two other anxiety scales (Spitzer et al., 2006).

**4.2.3. Design.** Participants were grouped by gender and also by autism status: those diagnosed with an ASC ('autistic/diagnosed ASC group'), those without an ASC diagnosis who scored above the criteria on the AQ ( $\geq 32$ ) ('potentially autistic/potential ASC group'), and those without an ASC diagnosis who scored below the criteria on the AQ ( $\leq 32$ ) ('non-autistic/no ASC group'). A between-subjects analysis was conducted on scores from the various questionnaires.

**4.2.4. Procedure.** The survey was designed on Qualtrics, and tested prior to distribution by three members of the research team who underwent the survey as though they were participants. The survey was set to open access allowing anyone to take it, however it only allowed for one response per participant; this was achieved through the monitoring of cookies. Items were set to forced response, and progression through the survey was dependent on all items being answered (non-response options were provided throughout).

Participants who took part in Study 1 were asked to enter a password they were emailed using the email addresses they had left in the previous study, which enabled them to skip the AQ and EQ measures. Alternatively, if they had not taken part previously then they were asked to select this option and were directed to a version of the survey which included the AQ and EQ. Participants were presented with an information page before beginning the survey; this informed them that the online survey was looking at gender differences in autistic traits, mental health, and individuals' social awareness and motivation. They were also informed that they would have a chance to win a £100 Amazon voucher upon completion of the survey.

The main survey presented participants with 5 blocks containing 6 questionnaires: the AQ was used to screen for autistic traits; the EQ was used to measure empathy; the FQ was used to measure quality and motivation of friendships; the Self-Monitoring Scale (SMS) was used to measure how well participants could adapt to different social situations; the Social Functioning Scale (SFS) was used to measure social functioning; the brief version of the RMET was used to measure ToM; the PHQ-9 was used to measure depression; and the GAD-7 was used to measure anxiety. They were then asked to indicate any autism or mental health diagnoses they had received and at what age, and to fill in a number of demographic questions about their age, gender, country/county of birth, and employment status. Once the survey was completed, the participants were fully debriefed and informed that the study was “looking specifically at whether social motivation and awareness was related to high scores on an autism screening tool in individuals who are not diagnosed with autism; more specifically whether there are gender differences”. They were also made aware that the AQ was not a diagnostic test and that it just looked at traits, and that we were unable to disclose individual scores for ethical reasons, however advice and support contacts were provided. Finally, they were given the opportunity to leave their email addresses to be entered into the prize draw.

### **4.3. Results**

**4.3.1. Data checks and descriptive statistics.** Group means and standard deviations on all measures are presented for participants in the diagnosed ASC group, potential ASC group, and no ASC group, separately for females (Table 4.1) and males (Table 4.2). Due to the low number of participants in the potential ASC male group it was not

possible to conduct the same analyses for males. Secondary analyses on males in the ASC group were conducted largely for descriptive and replication purposes.

Distributions for each of the three groups were visually inspected for normality. These revealed some departure from normality on most variables tested and therefore non-parametric tests were used throughout the analysis. Kruskal-Wallis H tests were used to explore group differences and Mann-Whitney U tests were used to explore pairwise comparisons; the Wilcoxon Signed Ranks test was used for pairwise comparisons for within subjects, both with Bonferroni corrections applied for multiple comparisons. For correlation analysis Spearman's was used, and for categorical variable analysis Chi-Squares were used. The main analysis includes a section on group differences on all questionnaire measures for female participants, a section on correlation analysis of the continuous variables derived from the survey results for female participants, analysis of mental health conditions and age of onset for females participants, and lastly an exploratory analysis of group differences between males and females in the ASC group.



**Table 4.1**

*Means and standard deviations on all measures for female participants, stratified by diagnostic group*

Measure	ASC	Potential ASC	No ASC
	<i>n</i> = 90	<i>n</i> = 77	<i>n</i> = 235
	Mean ( <i>SD</i> )	Mean ( <i>SD</i> )	Mean ( <i>SD</i> )
AQ	39.67 (5.13)	37.13 (4.10)	19.30 (7.35)
EQ	18.79 (8.23)	22.27 (10.17)	43.91 (12.34)
FQ	54.88 (21.35)	53.06 (18.36)	81.21 (19.84)
RMET	6.94 (2.40)	7.64 (1.91)	8.31 (1.41)
GAD-7	11.93 (6.02)	10.57 (5.94)	7.20 (5.65)
PHP-9	14.40 (6.30)	12.34 (6.46)	8.75 (6.09)
SMS	10.18 (4.94)	10.45 (4.42)	12.25 (3.92)
SFS	116.64 (26.24)	125.53 (20.29)	141.01 (21.48)

**Table 4.2**

*Means and standard deviations on all measures for male participants, stratified by diagnostic group*

Measure	ASC	Potential ASC	No ASC
	<i>n</i> = 27	<i>n</i> = 9	<i>n</i> = 67
	Mean ( <i>SD</i> )	Mean ( <i>SD</i> )	Mean ( <i>SD</i> )
AQ	37.93 (4.86)	35.22 (2.22)	19.76 (6.43)
EQ	17.33 (7.98)	19.67 (6.04)	36.19 (11.10)
FQ	54.48 (25.80)	40.33 (13.64)	67.15 (19.94)
RMET	6.78 (2.03)	7.56 (2.35)	8.27 (0.99)
GAD-7	10.22 (4.87)	6.00 (3.71)	4.93 (5.24)
PHP-9	12.41 (5.75)	10.22 (4.68)	7.24 (5.95)
SMS	9.67 (4.38)	11.89 (3.06)	14.28 (3.85)
SFS	113.63 (19.22)	121.33 (13.99)	136.22 (24.51)

#### **4.3.2. Female group differences on questionnaire measures.**

*EQ*: There was a significant difference in empathic traits between female diagnostic groups:  $\chi^2(2) = 220.039, p < .001$ . Using a Bonferroni corrected alpha score of .02, females in the diagnosed ASC group had a significantly lower EQ score than those in the potential ASC group ( $p = .022, d = .38$ ), and both groups had significantly lower scores than those in the no ASC group ( $p < .001, d = 2.40$  and  $1.91$ ). Looking at the subscales, there was a significant difference in cognitive empathy between diagnostic groups:  $\chi^2(2) = 88.16, p < .001$ . Females in the diagnosed ASC group scored

lowest on this subscale ( $M = 2.33$ ,  $SD = 2.48$ ), followed by females in the potential ASC group ( $M = 5.45$ ,  $SD = 4.75$ ), and females in the no ASC group ( $M = 11.78$ ,  $SD = 5.19$ ). The difference between females in the diagnosed ASC group and potential ASC group was significant and had a large effect size ( $U = 502.50$ ,  $p = .009$ ,  $d = 0.82$ ), as was the difference between females in the diagnosed ASC group and no ASC group ( $U = 243.00$ ,  $p < .001$ ,  $d = 2.32$ ), and between females in the potential ASC group and no ASC group ( $U = 511.00$ ,  $p < .001$ ,  $d = 1.27$ ). A significant difference was also found between diagnostic groups on the emotional reactivity subscale:  $\chi^2(2) = 44.92$ ,  $p < .001$ . Females in the diagnosed ASC group scored lowest on this subscale ( $M = 7.16$ ,  $SD = 3.86$ ), followed by females in the potential ASC group ( $M = 8.34$ ,  $SD = 4.72$ ), and females in the no ASC group ( $M = 12.68$ ,  $SD = 4.58$ ). There was no significant difference between females in the potential ASC group and those in the diagnosed ASC group ( $U = 619.50$ ,  $p = .184$ ), however there were significant differences with large effect sizes between females in the diagnosed ASC group and no ASC group ( $U = 835.50$ ,  $p < .001$ ,  $d = 1.30$ ), and between the potential ASC group and no ASC group ( $U = 688.00$ ,  $p < .001$ ,  $d = 0.93$ ).

*FQ:* There was a significant difference in friendship scores between female diagnostic groups:  $\chi^2(2) = 115.419$ ,  $p < .001$ . Using a Bonferroni corrected alpha score of .02, females in the diagnosed ASC and potential ASC groups scored similarly, and both groups had significantly lower scores than those in the no ASC group ( $p < .001$ ,  $d = 1.23$  and  $1.47$ , respectively).

*Self-Monitoring:* There was a significant difference in self-monitoring between female diagnostic groups:  $\chi^2(2) = 18.832$ ,  $p < .001$ . Using a Bonferroni corrected alpha score of .02, females in the diagnosed ASC and potential ASC groups scored similarly, and both groups had significantly lower scores than those in the no ASC group ( $p =$

.001,  $d = 0.46$  and  $p = .005$ ,  $d = 0.43$  respectively). There were no group differences on the ‘other-directedness’ subscale ( $X^2(2) = .404$ ,  $p = .817$ ) but there was a significant difference on the ‘acting’ subscale ( $X^2(2) = 15.50$ ,  $p < .001$ ) and the ‘extraversion’ subscale ( $X^2(2) = 71.577$ ,  $p < .001$ ). Females in the diagnosed ASC and potential ASC groups scored similarly on the acting subscale ( $M = 1.27$  and  $1.25$  respectively), and both groups had significantly lower scores than those in the no ASC group ( $M = 1.77$ ) ( $p = .017$ ,  $d = 0.35$  and  $p = .009$ ,  $d = 0.39$  respectively). Females in the diagnosed ASC and potential ASC groups also scored similarly on the extraversion subscale ( $M = 1.39$  and  $1.56$ ), and both groups had significantly lower scores than those in the no ASC group ( $M = 2.83$ ) ( $p < .001$ ,  $d = 0.93$  and  $p < .001$ ,  $d = 0.82$  respectively).

*Social Functioning:* There was a significant difference in social functioning between female diagnostic groups:  $X^2(2) = 74.404$ ,  $p < .001$ . Females in the diagnosed ASC group had a significantly lower mean SFS score than those in the potential ASC group, although this was not significant when Bonferroni corrections were applied with a new alpha criteria of .02 ( $p = .025$ ,  $d = 0.38$ ), however the effect size was medium, and both groups had significantly lower scores than those in the no ASC group ( $p < .001$ ,  $d = 1.02$  and  $0.74$  respectively).

Examining each subscale on the SFS a significant difference between groups was found for the majority of the subscales. There was a significant difference on the ‘engagement/withdrawal’ subscale between female diagnostic groups:  $X^2(2) = 78.702$ ,  $p < .001$ . Using a Bonferroni corrected alpha score of .002 throughout all comparisons described below, females in the diagnosed ASC group scored on average lower ( $M = 8.29$ ) than those in the potential ASC group ( $M = 9.39$ ) ( $p = .002$ ,  $d = 0.49$ ), who scored significantly lower than those in the no ASC group ( $M = 10.90$ ) ( $p < .001$ ,  $d = 0.63$ ). There was a significant difference between groups on the interpersonal communication

subscale:  $\chi^2(2) = 65.497, p < .001$ . Females in the diagnosed ASC group scored on average the same as those in the potential ASC group ( $M = 7.46$  and  $7.65$  respectively) but lower than those in the no ASC group ( $M = 8.44$ ) ( $p < .001, d = 0.84$  and  $0.74$  respectively). A significant difference on the 'independence-performance' subscale was also found between female diagnostic groups:  $\chi^2(2) = 39.821, p < .001$ . No differences were found between females in diagnosed ASC and potential ASC groups ( $M = 26.96$  and  $29.29$  respectively) but both scored significantly lower than those in the no ASC group ( $M = 32.74$ ) ( $p < .001, d = 0.79$  &  $1.03$ ). A significant difference on the 'independence competence' subscale was found between female diagnostic groups:  $\chi^2(2) = 89.276, p < .001$ . Females in the diagnosed ASC group scored significantly lower ( $M = 32.37$ ) than those in the potential ASC group ( $M = 35.78$ ) ( $p < .001, d = 0.63$ ), and those in the potential ASC group scored significantly lower than those in the no ASC group ( $M = 37.59$ ) ( $p < .001, d = 0.46$ ). The 'prosocial' subscale revealed a significant difference between diagnostic female groups:  $\chi^2(2) = 63.834, p < .001$ . No difference was found between females in the diagnosed ASC and potential ASC groups ( $M = 14.89$  and  $14.61$  respectively), however, both had significantly lower scores than those in the no ASC group ( $M = 22.01$ ) ( $p < .001, d = 0.77$  &  $0.90$  respectively). Significant differences between diagnostic female groups were found on subscale scores for employment:  $\chi^2(2) = 31.875, p < .001$ . Females in the potential ASC group and no ASC group scored similarly ( $M = 8.13$  &  $8.70$ ), but both groups scored significantly higher than those in the diagnosed ASC group ( $M = 6.59$ ) ( $p = .001, d = 0.39$  and  $p < .001, d = 0.57$  respectively). Finally, there was no significant difference between diagnostic female groups on the recreation subscale ( $\chi^2(2) = .618, p = .734$ ).

*RMET*: There was a significant difference in ToM between female diagnostic groups:  $\chi^2(2) = 24.543, p < .001$ . Using a Bonferroni corrected alpha score of .02, females in the diagnosed ASC and potential ASC groups scored similarly, and both

groups had significantly lower scores than those in the no ASC group ( $p < .001$ ,  $d = 0.71$  and  $p = .007$ ,  $d = 0.41$  respectively).

*GAD:* There was a significant difference in anxiety between female diagnostic groups:  $X^2(2) = 47.328$ ,  $p < .001$ . Using a Bonferroni corrected alpha score of .02, females in the diagnosed ASC and potential ASC groups scored similarly, and both groups had significantly higher scores than those in the no ASC group ( $p < .001$ ,  $d = 0.81$  and  $0.58$  respectively).

*Depression:* There was a significant difference in depression between female diagnostic groups:  $X^2(2) = 55.509$ ,  $p < .001$ . Using a Bonferroni corrected alpha score of .02, females in the diagnosed ASC and potential ASC groups scored similarly, and both groups had significantly higher scores than those in the no ASC group ( $p < .001$ ,  $d = 0.91$  and  $0.57$ ).

**4.3.3. Correlations between questionnaire measures for female groups.** As can be seen from the Spearman correlations in Table 4.3, for females in the diagnosed ASC group, the measures of social functioning were positively associated. Specifically, with Bonferroni corrections applied due to multiple tests, the AQ was significantly, negatively correlated with the EQ and FQ, and the EQ was significantly, positively correlated with the FQ and RMET. The RMET was also significantly, positively correlated with the FQ. Scores on the SMS and SFS were significantly, positively correlated with the FQ. Both the GAD and PHQ were significantly, positively correlated with each other but neither measure of mental health was associated with any of the measures of social functioning. Examining the two EQ subscales for correlations separately with a Bonferroni correction of  $p = .004$ , neither cognitive empathy nor emotional reactivity were found to correlate significantly with any other variables (AQ, FQ, SMS, RMET, SFS, PHQ-9, or GAD-7); all  $p$  values  $> .005$ .

**Table 4.3***Correlations between continuous measures for females in the ASC group*

Variable	AQ	EQ	FQ	SMS	RMET	SFS	GAD	PHQ
AQ	-							
EQ	-.490*	-						
FQ	-.461*	.536*	-					
SMS	-.155	.238	.335*	-				
RMET	-.212	.324*	.425*	.140	-			
SFS	-.210	.183	.374*	.158	.255	-		
GAD	.185	-.043	-.060	.122	-.030	-.252	-	
PHQ	.240	-.083	-.063	-.050	-.015	-.297	.835*	-

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\* Correlation is significant at the  $p = .002$  level (two-tailed) (Bonferroni corrected)

**Table 4.4***Correlations between continuous measures for females in the potential ASC group*

Variable	AQ	EQ	FQ	SMS	RMET	SFS	GAD	PHQ
AQ	-							
EQ	-.492*	-						
FQ	-.260	.457*	-					
SMS	-.161	-.036	.064	-				
RMET	-.221	.437*	.070	.025	-			
SFS	-.349*	.172	.134	.248	.144	-		
GAD	.003	.129	.047	.182	.131	-.014	-	
PHQ	.117	-.025	.100	.089	-.001	-.185	.743*	-

\* Correlation is significant at the  $p = .002$  level (two-tailed) (Bonferroni corrected)

As can be seen from Table 4.4, for females in the potential ASC group, and with Bonferroni corrections applied, both EQ and SFS scores were significantly, negatively correlated with the AQ, whilst both FQ and RMET scores were significantly, positively correlated with the EQ. The GAD and PHQ were significantly, positively correlated with each other but not with any of the measures of social functioning. Examining the two EQ subscales for correlations separately, cognitive empathy significantly correlated positively with RMET scores ( $r = .541$ ,  $n = 30$ ,  $p = .002$ ) and emotional reactivity significantly correlated negatively with AQ ( $r = -.587$ ,  $n = 29$ ,  $p = .001$ ) and positively with FQ ( $r = .661$ ,  $n = 29$ ,  $p < .001$ ). All other correlations with other variables (SMS,



SFS, PHQ-7, GAD-5) were non-significant once Bonferroni corrections ( $p = .004$ ) were applied (all  $p$  values  $> .01$ ).

**Table 4.5**

*Correlations between continuous measures for females in the no ASC group*

Variable	AQ	EQ	FQ	SMS	RMET	SFS	GAD	PHQ
AQ	-							
EQ	-.499*	-						
FQ	-.417*	.424*	-					
SMS	-.036	.424*	.100	-				
RMET	-.022	.111	.036	.116	-			
SFS	-.394*	.222*	.428*	.006	.055	-		
GAD	.416*	-.154	-.252	.092	-.096	-.332*	-	
PHQ	.368*	-.145	-.282*	.120	-.169	-.453*	.752*	-

\* Correlation is significant at the  $p = .002$  level (two-tailed) (Bonferroni corrected)

As can be seen from Table 4.5, for females in the no ASC group, and with Bonferroni corrections applied, the AQ was significantly, negatively correlated with the EQ, FQ and SFS. The EQ was significantly, positively correlated with the FQ, SMS, and SFS, while the FQ was significantly, positively correlated with the SFS. Both GAD and PHQ had significant, negative correlations with SFS, and significant, positive correlations with each other. The PHQ also had significant, negative correlations with the FQ and RMET. Examining the two EQ subscales for correlations separately,

cognitive empathy significantly correlated negatively with AQ scores ( $r = -.436$ ,  $n = 93$ ,  $p < .001$ ), and positively with FQ scores ( $r = .407$ ,  $n = 88$ ,  $p < .001$ ) and emotional reactivity significantly correlated positively with FQ ( $r = .554$ ,  $n = 85$ ,  $p < .001$ ). All other correlations with other variables (SMS, SFS, PHQ-7, GAD-5) were non-significant once Bonferroni corrections ( $p = .004$ ) were applied (all  $p$  values  $> .006$ ).

**4.3.4. Predicting the age of autism diagnosis.** Correlations were performed to determine whether later diagnosis was associated with higher scores for the measures of self-monitoring, social functioning, friendship quality and motivation, and ToM amongst males and females in the ASC group. Because age of diagnosis was significantly, positively correlated with current chronological age for both genders,  $p$  values  $< .001$ , age was entered as a control variable.

When males and females in the ASC group were analysed together, results showed a reliable, positive correlation between age of autism diagnosis and self-monitoring score: partial  $r(117) = .215$ ,  $p = .019$ . However, the correlation failed to reach significance when the two genders were considered separately,  $p$  values  $> .05$ . For neither the group as a whole, or for the two genders considered separately, was age of diagnosis predicted by any of the measures of social functioning, friendship motivation and quality, or ToM; all  $p$  values  $> .05$ .

**4.3.5. Other mental health diagnoses in females.** Of females in the diagnosed ASC group, 83.3% ( $n = 75$ ) were diagnosed with a mental health condition, compared to 57.1% ( $n = 44$ ) of females in the potential ASC group, and 34.5% ( $n = 81$ ) in the no ASC group. Differences between the groups were significant:  $\chi^2(2) = 64.240$ ,  $p < .001$ ,  $\phi = .400$ . Odds ratio calculations showed that females in the diagnosed ASC group were 3.75 times more likely than those in the potential ASC group and 9.50 times more likely than those in the no ASC group to have a mental health diagnosis. Females in the

potential ASC group were 2.54 times more likely than those in the no ASC group to have a mental health diagnosis.

A significant difference was found between female groups in the number of mental health diagnoses they had:  $\chi^2(2) = 66.589, p < .001$ . Females in the diagnosed ASC group had on average more mental health diagnoses ( $M = 1.87, SD = 1.47$ ) than females in the potential ASC group ( $M = 1.31, SD = 1.57$ ). Using a Bonferroni corrected alpha score of .02, this difference was significant:  $U = 2586.50, p = .004, d = 0.37$ . Females in the potential ASC group had on average more mental health diagnoses than those in the no ASC group ( $M = 0.63, SD = 1.03$ ). This difference was significant:  $U = 6683.00, p < .001, d = 0.51$ .

No significant difference was found between female groups on age of first mental health diagnosis made:  $\chi^2(2) = 1.341, p = .512$ . Females in the diagnosed ASC group who had other mental health problems were diagnosed with their first mental health condition on average at the age of 18.63 ( $SD = 6.05$ ), those in the potential ASC group were first diagnosed on average at the age of 19.75 ( $SD = 5.89$ ), and those in the no ASC group were diagnosed on average at the age of 19.02 ( $SD = 5.64$ ).

#### **4.3.6. Exploratory comparisons between males and females in the ASC groups.**

*Age of ASC diagnosis:* Females in the diagnosed ASC group were on average diagnosed with ASC later than males:  $M = 24.88 (SD = 7.89)$  vs  $M = 18.96 (SD = 10.95)$ :  $U = 793.500, p = -.008, d = 0.62$ .

*Mental health:* Females in the diagnosed ASC group were more likely to have been diagnosed with another mental health condition than males (83.3% vs 55.6%):  $\chi^2(2) = 10.433, p = .005, \phi = .294$ . Autistic females were 4 times more likely than autistic males to have a mental health diagnosis. They also had more mental health

diagnoses than autistic males:  $M = 1.89$  ( $SD = 1.47$ ) vs  $M = 0.78$  ( $SD = 0.85$ ). However, average age of first mental health diagnosis made was comparable between the two groups (males  $M = 16.40$ ,  $SD = 6.38$  and females  $M = 18.63$ ,  $SD = 6.05$ ):  $U = 414.50$ ,  $p = .108$ .

To situate the age of ASC diagnosis within the context of all other mental health diagnoses, for all participants with diagnosed autism the following two variables were calculated: (1) the number of mental health diagnoses prior to ASC diagnosis, and (2) the number of mental health diagnoses following the ASC diagnosis. In the rare cases where another mental health diagnosis was concurrent with the ASC diagnosis, only the latter was counted. For females, the number of earlier mental health diagnoses ( $M = 1.74$ ,  $SD = 1.41$ ) was significantly greater than the number of later mental health diagnoses ( $M = 0.40$ ,  $SD = 0.92$ ),  $z = -4.798$ ,  $p < .001$ . For males, in contrast, the number of earlier mental health diagnoses ( $M = 0.80$ ,  $SD = 0.86$ ) was not significantly different to the number of later mental health diagnoses ( $M = 0.53$ ,  $SD = 0.52$ ),  $z = -.714$ ,  $p = .475$ .

Additionally, a count was made of the number of times that the ASC diagnosis was the only, first, middle or last diagnosis, separately for males and females. For females, the ASC diagnosis was the last diagnosis on 51 of 89 occasions (57%). In contrast, for males the ASC diagnosis was the last on 7 of 27 occasions (26%). Chi-Square analysis revealed a significant difference between males and females:  $\chi^2(2) = 9.137$ ,  $p = .028$ ,  $\phi = .281$ . Autistic females were 3.8 times more likely than autistic males to have received their autism diagnosis last.

*Other Questionnaire scores:* There were no significant differences between the performance of autistic males and autistic females on any other scales (EQ, FQ, RMET, GAD, PHP, SMS, or SFS); all  $p$  values  $> .05$ .

#### 4.4. Discussion

Findings from Study 1 left several unanswered questions that needed to be researched further in order to better explore the female autism phenotype. The aim of this current study was to address these gaps by providing participants with a second survey that would measure social abilities, traits of depression and anxiety, and ages of other psychiatric diagnoses. Study 1 and Study 2 combined could provide a novel contribution to our current knowledge of the manifestations of autism in women.

As predicted, potentially autistic women in the current study did have a significant empathy advantage over diagnosed autistic women, consistent with findings made in Study 1. When looking at the subscales this was again found only on the cognitive empathy subscale and not the emotional reactivity subscale. It should be noted that 72.51% of the sample for Study 2 were derived from Study 1, which therefore explains this consistency in EQ scores across studies. No differences were found on the RMET however, which is surprising given there were differences on the cognitive empathy subscale, which ToM is thought to relate most closely to (Stietz et al., 2019). Although, this is supported by research from Livingston et al. (2018), who recently found that heightened levels of IQ, EF, and anxiety were all linked to a greater ability to compensate for underlying deficits in ToM. These potentially autistic women may be better able to mask their autistic traits and apparent ToM deficits than their diagnosed autistic peers due to advantages in certain other areas, for example in empathy. Although, Oakley et al. (2016) caution against over interpreting ToM based on the RMET, as they found that rather than measuring ToM ability it instead measures emotion recognition. They argue that emotion recognition may be affected by a sub-clinical condition known as alexithymia, which affects the ability to describe and recognise one's own feelings, and that is relatively common in the autistic population

(Cook et al., 2013; Oakley et al., 2016). As this was not tested in this study, it is unclear what other factors may have contributed to this null finding.

In terms of social performance skills, the prediction that potentially autistic women would score more highly on social functioning than diagnosed autistic women was confirmed. Moreover, both groups were more impaired on the SFS than the non-autistic control participants. These findings lend support to the FPT, suggesting that autistic females often miss receiving an ASC diagnosis due to less impaired social difficulties than those receiving a diagnosis. In particular, this was seen on the engagement and independence-competence subscales of the SFS, and evidenced through similar employment scores to non-autistic women. It is possible that this may be one of the reasons why these females have been missed by professionals. For example, Dworzynski et al. (2012) found that potentially undiagnosed girls who had a high number of autistic traits had significantly fewer social autistic traits and challenging behaviours, and more prosocial behaviours than diagnosed autistic girls compared to boys.

Despite this, the current study did not find that better social abilities among the potentially autistic women resulted in increased friendship motivation or quality. This conflicts with previous studies that had observed that autistic girls appeared to be better at friendships than autistic boys (Dean et al., 2017; Sedgewick et al., 2016). However, the current study measured adults only, and it is reasonable to expect that friendships in adulthood are more complex, involving more than the playground interactions that these previous studies had investigated. For example, Baron-Cohen and Wheelwright (2003) did not find a difference on the FQ between autistic males and autistic females, suggesting that the quality of friendship might not be an indicator of the female phenotype of autism, or alternatively that autistic women may rate themselves more

harshly on these measures. Given that potentially autistic females are still impaired socially in many areas, friendship may remain a difficult aspect of socialising to manage for many.

The current study also did not find that potentially autistic women performed any better than diagnosed autistic women on self-monitoring, a proxy measure for camouflaging. This had not been measured before in an autistic population, but self-monitoring has been argued to be linked to the ability to adjust in social situations and to socially mimic others (Estow et al., 2006; Schaffer et al., 1982; Snyder, 1974). It may be the case that the SMS is not sensitive to the subtle social differences between different autism presentations; or given that it is a self-report, autistic women may be more aware of their difficulties and so again rate themselves more harshly. For example, autistic women often rate themselves higher on measures of autistic traits than autistic males, despite not being observed to have more severe traits (Lai et al., 2013; Lai et al., 2011; Lenhardt et al., 2016). Alternatively, the fact that many of the diagnosed autistic women were diagnosed in later adolescence and adulthood could account for their similar performance to potentially autistic women on the SMS.

In contrast, the prediction that empathy would positively correlate with ToM, friendship, self-monitoring, and social functioning, was partially supported. For females in the ASC group, both FQ and RMET scores significantly, positively correlated with EQ scores, and both SMS and SFS correlated positively with FQ. For females in the potential ASC group, positive correlations between the EQ and FQ and EQ and RMET were found. These findings are consistent with the suggestion that better empathy skills give rise to better friendship quality. However, empathy scores did not correlate with social ability measures (SFS or SMS) for either group, suggesting other factors may contribute towards the social functioning advantage seen in potentially autistic women

compared to diagnosed autistic women. In particular, higher cognitive empathy was correlated with higher ToM scores on the RMET in this group, whilst lower emotional reactivity was correlated with higher AQ scores and lower scores on the FQ. Different correlations were observed for non-autistic females. For example, in this group self-monitoring and social-functioning did correlate positively with empathy, and social-functioning correlated negatively with traits of anxiety and depression.

The prediction that measures of social abilities would correlate with age of ASC diagnoses was also partially supported. Across both men and women in the diagnosed autistic group, age of ASC diagnosis was significantly, positively correlated with self-monitoring. These findings suggest that the ability to adapt one's behaviour in social situations may delay identification of ASC. This could be the result of camouflaging of autistic traits, caused by an autistic person's ability to 'fit in' appropriately to social situations. Nevertheless, no correlation was found between age of ASC diagnosis and social functioning, friendship, or ToM across genders, and the correlation between self-monitoring and age of ASC diagnosis was weak, suggesting that skills in these areas may not be the most important factor delaying ASC diagnosis.

It had also been hypothesized that females in the potential ASC group would have higher levels of anxiety and depression than females in the diagnosed ASC group, and that this would be correlated to better social abilities. Whilst potentially autistic females did not score higher on these measures than females in the diagnosed ASC group, they did score similarly. This is in contrast to findings that females in the diagnosed ASC group are more likely to be diagnosed with a psychiatric disorder and have significantly more mental health diagnoses than females in the potential ASC group. These findings raise the possibility that while diagnosed autistic women receive more psychiatric diagnosis than potentially autistic women, they are not more likely to



suffer from mental health difficulties. Both females in the diagnosed ASC group and those in the potential ASC group performed similarly on two of the social scales (FQ and SMS), which might indicate that to some extent both groups are using camouflaging strategies and learning social behaviours to ‘fit in’, which is thought to increase mental health problems (Cassidy et al., 2018; Hull, Mandy, et al., 2019; Livingston et al., 2018). However, anxiety and depression scores were not found to correlate significantly with any of the social measures used in the ASC group or the potential ASC group, whilst they did positively correlate with AQ scores and negatively with SFS and FQ scores in the non-autistic group. This suggests that the autistic traits and difficulties associated with being autistic increase the likelihood of having mental health problems.

To explore the pattern of psychiatric diagnoses for diagnosed autistic females and males, the current study also analysed the ages of other psychiatric diagnoses. Autistic females had significantly more psychiatric diagnoses made prior to their ASC diagnosis compared to after. For males no difference between the number of psychiatric diagnoses made prior to or after their autism diagnosis was made. These findings support the suggestion that diagnosis may be delayed for autistic females due to clinicians’ diagnosis of other co-morbid or misdiagnosed conditions instead of ASC (Lai & Baron-Cohen, 2015). Findings also revealed that an ASC diagnosis is more likely to come last for women than it is for men, although this may be due to the later age of ASC diagnosis in this group; autistic males were generally diagnosed earlier and therefore have had more time to receive other psychiatric diagnoses. Finally, no significant difference in the age of first mental health diagnosis between the potentially autistic and diagnosed autistic women, or between diagnosed autistic men and women was made. This suggests that earlier identification of other psychiatric difficulties may not prompt diagnosis of autism by professionals.

Lastly, the current study compared the results for diagnosed autistic males and diagnosed autistic females on all measures. It was found that whilst autistic women were diagnosed significantly later and had significantly more mental health diagnoses than autistic men, the groups scored similarly on measures of social abilities, depression, and anxiety. This evidence does not provide support for the theory that autistic women have a different phenotype than autistic males due to masking of symptoms with better social abilities. As discussed above, though, it is possible that self-report measures paint a false picture as individuals who are more aware of their difficulties tend to rate their social abilities poorly. Additionally, it should be noted that the small sample of autistic males in this study means that the statistical tests lacked power. These limitations to the study are discussed further in the General Discussion (Chapter 6). Additionally, the men were diagnosed on average later than previous studies had found and therefore may be more like the females in this sample in their presentation.

In conclusion, this study has explored the impact of social abilities on autism diagnosis, as well as age of other psychiatric diagnoses. The study found that potentially autistic women have an advantage over diagnosed women not just in empathy, but also social functioning. Age of ASC diagnosis was found to be later across both autistic men and women who showed greater self-monitoring, although this trend was relatively weak. For diagnosed autistic women but not for diagnosed autistic men, significantly more other psychiatric diagnoses were made prior to their autism diagnosis compared to after; a diagnosis of autism was more likely to be the final psychiatric diagnosis for women. However, against expectations there was no evidence that potentially autistic women used self-monitoring more than diagnosed autistic women. As discussed, it is possible that greater self-monitoring is associated with better self-awareness, and that autistic women who have more insight into their difficulties tend to rate themselves

harshly on self-report measures of social abilities. Accordingly, Study 3 will follow-up these findings by using a newly developed measure of camouflaging and objective measures of social performance (i.e., peer ratings rather than self-report) to see whether a link between camouflaging and social abilities can be demonstrated.



## **CHAPTER 5**

### **Study 3: Differences in Self-Reported Camouflaging and Peer Judgements of Social Abilities between Autistic Males and Autistic Females**

#### **5.1. Introduction**

Studies 1 and 2 identified a group of potentially autistic women, comparing them to diagnosed autistic women to determine what factors may contribute to their lack of diagnosis. A significant empathy and social functioning advantage over diagnosed autistic women was found in potentially autistic women, and self-monitoring was significantly, positively correlated with age of ASC diagnosis across both diagnosed autistic males and females. However, differences in self-monitoring (a proxy measure for camouflaging) were not observed between potentially autistic and diagnosed autistic women, and scores on the SMS did not correlate with social functioning, empathy, depression or anxiety in these groups either. One possible explanation for these conflicting findings is that self-report measures are not reliable, particularly as women with greater insight into their difficulties might be overly severe in their self-ratings. The primary aim of Study 3, therefore, is to use a more objective measure of social performance, namely, peer ratings, and to examine the link between these, age of autism diagnosis, and a more direct measure of self-reported camouflaging.

Since Studies 1 and 2 were conducted, a new self-report instrument measuring camouflaging has been devised called the Camouflaging Autistic Traits Questionnaire (CAT-Q) (Hull, Mandy et al., 2019). Using this instrument, recent research has explored the theory that autistic women may deliberately camouflage their autistic traits more than autistic males, which will be discussed in more detail later in this chapter. Importantly, though, there is a gap in the literature as no studies have examined whether camouflaging strategies by autistic women actually are successful in masking their

disorder. If autistic women are viewed more favourably than autistic men during social interactions by observers who are not informed explicitly about their autism, then this could explain why clinicians frequently miss it. Therefore, the main aims of Study 3 were (1) to compare the self-reported camouflaging behaviours of autistic women, autistic men, non-autistic women and non-autistic men using the CAT-Q, and (2) to examine whether scores on the CAT-Q are predictive of non-autistic observers' impressions of the social skills and likability of the autistic participants during ordinary social interactions.

**5.1.1. Camouflaging and associated traits in autism.** Livingston and Happé (2017) describe camouflaging as a strategy utilised by those with a neurodevelopmental disorder as part of a wider strategy to compensate for one's disorder, in order to improve the behavioural presentation of oneself despite cognitive impairments. As discussed in Chapter Two, autistic women and girls have consistently reported using camouflaging strategies as a way to manage social relationships (e.g. Tierney et al., 2016). In particular, autistic females have reported using deliberate mimicry (e.g. Bargiela et al., 2016), compensatory behaviours such as purposefully using non-verbal gestures, maintaining appropriate levels of eye contact, avoiding dominating conversations, and practising conversations beforehand to maintain a social script (Hull, Petrides, et al., 2017). These reports are supported by findings of several studies that have compared the social behaviours of autistic males and females. For example, Dean et al. (2017) observed 24 autistic girls and 24 autistic boys during play with other children. They found that the autistic girls were more likely to engage in 'joint play', which they hypothesised may be due to better social camouflaging. Furthermore, Sedgewick et al. (2016) found that 13 autistic girls scored higher than 10 autistic boys on social motivation and friendship closeness.

Development of the CAT-Q has made it possible for researchers to evaluate different facets of camouflaging. The CAT-Q asks 25 questions related to ‘compensation’ (strategies to compensate for social and communication difficulties), ‘masking’ (strategies to appear less autistic to others), and ‘assimilation’ (strategies to fit into uncomfortable social situations). On this scale, self-reported camouflaging behaviour has been found to be higher in autistic people than non-autistic people, and higher in autistic females than autistic males. It was found that autistic females scored on average 124.35 ( $SD = 23.27$ ), autistic males scored on average 109.64 ( $SD = 26.50$ ), non-autistic females scored on average 90.87 ( $SD = 27.67$ ), and non-autistic males scored on average 96.89 ( $SD = 24.22$ ) (Hull, Lai, et al., 2019). Note, however, that these group differences were mainly apparent on the ‘assimilation’ and ‘masking’ subscales, where autistic females scores significantly higher than autistic males, and not in the ‘compensation’ subscale, where no differences were observed. When compared to non-autistic participants, autistic females scored significantly higher on all subscales than non-autistic females, and autistic males scored higher on all subscales except for ‘masking’ than non-autistic males.

Several factors have been considered to relate to camouflaging, one of these being executive functioning (EF). Better EF is thought to assist with camouflaging because to camouflage one must inhibit inappropriate social responses, be able to script social situations beforehand, and have the flexibility to deal with unexpected social situations (Sedgewick et al., 2016). Some studies have found a female advantage among autistic participants for cognitive flexibility and processing speed (Bolte et al., 2011; Lai et al., 2012; Lenhardt et al., 2016). Other studies have linked better EF with better ToM, which could be argued to aid in camouflaging as it would be beneficial to understand the mental states of others in order to ensure one’s own behaviour is appropriate to the situation. For example, Ahmed et al. (2011) found several ToM tests

were related to different aspects of EF when tested with 135 non-autistic participants. Verbal fluency and problem solving were predictive of performance on the Strange Stories task and the Faux Pas Test; verbal fluency was suggested to involve flexibility in initiating responses such that in social situations one could generalise the basic concepts of social interaction and apply these; and deductive reasoning was suggested to depend on one's ability to solve a puzzle from clues, which in social situations is required to figure out why someone is behaving how they are. In a recent study by Livingston et al. (2018), higher IQ, superior EF, and greater anxiety were all linked to a better ability to compensate for underlying deficits in ToM amongst a sample of 136 autistic adolescents. However, the study did not find a gender difference in compensation, and there has been little to suggest that in clinical populations autistic females outperform autistic males on ToM ability (Buitelaar et al., 1999; Happé, 1995).

As discussed in Chapter 2, another factor found to be associated with camouflaging is poor mental health, including increased depression, anxiety, and suicidal behaviours, thought to be due to the increased exhaustion of consciously masking one's autism (Livingston et al., 2018). Very few studies to date have measured self-reported camouflaging traits in relation to mental health measures. Cassidy et al. (2018) found that camouflaging, as measured with their four-item questionnaire, significantly predicted suicidality even when depression and anxiety were controlled for. In support of these findings, Hull, Mandy, et al. (2019) found depression and generalised anxiety were positively correlated with the CAT-Q. However, somewhat different findings were obtained by Cage and Troxell-Whitman (2019), who tested 135 autistic females and 111 autistic males on the CAT-Q, as well as developing their own scales measuring 21 possible reasons for camouflaging and 22 possible contexts for camouflaging, with mental health measured using the Depression, Anxiety and Stress Scale (DASS-21). Out of the possible contexts for camouflaging, two broad categories



were determined: formal and interpersonal. Participants were categorised as camouflaging consistently high for both contexts (high camouflagers), as being significantly high in one context but low in the other (switchers), or as camouflaging consistently low in both contexts (low camouflagers). Depression scores were not significantly different between the three participant groups. However, consistently low camouflagers had significantly lower rates of anxiety than high camouflagers, and also significantly lower rates of stress than both high camouflagers and switchers. These findings suggest that the mental health consequences of camouflaging may depend on the context in which it is used.

As reviewed in this section, camouflaging by autistic adults has been linked positively with EF and ToM, and negatively with mental health. A further objective of Study 3 was therefore to attempt to replicate and extend these findings. Given that Studies 1 and 2 found a slight empathy advantage in potentially autistic women, Study 3 examined whether empathy is also related to camouflaging ability. Therefore, in addition to the CAT-Q, participants in Study 3 completed tests of EF, ToM, autistic traits (AQ) and empathy (EQ). Given that autistic women tend to be diagnosed with autism later than autistic males and are more likely to be misdiagnosed with other mental health conditions, with greater camouflaging being suggested as a cause (Lai & Baron-Cohen, 2015), Study 3 collected information about participants' various mental health problems. It also examined the association between camouflaging and age of ASC diagnosis.

**5.1.2. The effects of camouflaging on impressions made on others.** Research on camouflaging in autism is still in its infancy, and there have been very few studies on the topic. Most studies have investigated the first-person experience of camouflaging through self-report questionnaires, in order to conceptualise the behaviours and

motivations associated with it as a strategy for autistic people. Others have made observations hypothesised to be related to social camouflaging (e.g. performance on the ADOS, friendship quality, and engagement in shared play). Lai et al. (2017) measured the discrepancy between self-reported autistic traits and external behaviours observed by a clinician, hypothesising that autistic females may report similar levels of autistic traits as males but that they may score lower on clinician observations, causing a greater discrepancy in scores between self-reported and observed autistic traits. They found that autistic females did have a much greater discrepancy score than autistic males, with autistic females being rated as performing better on social communication of the ADOS Module 4 by clinicians but higher than males for self-reported autistic traits. As discussed in Chapter Two, the study's claim that this discrepancy score represents camouflaging is somewhat problematic, given that camouflaging has not been measured and a number of other factors could cause this discrepancy. However, a potentially important aspect of this study is the use of observations by clinicians that determined that autistic males scored higher for social communication difficulties ( $M = 8.5$ ) than autistic females ( $M = 4.3$ ), which was significant and had a large effect size ( $d = 1.04$ ). This was despite autistic females scoring significantly higher on the AQ ( $M = 37.5$ ) than autistic males ( $M = 32.7$ ), and similarly to autistic males on the ADI-R, which measured reciprocal social behaviours, communication, and RRBI. These findings suggest that in social situations autistic females are viewed more favourably by clinicians, and this might reduce the probability of those females receiving an ASC diagnosis. However, it is unclear whether the results mean that autistic females camouflage their autistic traits in social settings, and therefore appear less 'autistic', or whether there is a clinician bias, specifically, such that clinicians are more used to associating social communication difficulties with males and therefore may miss the autistic presentation demonstrated by females.

Additionally, several studies have investigated differences between autistic and non-autistic people in how they are perceived by others, which may be a useful method in determining the success of camouflaging strategies. For example, Grossman (2015) took short 1-3 second video clips of 9 autistic and 10 non-autistic children (17 male) telling a made-up story. Eighty-seven non-autistic participants with a mean age of 23 (64 females and 23 males) were shown the clips, unaware of which children were autistic, and asked if the child they saw appeared to be socially awkward. The autistic children were rated as more socially awkward than the non-autistic children on both 3 second and 1 second clips, regardless of whether audio-visual clips, audio only clips, or still images were used. However, it is unknown whether autistic females are rated as less socially awkward than autistic males, which the FPT may suggest would be the case if they are successfully camouflaging difficulties.

Sasson et al. (2017) conducted a number of experiments to evaluate the first impressions of autistic adults and children by non-autistic peers using thin-slices of real-life social behaviours. In their first study, 20 autistic participants and 20 non-autistic participants (17 males in each), with a mean age of 25 years, were used as stimuli ('participant-stimuli'). They were recorded engaging in a mock audition for a reality/game show, which was cut into 10-second clips and edited into five different modalities (audio-only, visual-only, static image, and transcript of speech content). Non-autistic participants were used as raters (participant-raters) and were shown the video clips of each of the 40 participant-stimuli in one of the modalities. There were 214 participant-raters in total (164 females), with a mean age of 21. A rating scale was used which listed six attributes found to be reliably perceived when forming first-impressions, these were attractiveness, awkwardness, intelligence, likeability, trustworthiness, and dominance/submissiveness. In addition to these items, four others were measured that reflected behavioural intent towards the participant-stimuli

(willingness to live near, likelihood of hanging out in their free time, level of comfort sitting next to, and likelihood of starting a conversation with). Autistic participant-stimuli were rated less favourably overall than non-autistic participant-stimuli, and this was the case across all modalities except in the transcript condition. Also, autistic participant-stimuli were rated worse on the audio-visual modality than the others. Looking at each item type, it was apparent that autistic participant-stimuli were rated less favourably on all traits except trustworthiness, intelligence, and the raters' willingness to live near them. For the autistic participant-stimuli, social awkwardness was found to correlate negatively with raters' intent to talk to and socialise with the person. No differences were found between male and female participant-stimuli, though it is worth noting there were only 3 autistic females included in this part of the study.

In a follow-up study conducted by the same authors, 12 autistic (10 male) and 16 non-autistic (9 male) participant-stimuli were presented to 37 participant-raters (19 male). Participant-stimuli were filmed engaging in natural conversation with an experimenter who asked open-ended questions such as “have you seen any good movies recently?” Unlike the first study, this study was filmed using video-recording glasses to give a first-person viewpoint to the participant-raters. The recordings were edited into 10 still frames per participant-stimulus and shown to the participant-raters, who rated them on three questions (“How socially awkward is this person?”, “How approachable is this person?”, and “Would I see myself being friends with this person?”). Once again, autistic participant-stimuli were rated less favourably than non-autistic participant-stimuli, even though the raters were not aware that the participants had autism.

Better knowledge of autism has been found to be associated with more favourable first-impression ratings, suggesting that harsh judgements may be reduced when people are able to understand the persons' appearance and behaviour in context of

their condition. For example, in a later study by Sasson and Morrison (2019), first-impression scores improved when participant-raters were aware that the participant stimuli had autism compared to when they did not know. The researchers used the same participant-stimuli from their first study, which included 20 autistic and 20 non-autistic participant-stimuli. When the participant-raters were provided the correct diagnosis of the participant-stimuli, ratings were more favourable than when they were mislabelled as either non-autistic or as having a schizophrenia diagnosis. The non-autistic participants were also rated more favourably when they were mislabelled as autistic compared to being labelled correctly or mislabelled as schizophrenic. These findings are consistent with those of an earlier study by Matthews et al. (2015), who found college students' perceptions of peers with autism were more favourable when they knew they were autistic.

Taken together, these studies suggest that autism affects the overt behavioural appearance of an individual, and that others rate the traits displayed by autistic individuals as less favourable. Moving forward, it would be beneficial to measure how ordinary non-autistic peers (i.e. non-clinicians without training in autism) view autistic males and females who they are unaware are autistic, and whether they view autistic females more favourably than their autistic male counterparts. If being viewed more favourably by these peers is associated with higher camouflaging scores, then this may provide important evidence of the use and success of camouflaging as a strategy to 'fit in' and evade diagnosis. On the other hand, if more favourable ratings are not associated with self-reported camouflaging then this may suggest either that there is a societal bias in the judgement of atypical behaviours, or that our current measures of camouflaging are unable to detect the successful use of those strategies.

**5.1.3. Aims and hypotheses.** The first aim of Study 3 was to explore gender differences in the use of self-reported camouflaging in autistic versus non-autistic adults, and links between camouflaging and the AQ, EQ, EF, ToM, mental health diagnosis, and age of ASC diagnosis. This aim was addressed by modelling the procedures used by Hull, Lai, et al. (2019), which examined gender differences in camouflaging, and the correlation between mental health and camouflaging. Study 3 extended Hull, Lai, et al.'s (2019) study by also investigating whether camouflaging was correlated with better ToM, EF, and empathy, which has yet to be investigated using the CAT-Q. It was predicted that autistic people would have lower EQ scores but higher AQ and camouflaging (CAT-Q) scores than non-autistic people, and that autistic females would score higher than autistic males on self-reported camouflaging. It was also predicted that higher camouflaging scores would be associated with better EF skills, better performance on tests of ToM, empathy, a later age of ASC diagnosis, and also more mental health diagnoses. This was because previous studies have shown camouflaging to be associated with enhanced cognitive abilities (which can delay diagnosis) but poorer mental health.

The second aim of Study 3 was to extend the Sasson et al.'s (2017) first-impression peer rating study by examining whether the social behaviours of autistic adults are perceived less favourably than the social skills of people without autism by non-autistic age-matched observers, whether results are affected by participant gender or rater gender, and whether the first-impression scores correlate with camouflaging scores and age of ASC diagnosis. Importantly, Study 3 used more naturalistic film clips than Sasson et al. (2017) and included equal numbers of autistic males and autistic females as participant-stimuli to enable a gender comparison. In terms of the first-impression ratings, it was predicted that autistic males would be rated less favourably than autistic females, and that both groups would be rated less favourably than non-

autistic males and females. Additionally, it was predicted that first-impression scores would correlate positively with age of ASC diagnosis and camouflaging. This prediction was made on the basis of the FPT, which suggests that camouflaging in autistic women leads to later and missed diagnosis.

The remainder of this chapter is divided into two parts. Part 1 reports the method, results and discussion relevant to the first aim, that is, to explore the relations between autism, gender, empathy, EF, ToM, mental health diagnoses, age of ASC diagnosis and self-reported camouflaging. Part 2 reports the method, results and discussion relevant to the second aim, that is, to explore the first impressions made on non-autistic peers by males and females with autism, and the relation between first impression scores and self-reported camouflaging.

## **5.2. Part One**

### **5.2.1. Method**

**5.2.1.1. Participants.** The study was advertised in local universities and on social media asking participants to take part in a study looking at differences in social behaviours between autistic and non-autistic individuals. The majority of autistic participants were recruited from advertisements placed in private autism groups on Facebook and in community centres holding autism meetings/clinics. Participants were required to be UK citizens and speak English as a first language; this was to ensure that any cultural effects would not bias the second part of the study which would use the same group of participants. Eighty participants were recruited for part one of this study. Forty of these had an ASC diagnosis (20 males and 20 females) and 40 were non-autistic controls (20 males and 20 females). One female and one male autistic participant identified as transgender and were grouped according to their currently defined gender. Participants

were required to be between the ages of 18-40 years (young adult) to limit the effects of aging on autistic traits and EF, and also to ensure that in the second part of the study the participant-stimuli and participant-raters would be equivalent in age. Age was comparable between the four groups of participant-stimuli (autistic females = 25.45 years, autistic males = 25.85 years, non-autistic females = 27.75 years, non-autistic males = 27.80 years;  $F(3, 76) = .753, p = .524$ ).

The National Adult Reading Test (NART) (Nelson & Willison, 1991) was administered to check that IQ was comparable between the groups. It comprises a list of 50 words which become progressively harder to pronounce as the list goes on. Participants are instructed to read each of the words on the list aloud, and a point is assigned if the word is pronounced correctly. NART error scores are used to predict WAIS full scale IQ, verbal IQ, and predicted IQ (Bright et al., 2016). As can be seen from Table 5.1 NART error scores were comparable between the four groups (autistic females = 17.53, autistic males = 19.68, non-autistic females = 20.00, non-autistic males = 19.42):  $F(3, 72) = .759, p = .386$  .



**Table 5.1**

*Average predicted WAISS full-scale, verbal, and performance IQ scores from NART errors and standard deviations per group*

Gender	Predicted full-scale IQ ( <i>SD</i> )	Predicted verbal IQ ( <i>SD</i> )	Predicted performance IQ ( <i>SD</i> )
Autistic			
Females	113.21 (4.34)	112.89 (4.99)	112.11 (3.53)
Males	111.37 (7.82)	111.00 (8.62)	110.89 (6.17)
Non-Autistic			
Females	111.37 (4.44)	110.63 (4.88)	110.53 (3.44)
Males	111.63 (5.18)	111.16 (5.81)	111.00 (4.08)

ASC diagnoses were confirmed by requesting to see evidence, including education and health statements and diagnostic reports. Whilst all autistic participants reported having an ASC and gave details of how they were diagnosed, 11 failed to submit their evidence. In most cases these reports remained with their guardians as they were diagnosed as children, and the current research was unable to confirm diagnoses by using methods such as the ADOS due to a lack of resources. However, there were no differences in self-reported autistic traits on the AQ screening measure between those who had submitted a report ( $M = 35.09$ ,  $SD = 7.65$ ) and those who had not ( $M = 35.00$ ,  $SD = 7.85$ ),  $t(38) = .033$ ,  $p = .974$ . Four of the latter group scored below the AQ criteria ( $>32$ ), the lowest scoring 23, but the remaining three scored above the less conservative AQ criteria ( $>28$ ) suggested by Baron-Cohen et al. (2001) for those in clinical settings with an autism diagnosis. Therefore, it is reasonable to assume that these participants were autistic and that they had similar levels of autistic traits to those who were able to

confirm their diagnoses, preventing any confounding effects from different levels of autistic traits. Note also that the method of sampling autistic people without officially confirming their diagnosis with tests undertaken by the researchers has been used recently in other studies (Cage & Troxell-Whitman, 2019; Cassidy et al., 2018). The advantages of this method are that it is not exclusive to a clinical population and it saves the time and stress on participants associated with having to go through another diagnostic assessment. None of the non-autistic participants reported an ASC diagnosis, and only four reported having a first-degree family member with autism. Of these, one non-autistic female and one non-autistic male had an autistic son, and one non-autistic female and one non-autistic male had an autistic sister. Participants received £7 for their time (1 hour) and all reasonable travel expenses were refunded.

#### **5.2.1.2. Measures.**

*AQ*: The full 50 item Autism Quotient (AQ) (Baron-Cohen et al., 2001) was used to measure autistic traits. A detailed description of the measure can be found in Chapter 3, section 3.2.2 .

*EQ*: The 40 item version of the Empathy Quotient (EQ) (Baron-Cohen & Wheelwright, 2004) was used to measure empathy. A detailed description of the measure can also be found in Chapter 3, section 3.2.2. The EQ scores were again split into two subscales reflecting cognitive empathy and emotional reactivity.

*CAT-Q*: The Camouflaging Autistics Traits Questionnaire (CAT-Q) is a 25-item self-report questionnaire developed from the theoretical model set out by Hull, Petrides, et al. 2017), who provided a qualitative analysis of camouflaging by autistic participants. The items in the questionnaire were intended to reflect two aspects of camouflaging: first, compensation of social and communication difficulties, and second, masking one's presentation to appear non-autistic (Hull, Mandy, et al., 2019).

Participants answer each question on a seven point Likert scale from ‘Strongly Disagree’ to ‘Strongly Agree’, with higher scores indicating higher camouflaging. The scale was validated by the authors on 354 autistic participants and 478 non-autistic participants (300 males and 434 females) with a mean age of 36. Factor analysis revealed that the scale actually measured three factors: compensation and masking (as described above), and assimilation, which involved strategies reflecting a need to fit in with others socially. High internal consistency was found for the scale as a whole ( $\alpha = 0.94$ ), as well as each of the three subscales (Compensation = 0.91, Masking = 0.85, and Assimilation = 0.92). Test-retest reliability, as calculated from 30 autistic participants who completed the questionnaire again three months later, was high ( $r = .77$ ). Furthermore, convergent validity was achieved because outcomes for the CAT-Q were significantly, positively correlated with autistic traits and social anxiety in both autistic and non-autistic samples, positively to wellbeing in both autistic and non-autistic participants, and positively to depression and generalised anxiety in autistic participants (non-autistic participants were not tested with depression and anxiety measures) (Hull, Mandy, et al., 2019).

*Executive Functioning:* A battery of executive functioning (EF) tasks was administered using PEBL software (Mueller & Piper, 2014). The tasks assessed set shifting (Berg’s ‘Wisconsin’ Card Sorting Test), inhibition, cognitive flexibility, and processing speed (Numerical Stroop Task), and problem solving and planning (Tower of London).

The original Card Sorting Test (BCST) was created by Berg (1948) to test peoples’ ability to respond selectively to one aspect of a situation and to shift attention from one to another. The BCST presents participants with four cards each with an item characterized by colour (red, green, yellow, or blue), shape (triangle, star, cross, or

circle), and number appearing on them (1-4). A series of cards are then presented to the participant, with different shapes, colours, and number of shapes on them, and the participant is required to sort them into one of the four piles according to an unwritten rule; they may match on colour, shape, or number of shapes. Participants are told whether they have guessed the rule correctly or incorrectly and must continue sorting according to that rule until a new rule is required, prompting the participant to shift their responses and attempt to determine through trial and error the new rule. There are 117 trials in total and the main score is taken from the number of errors made.

The Stroop task captures an effect that has been described as a mismatch in stimuli resulting in a delay in reaction time on a task requiring cognitive inhibition (Stroop, 1935). The current study used the Numerical Coding Stroop Task developed by Windes (1968), which requires participants to select on their keyboard the number of characters present on the screen for each trial. Each trial contains either neutral stimuli (1-3 of the same letters are presented on the screen, e.g. 'Z', 'ZZ', and 'ZZZ'), congruent stimuli (1-3 of the same numbers are presented on the screen, and the number will correspond to the number of characters, e.g. '1', '22', or '333'), and incongruent stimuli (1-3 of the same numbers are presented on the screen, and the numbers will not correspond to the number of characters, e.g. '11', '222', or '3'). Incongruent trials generally take longer to respond due to a delay in response caused by cognitive inhibition. Participants were given time to practise the task before being given 192 randomised trials, and both reaction time and accuracy were recorded for each trial.

The Tower of London (ToL) task is an adaptation of the problem solving puzzle 'Tower of Hanoi', which measures a person's ability to solve a problem through forward planning (Shallice, 1982). The task requires participants to mentally plan a sequence of moves of three piles of different coloured disks in order to match a set of

disks within a certain number of moves. There are 12 trials in total and a score is accumulated for each trial (3 points per successful trial, with a maximum of 46 points in total).

*ToM*: The Short Story Task (SST) was used to measure mentalising ability (also referred to as ToM) (Dodell-Feder et al., 2013). This task has been specifically designed to avoid ceiling effects and to assess the full range of ToM abilities, using multiple levels of complexity of both first-order ToM (understanding another person's thoughts) and second-order ToM (understanding one other person is thinking about another person's thoughts). The task also tests ToM in a realistic social context, which requires participants to understand the social landscape in order to make mental state inferences. As Study 3 is concerned with social behaviours, it was decided that this measure of ToM would best serve the study's aims. The SST is also relatively quick and easy to administer, requiring participants to read a short extract from the story 'The End of Something' by Ernest Hemingway, and then answer 14 questions which relate to their comprehension of the story, explicit mental state reasoning, and spontaneous mental state reasoning. Spontaneous mental state reasoning was measured with one question (participants were asked to summarise the story with no prompts); if participants described the mental states of others in the story they were given one point, all other responses scored 0. Comprehension was measured using five questions (e.g. "Nick and Marjorie have a pail of perch for what purpose?"), with a possible two points assigned for each (0 = inaccurate response, 1 = partial understanding of non-mental story details, and 2 = full understanding of non-mental story detail). Explicit mental state reasoning was measured using eight questions (e.g. "Why does Nick say to Marjorie 'you know everything'?"), with a possible two points assigned for each (0 = no mental state inference or inaccurate mental state inference, 1 = consideration of only one perspective, or partially understood, 2 = consideration of several character's mental

states (second-order mental state references), and accurate mental state reasoning).

Possible overall scores could be between 0 and 16.

Inter-rater reliability has been found to be relatively high for both mental state reasoning (.98) and comprehension (.90) (Dodell-Feder et al., 2013). In the initial testing of the measures scores ranged from 2 to 14, and there was no indication of a ceiling effect. Concurrent validity was achieved by examining the relationship between participants' scores on other ToM measures, including the Interpersonal Reactivity Index (IRI) and the RMET. Mental state reasoning on the SST demonstrated a statistically significant relationship on the IRI 'fantasy' subscale, but not on the 'perspective-taking', 'empathic concern', or 'personal distress' subscales. A significant relationship was found between SST mental state reasoning and the RMET.

**5.2.1.3. Procedure.** Prior to being tested, participants were fully informed about what would happen in the study and were sent an online survey, accessed via Qualtrics, which included a consent form for the study, the AQ, EQ, and CAT-Q. It also asked a number of demographic questions, including confirmation of their age, gender, nationality, first language, ASC diagnosis, age of ASC diagnosis, who their ASC diagnosis was made by, any relatives with an ASC diagnosis, and if they were diagnosed with any mental health problems or learning difficulties, and to specify what these were.

Once the survey was completed, participants were asked to attend a one-hour testing session at the university. Informed consent was collected again and participants were reminded of the testing that would take place. Initially, participants were filmed having an everyday conversation with a research assistant (see Part Two, section 5.3.1.2 for more details). Following this, participants were given the computer battery of EF tasks to complete, which were ordered randomly each time to avoid fatigue effects.

They were then asked to read out the list of words on the NART test, which was recorded for later analysis. Lastly, they were asked to read the short story for the ToM task, and were then recorded answering questions on the story they had just read.

## **5.2.2. Results**

**5.2.2.1. Data checks and descriptive statistics.** A descriptive table was initially created to examine group averages on each of the continuous variables (AQ, EQ, CAT-Q, EF, and ToM), that is, for autistic females, autistic males, non-autistic females, and non-autistic males. A two-way ANOVA was conducted for each of the measures to determine if there was an interaction between gender and autism group. Pairwise comparisons were made between groups using a Bonferroni correction for multiple comparisons. Correlations were also calculated between all the variables and the CAT-Q, again with Bonferroni corrections applied. Correlations were only carried out on samples with over 30 participants; any associations involving 30 or fewer participants were considered exploratory due to limited power.

Prior to conducting the analyses, tests of normality were performed on continuous variables to ensure these were not heavily skewed or abnormally distributed. Examining histograms and employing the Kolmogorov-Smirnov (K-S) test indicated slight departures from normality on EQ, ToL, and Stroop task though the K-S test results were not significant. BCST scores had a strong negative skew and significant K-S statistic demonstrating abnormality in the distribution. The BCST scores were therefore transformed using log transformations; this improved the skew of the scores slightly although it did remain significantly abnormally distributed according to the K-S test. However, ANOVAs with equal numbers remain relatively robust to departures of normality.

**5.2.2.2. Effects of gender and autism on all measures.** Table 5.2 presents descriptive statistics (means and standard deviations/frequency data) for all measures as a function of gender and group. Scores for the AQ, EQ, and CAT-Q are averages of the raw scores. The ToM measure has three scores: the percentage of each group who demonstrated a spontaneous mental state inference, the average percentage of correct comprehension answers given, and the average percentage of correct explicit mental state answers given. The EF measure has four scores: the difference in reaction times on the numerical Stroop task between the incongruent and congruent trials (higher scores represent worse inhibition), the percentage of correct moves on the BCST, the total score on the TOL, and the total EF score derived by summing the average Z scores for the three tasks (after reverse-scoring inhibition), with higher values representing better EF overall.



**Table. 5.2***Means and standard deviations on all measures as a function of group and gender*

Measure	ASC		Non-Autistic	
	Females	Males	Females	Males
AQ	36.55 (7.55)	34.05 (7.52)	18.25 (8.99)	18.90 (7.22)
EQ	25.10 (10.80)	23.89 (10.56)	46.20 (14.03)	38.80 (11.81)
Cognitive	3.25 (3.49)	4.32 (5.89)	12.20 (5.55)	11.60 (4.51)
Reactivity	9.50 (4.71)	8.21 (3.29)	14.05 (4.63)	10.05 (4.17)
CAT-Q	123.20 (28.76)	114.47 (27.06)	89.95 (25.69)	88.90 (29.36)
Compensating	42.60 (12.68)	39.53 (11.40)	26.10 (10.94)	25.80 (12.46)
Masking	38.50 (11.17)	34.58 (11.93)	35.60 (10.42)	35.50 (7.26)
Assimilation	42.05 (12.25)	40.37 (8.45)	28.20 (8.76)	27.60 (12.29)
ToM				
Spontaneous	10.53%	21.05%	10.53%	26.32%
mental state				
inferences (% who made)				
Comprehension	68.42 (17.72)	65.79 (19.53)	66.32 (16.06)	72.63 (17.90)
(% correct)				
Explicit mental	49.67 (14.80)	41.78 (17.44)	51.97 (18.05)	49.67 (17.98)
state (% correct)				
EF (Z score)	-0.12 (0.62)	-0.05 (0.62)	0.19 (0.47)	0.01(0.66)
Stroop RT (ms)	68.70 (31.50)	68.90 (45.61)	73.18 (47.66)	66.59 (29.95)
BCST % correct	81.25 (7.35)	78.74 (12.85)	76.57 (11.28)	76.70 (13.01)
ToL	22.80 (8.67)	23.70 (8.25)	26.70 (6.07)	25.20 (7.93)

*CAT-Q*: As can be seen from Table 5.2, autistic females scored on average highest on the CAT-Q, followed by autistic males, and non-autistic females and non-autistic males who had similar average scores. A two-way ANOVA revealed a non-significant interaction between gender and group on the overall CAT-Q score,  $F(1,76) = .580, p = .556$ . However, there was a significant main effect for group reflecting greater self-reported camouflaging in the autistic participants,  $F(1, 76) = 23.017, p < .001, \eta_p^2 = .23$ . When considering the individual scales of the CAT-Q, in no case was there a significant interaction between gender and group, all  $p$  values  $> .02$  (Bonferroni corrected). However, there was a significant main effect for group, reflecting greater camouflaging by the autistic participants for both compensation,  $F(1,76) = 32.524, p < .001, \eta_p^2 = .30$ , and assimilation,  $F(1,76) = 31.219, p < .001, \eta_p^2 = .29$ , but not masking,  $p = .02$ .

*AQ*: As can be seen from Table 5.2, autistic females scored on average highest on the AQ, followed closely by autistic males, whilst non-autistic females and non-autistic males had similar average scores that were much lower. A two-way ANOVA revealed a non-significant interaction between gender and group on the AQ,  $F(1,76) = 1.096, p = .298$ . There was a significant main effect for group reflecting higher AQ scores in the participants with an ASC diagnosis,  $F(1, 76) = 86.675, p < .001, \eta_p^2 = 0.53$ .

*EQ*: As can be seen from Table 5.2, autistic males scored on average lowest on the EQ, followed by autistic females, non-autistic males, and non-autistic females. A two-way ANOVA revealed a non-significant interaction between gender and group on the EQ,  $F(1,76) = 1.714, p = .194$ . There was a significant main effect for group reflecting lower EQ scores in the participants with an ASC diagnosis,  $F(1,76) = 43.345, p < .001, \eta_p^2 = 0.38$ . A similar pattern was observed when the EQ subscales were looked at separately. A non-significant interaction between gender and group was observed for

cognitive empathy,  $F(1,76) = .562, p = .456$ , but with a significant main effect for group only, reflecting lower cognitive empathy scores in the participants with an ASC diagnosis,  $F(1,76) = 53.367, p < .001, \eta_p^2 = 0.42$ . A non-significant interaction between gender and group was also observed for emotional reactivity,  $F(1,76) = 2.641, p = .108$ , but with a significant main effect for group only, reflecting lower emotional reactivity scores in the participants with an ASC diagnosis,  $F(1,76) = 9.424, p = .003, \eta_p^2 = 0.11$ .

*ToM:* As can be seen from Table 5.2, all groups scored similarly in terms of spontaneous mental state inferences, comprehension, and on explicit mental state inferences in the SST. A Chi-Square analysis revealed that the number of participants making a spontaneous mental state inference did not differ significantly by group,  $\chi^2(3) = 2.505, p = .474$ . A two-way ANOVA revealed a non-significant interaction between gender and autism on comprehension on the SST,  $F(1,72) = 1.194, p = .278$ , and on explicit ToM on the SST,  $F(1,72) = .507, p = .479$ . There were no significant main effects or interactions when considering percentage accuracy of comprehension and explicit ToM.

*Executive Functioning:* As can be seen from Table 5.2, all groups scored similarly on the EF battery. A two-way ANOVA found a non-significant interaction between gender and autism on the percentage of correct moves on the BCST,  $F(1,76) = .091, p = .764$ , scores on the ToL,  $F(1,76) = .474, p = .493$ , and on the reaction times differences between congruent and incongruent trials on the numerical Stroop task,  $F(1,76) = .148, p = .702$ . A non-significant interaction was also reported for overall EF scores,  $F(1,76) = .596, p = .442$ . No main effects for gender or autism were observed in any of the tests or in the overall EF score.

*Mental health:* More autistic women had a mental health condition than autistic men and non-autistic participants, and more autistic males had mental health conditions

than non-autistic participants (autistic females = 12, autistic males = 8, non-autistic females = 5, and non-autistic males = 1). A Chi-Square analysis revealed that the group difference was significant:  $\chi^2(3) = 17.582$ ,  $\phi = .469$ ,  $p = .001$ . Odds ratios revealed autistic females were 2.3 times more likely than autistic males, 5.6 times more likely than non-autistic females, and 28.5 times more likely than non-autistic males to have a mental health condition.

Autistic participants were divided into two groups, low and high camouflagers, using their median camouflaging score on the CAT-Q (median = 118.50). It was found that the number of participants with a mental health condition did not differ between high- and low camouflagers (11 versus 9 respectively).

*Age of ASC diagnosis:* Autistic females received their diagnoses later than autistic males (females:  $M = 22.25$ ,  $SD = 10.00$ , males:  $M = 13.90$ ,  $SD = 8.81$ ), which an independent measures  $t$  test found to be significant,  $t(38) = 2.802$ ,  $p = .008$ ,  $d = 0.89$ .

**5.2.2.3. Correlation analyses.** Pearson correlations were calculated between all continuous measures, first for all participants and then for autistic and non-autistic participants separately. Groups were collapsed across gender as no consistent differences between males or females were found on the tests described above. Bonferroni corrections were applied to control for multiple tests.

As can be seen from Table 5.3, across all participants CAT-Q scores were significantly, positively correlated with AQ scores, and significantly, negatively correlated with EQ scores. Looking at correlations between other variables, AQ was significantly, negatively correlated with EQ. Separate analysis conducted using the two subscales on the EQ and three from the CAT-Q, with a Bonferroni correction, revealed a significant negative correlation between cognitive empathy and AQ scores (partial

$r(80) = -.811, p < .001$ ) and overall CAT-Q scores (partial  $r(80) = -.393, p < .001$ ). In particular cognitive empathy was negatively associated with compensation on the CAT-Q (partial  $r(80) = -.435, p < .001$ ) and assimilation (partial  $r(80) = -.518, p < .001$ ), but not with masking ( $p = .836$ ). Whilst emotional reactivity significantly correlated negatively with only AQ (partial  $r(80) = -.478, p < .001$ ) and the CAT-Q assimilation subscale (partial  $r(80) = -.382, p < .001$ ).

**Table 5.3**

*Correlations between continuous measures for all participants*

Measures	CAT-Q	AQ	EQ	EF	ToM
CAT-Q	-				
AQ	.545**	-			
EQ	-.469**	-.800**	-		
EF	-.032	-.116	.183	-	
ToM	-.042	-.156	.258	.208	-

\*Correlation is significant at the  $p < .003$  level (two-tailed) (Bonferroni corrected)

As can be seen from Table 5.4, when the correlations were examined just in the autistic groups, none of the variables correlated significantly with CAT-Q scores and the only significant relationship was between AQ scores and EQ scores (negative). Separate analysis conducted using the two subscales on the EQ and three from the CAT-Q, with a Bonferroni correction, revealed a significant negative correlation between cognitive empathy and AQ scores only (partial  $r(40) = -.619, p < .001$ ), which was the same for emotional reactivity (partial  $r(40) = -.611, p < .001$ ). Given the strong, positive correlations between current age and age of ASC diagnosis for both genders,

the correlation between CAT-Q and age of ASC diagnosis was re-examined after controlling for current age. However, with Bonferroni corrections applied, there were still no significant correlations between CAT-Q scores and other variables for this group.

**Table 5.4**

*Correlations between continuous measures for autistic participants*

Measures	CAT-Q	AQ	EQ	EF	ToM	ASC diagnosis age
CAT-Q	-					
AQ	.249	-				
EQ	-.070	-.810**	-			
EF	.092	.196	-.109	-		
ToM	.080	-.104	.188	.244	-	
ASC diagnosis age	.187	.405	-.202	.305	.388	-

\* Correlation is significant at the  $p < .003$  level (two-tailed) (Bonferroni corrected)

As can be seen from Table 5.5, when the correlations were examined just in non-autistic populations, the only significant relationship was between AQ scores and EQ scores (negative). However, when separate analysis was conducted using the two subscales on the EQ and three from the CAT-Q, with a Bonferroni correction, only cognitive empathy was significantly correlated negatively to AQ scores (partial  $r(40) =$

-.680,  $p < .001$ ), and no other correlations between other variables or emotional reactivity were found.

**Table 5.5**

*Correlations between continuous measures for non-autistic participants*

Measures	CAT-Q	AQ	EQ	EF	ToM
CAT-Q	-				
AQ	.400	-			
EQ	-.411	-.556**	-		
EF	0.15	-.185	.293	-	
ToM	-.012	-.038	.223	.137	-

\*Correlation is significant at the  $p < .003$  level (two-tailed) (Bonferroni corrected)

### 5.2.3. Summary

Autistic participants scored higher than non-autistic participants on measures of autistic traits and camouflaging and lower on empathy. No group or gender differences were found on ToM or EF, and no interaction between gender and autism, or main effect of gender, was noted on any of the variables. In terms of mental health conditions, autistic females were found to be significantly more likely to have them; however, this was not found to be related to whether participants were high or low camouflagers.

When correlations were investigated, camouflaging was predicted by the AQ and EQ only when the whole sample was considered. When the sample was divided into autistic and non-autistic groups, this pattern was no longer significant. Together these

results suggest that camouflaging is a behaviour shown particularly by autistic individuals, but that it does not vary according to gender or cognitive abilities as previously thought. As predicted, higher camouflaging scores were linked with a later age of ASC diagnosis – but only in males.

### **5.3. Part Two**

#### **5.3.1. Method**

**5.3.1.1. Participants.** Participant-raters were recruited from the university, using both online and physical posters asking participants to partake in a study looking at social judgements of others based on first-impressions (note, no mention of autism was given here). Course credits were offered as well as a place in a prize draw with a chance to win a £50 Amazon voucher. In total, 53 males and 74 females were recruited; one male was transgender and was therefore categorised as the gender they currently identified as (male). Participants were aged between 18 and 40 years (males:  $M = 27.17$ ,  $SD = 6.05$ , females:  $M = 24.08$ ,  $SD = 5.51$ ). They were further required to not have an ASC, or any uncorrected visual or hearing impairments, and they must speak English as a first language. These criteria ensured that the participant-raters were similar to the participants being observed (hereafter referred to as participant-stimuli) in terms of age and cultural background, and therefore could be considered ‘peers’.

**5.3.1.2. Materials.** Video clips to be rated were created from the video-recorded social interactions created during part one of the study; consent was gained from the participant-stimuli to use their video clips in this way. Each of the 80 participants described in part one were video-recorded having a conversation with a research assistant. Following the procedures used by Sasson et al. (2017), the participant-stimuli were recorded engaging in as natural a conversation as possible. Two female research



assistants aged in their early 20s met briefly with participants prior to recording, but were not informed about group membership by the researcher beforehand as previous research had found that this affects first-impression ratings (Grossman, 2015; Sasson & Morrison, 2019). A similar number of participants across each of the four groups were interviewed by each of the research assistants (RA 1 tested 10 non-autistic females, 10 non-autistic males, 8 autistic females, and 8 autistic males. RA 2 tested 10 non-autistic females, 10 non-autistic males, 12 autistic females, and 11 autistic males). A Chi-Square analysis found no significant differences between these frequencies ( $\chi^2(3) = .659, p = .883$ ), and an independent-groups T-Test found no differences in the overall first-impression ratings given to participants interviewed by either of the RAs ( $t(38) = -.800, p = .429$ ).

Each interview was conducted by a single research assistant who sat directly opposite the participant (approximately 1 meter away) and began by asking them a number of open-ended questions about mundane topics (e.g., ‘what have you been up to this summer?’ and ‘what do you like to do in your spare time?’). Subsequently, to ensure consistency of content across participant-stimuli, the research assistants were instructed to ask, at a natural and convenient point in the conversation, if the participant could describe a film or book they had recently watched or read, or that was their favourite. This meant that the participant-stimuli were all discussing similar topics and were not disclosing any personal details about their lives or hobbies, which might bias subsequent ratings.

Each research assistant wore a GoPro camera (Hero 4; recording in 1080p wide at 60fps) on their head to record the conversation from a first-person point of view, similar to the camera glasses used by Sasson et al. (2017). This enabled those participant-raters later viewing the videos to observe the participant-stimuli as they

would if they were having a conversation with them themselves, from a natural angle where the full face could be observed. The research assistants had been given training in an interview technique that encouraged them to respond non-verbally as much as possible (i.e., nodding and smiling), speaking only when needed to keep the conversation going. Whilst the position of the GoPro camera may have felt intrusive to the participants, the research assistants ensured that they had begun building a rapport with the participants prior to attaching the headset, explaining to them why they would be wearing it, making light of the unusual situation, and explaining that the conversation was just a general informal chat and to try and ignore the camera. We did not reveal to these participants exactly what participant-raters would be judging their conversations on, so as not to influence the behaviours of the participant-stimuli. We also stressed that we were not testing the content of the conversation, and that we just needed natural clips of them having a ‘normal’ everyday conversation. Due to ethical considerations it was important that participants knew they were being filmed, and had fully consented to others viewing their conversations. In an attempt to mitigate from this distraction, video clips of the recordings were taken after the participant-stimuli had been talking for over one minute to give them time to feel more at ease with the unusual situation.

For each of the participant-stimuli, an excerpt of their recording lasting 10-15 seconds was extracted. These clips were always taken whilst the participant discussed a book or film, which always occurred midway through or towards the end of the conversation. The choice of 10-15 seconds was based on Sasson et al.’s (2017) study, which used 10-second clips. Furthermore, Willis and Todorov (2006) found that confidence in the judgements of others using the key trait assessments (social awkwardness, attractiveness, trustworthiness, likeability, smartness, and dominance) increased when the time of video clips increased from 1 second to 5 seconds, and from 5 seconds to 10 seconds. The precise point at which the clip was taken was selected

using a random number generator. However, these clips were also checked to ensure that, where possible, they started and ended at a natural point in the utterance, for example not in the middle of a sentence or word. No significant differences in the length of videos was found between the four groups:  $F(1,36) = 1.352, p = .273$ .

Two independent raters reviewed clips to ensure the sound and picture quality was consistent. There were 18 clips that were deemed of insufficient quality (non-autistic females = 3, non-autistic males = 1, autistic females = 4, autistic males = 2). For these clips, either the participant failed to engage in a sufficiently long enough discussion of the topic (i.e., less than 10 seconds unbroken speech), or the research assistant could be overheard responding to what the participant was saying (which could potentially influence the participant-raters to view them as more sociable/friendlier). A further 6 clips were discarded either because the participant-stimuli had visible disabilities (two autistic female participant-stimuli and two autistic male participant-stimuli), or because they had strong and sometimes incomprehensible regional accents (two non-autistic females). Finally, one autistic male did not agree for filming to take place. This left usable clips for 15 non-autistic females, 19 non-autistic males, 14 autistic females, and 14 autistic males. From this pool, ten clips were randomly selected from each of the four participant-stimuli groups. The average age of the participant-stimuli did not significantly differ between groups,  $F(3,36) = .231, p = .874$  ( $M$ : non-autistic females = 27.20, non-autistic males = 26.90, autistic females = 25.90, autistic males = 25.20).

Video clips were uploaded onto the online survey platform Qualtrics and presented to each participant-rater in a random order to avoid order effects. Each video clip was accompanied by a short questionnaire on first-impressions derived from Sasson et al.'s (2017) initial study. The questionnaire had 10 items, where participant-raters

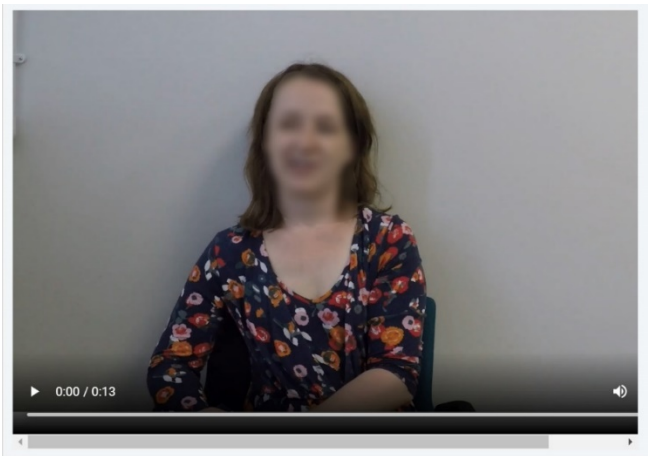
rated how much they agreed with the behavioural intent and trait items for each of the participant-stimuli on a four point scale from strongly agree (4) to strongly disagree (1) with four items reverse-scored; larger first-impression scores therefore indicated more favourable behavioural intent and trait assessments. There were six items related to traits (social awkwardness, attractiveness, trustworthiness, aggressiveness, likeability, and intelligence), found previously to reliably measure first-impressions (Grossman, 2014; Willis & Todorov, 2006). There were four items related to behavioural intentions (willingness to live near the participant-stimulus, likelihood of hanging out with the participant-stimulus in their free time, comfortableness sitting next to the participant-stimulus, and likelihood of starting a conversation with the participant-stimulus), found previously to reliably measure first-impressions (Campbell et al., 2004; Matthews et al., 2015; Nevill & White, 2011). Sasson and Morrison (2019) found that averaging the 10 items into a single first-impression score indicated strong internal consistency (Chronbach's  $\alpha = 0.82$ ).

**5.3.1.3. Procedure.** Participant-raters completed the study online after being provided with the link on request and instructions about how to open and view the videos. Participants were informed that the study would involve watching and listening to 40 videos and then rating these using a questionnaire. However, they were not informed that some of the videos were of autistic people or that first impressions of autistic and non-autistic people were being compared. They were told only that the study was looking at the social judgements made when viewing short video clips of strangers. Questions at the beginning of testing checked that the participants met the inclusion criteria on age, were non-autistic, and that they didn't have any uncorrected visual or hearing impairments. A short test video was initially played where the experimenter was seen verbally providing participants with a password to enter before proceeding. This ensured that all participants were able to see and hear the videos they

were about to watch and rate. The actual test session was divided into two halves. Five videos from each of the four participant-stimuli groups were played randomly in the first half, followed by a five minute break, and then the final 20 videos. The First- Impressions scale was presented after each video (see Figure 5.1 for an example). Finally, participants were debriefed on the general aims of the study, which stated that it aimed to, “investigate the first impressions of different groups based on short video clips of social interactions, and whether this related to self-reported social camouflaging, ToM, and empathy abilities.”

**Figure 5.1**

*Example of video clip and survey layout on Qualtrics*



Please indicate how much you agree or disagree that you would...

	Strongly Agree	Agree	Disagree	Strongly Disagree
mind if you had to live near this person	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
hang out with this person in your free time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
be uncomfortable sitting next to this person	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
start a conversation with this person	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please indicate how much you agree or disagree that this person is...

	Strongly agree	Agree	Disagree	Strongly disagree
socially awkward	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
attractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
trustworthy/honest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
aggressive/dominant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
likeable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
as smart you are	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### **5.3.2. Results**

**5.3.2.1. Participant-raters' first-impressions of participant-stimuli.** A 2 x 2 x 2 mixed ANOVA was conducted on the overall first-impression scores. Independent variables included between-subject participant-rater gender (male versus female), and within subjects participant-stimuli gender (male versus female), and participant-stimuli group (autistic versus non-autistic). Distributions of first-impression scores were normal for each condition group, and Levene's test was non-significant.

**Table 5.6**

*Means and standard deviations for the first-impression scores as a function of group and gender*

	<b>Autistic</b>	<b>Autistic</b>	<b>Non-autistic</b>	<b>Non-autistic</b>
	<b>Females</b>	<b>Males</b>	<b>Females</b>	<b>Males</b>
First-impressions	28.02 (2.70)	26.74 (2.92)	29.43 (2.85)	28.65 (3.06)
Behavioural-intent	11.28 (1.37)	10.83 (1.53)	11.98 (1.43)	11.57 (1.70)
Live near*	3.01 (0.42)	3.11 (0.53)	3.28 (0.48)	3.21 (0.50)
Hang out	2.48 (0.45)	2.29 (0.45)	2.66 (0.44)	2.54 (0.46)
Sitting next to*	3.14 (0.54)	2.94 (0.48)	3.21 (0.54)	3.11 (0.55)
Start conversation	2.65 (0.45)	2.49 (0.48)	2.82 (0.44)	2.71 (0.46)
Traits	16.74 (1.53)	15.92 (1.59)	17.45 (1.64)	17.05 (1.70)
Socially awkward*	2.34 (0.43)	2.20 (0.44)	2.85 (0.39)	3.05 (0.40)
Attractive	2.58 (0.44)	2.07 (0.44)	2.59 (0.42)	2.53 (0.43)
Trustworthy	2.91 (0.31)	2.86 (0.33)	2.96 (0.32)	2.82 (0.35)
Aggressive*	3.25 (0.42)	3.25 (0.42)	3.11 (0.46)	2.91 (0.48)
Likeable	2.88 (0.32)	2.78 (0.35)	3.06 (0.32)	2.96 (0.33)
Smart	2.78 (0.48)	2.76 (0.55)	2.88 (0.48)	2.77 (0.49)

\* Reverse scored item as negatively worded (higher score = more favourable)

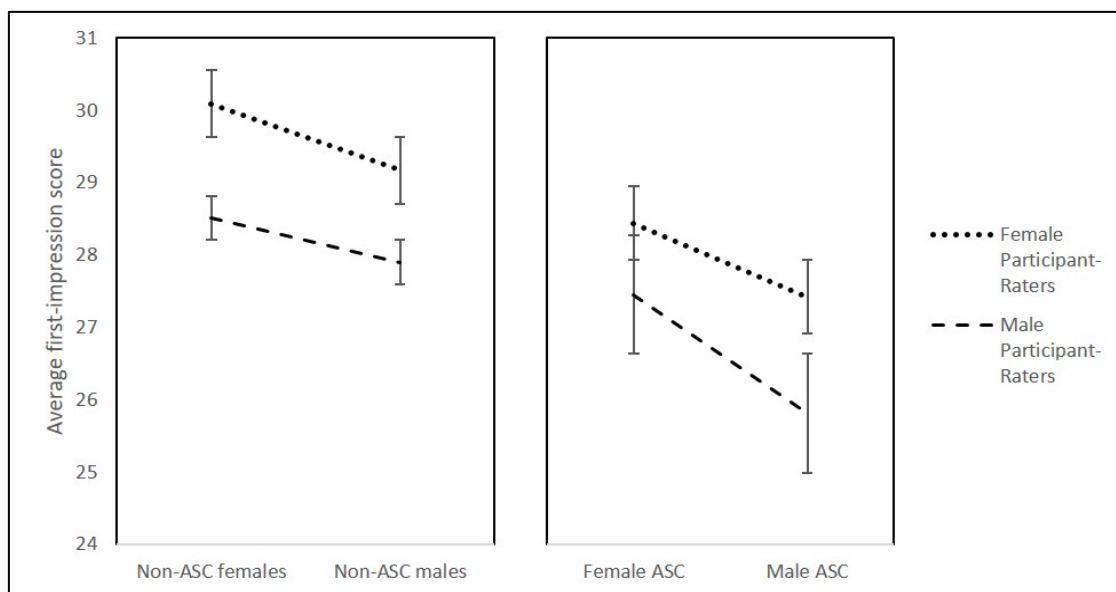
Main effects were found for participant-stimuli group,  $F(1,123) = 147.498, p < .001, \eta_p^2 = 0.55$ , participant-stimuli gender,  $F(1,123) = 55.110, p = .001, \eta_p^2 = 0.31$ , and for participant-rater gender,  $F(1,123) = 8.369, p = .005, \eta_p^2 = 0.08$ . As can be seen from Table 5.6 and Figure 5.2, autistic participant-stimuli were rated significantly poorer than

non-autistic participant-stimuli, males were rated significantly poorer than females, and male participant-raters rated all participants significantly more negatively than female participant-raters.

A significant 2-way interaction was found between participant-stimuli group and participant-stimuli gender,  $F(1,123) = 11.086, p = .001, \eta_p^2 = 0.08$ . However, non-significant interactions were found between participant-stimuli group and participant-rater gender,  $F(1,123) = .345, p = .558, \eta_p^2 = 0.03$ , and between participant-stimuli gender and participant-rater gender,  $F(1,123) = .326, p = .5691, \eta_p^2 = 0.03$ .

**Figure 5.2.**

*Average first-impression scores of non-ASC females, non-ASC males, ASC females, and ASC males for male and female participant-raters with SD bars.*



The 3-way interaction of participant-stimuli group x participant-stimuli gender x participant-rater gender was significant,  $F(1,123) = 5.444, p = .021, \eta_p^2 = 0.42$ . This was followed up by two (2 x 2) simple repeated measure ANOVAs, to investigate the interaction between participant-stimuli gender and participant-stimuli group separately for male and female raters. For male raters, an interaction between participant-stimuli



gender and group was found ( $F(1,51) = 11.716, p = .001, \eta_p^2 = 0.187$ ). Moreover, main effects were observed for both autism group ( $F(1,51) = 53.855, p < .001, \eta_p^2 = 0.514$ ) and gender ( $F(1,51) = 16.354, p < .001, \eta_p^2 = 0.243$ ). Paired  $t$  tests, using a Bonferroni correction due to multiple comparisons ( $p = .008$ ), revealed significant differences in the ratings between certain groups. Autistic females were rated significantly more favourably ( $M = 27.45, SD = 2.33$ ) than autistic males ( $M = 25.81, SD = 2.79$ ) but significantly less favourably than non-autistic females ( $M = 28.51, SD = 2.40$ ),  $p < .001$ . Autistic males were rated significantly less favourably than both non-autistic females ( $M = 28.51, SD = 2.40$ ) and non-autistic males ( $M = 27.90, SD = 2.96$ ),  $p < .001$ . No significant differences in first-impression scores were found between autistic females and non-autistic males or between non-autistic males and non-autistic females.

For female raters, there was no significant interaction between participant-stimuli gender and group,  $F(1,72) = .679, p = .413, \eta_p^2 = .009$ . However, there was a main effect of autism group ( $F(1,72) = 101.880, p < .001, \eta_p^2 = .586$ ), and gender ( $F(1,72) = 53.920, p < .001, \eta_p^2 = .428$ ). Paired  $t$  tests, using a Bonferroni correction due to multiple comparisons ( $p = .008$ ), revealed significant differences in the ratings between certain groups. Autistic females were rated significantly more favourably ( $M = 28.47, SD = 2.88$ ) than autistic males ( $M = 27.42, SD = 2.85$ ), but significantly worse than non-autistic females ( $M = 30.09, SD = 2.98$ ) and non-autistic males ( $M = 29.21, SD = 3.03$ ),  $p < .001$ . Whilst autistic males were rated significantly worse than both non-autistic males and females,  $p < .001$ , and non-autistic males were rated significantly worse than non-autistic females,  $p < .001$ .

Taken together the results indicate that non-autistic females scored most favourably on overall first-impression scores, followed by non-autistic males, autistic females, and then autistic males. Both male and female participant-raters rated non-

autistic males less favourably than non-autistic females, and male participant-raters rated both males and females less favourably than female participant-raters. This pattern is the same for male and female participant-raters when rating autistic stimuli. However, it is also apparent that male participant-raters rated autistic males more harshly than other groups.

**5.3.2.2. Correlation analyses.** The average first-impression score was calculated for each of the participant-stimuli and entered into a correlation analysis with each participant-stimulus' camouflaging scores from the CAT-Q and the autistic-stimulus' age of autism diagnosis. No significant correlation between first-impression ratings and camouflaging was found when including all participant groups,  $r(40) = .047$ ,  $p = .775$ , or for just autistic participant-stimuli,  $r(20) = .361$ ,  $p = .117$ , and non-autistic participant-stimuli,  $r(20) = .111$ ,  $p = .641$ , when considered separately. However, a significant, positive correlation was found between first-impression ratings and age of diagnosis for the autistic-stimuli,  $r(20) = .505$ ,  $p = .023$ . When autistic males and females were considered separately no significant correlations was found ( $r(10) = .105$ ,  $p = .772$  and  $r(10) = .535$ ,  $p = .111$  respectively).

### **5.3.3. Summary**

As predicted, there was a significant interaction between group and gender on overall first-impression scores. Significant differences were found between all four groups with autistic males being rated least favourably, followed by autistic females, non-autistic males, and finally non-autistic females. Importantly, gender of the rater was found to moderate this pattern. Generally, both male and female raters rated males less favourably than females and autistic participant-stimuli less favourably than non-autistic participant-stimuli. However, male raters were significantly harsher in their ratings of

autistic males than females were. Therefore, the interaction between group and gender of those being rated was being driven by male raters. Nevertheless, female raters showed significant main effects for both gender and group, reflecting the fact that they too rated autistic participants less favourably than non-autistic participants, and male participants overall less favourably than female participants. Correlation analysis revealed that while first-impression scores for the participant-stimuli showed a positive correlation with camouflaging scores, it did not reach significance. However, first-impression scores were significantly, positively correlated with age of ASC diagnosis in the autistic participants.

#### **5.4. General Discussion**

Studies 1 and 2 highlighted a cohort of women with a potential ASC. Whilst these women showed a slight advantage in empathy and social functioning over diagnosed autistic women, they still demonstrated similar impairments on measures of friendship, ToM, self-monitoring, and anxiety and depression. Study 3 therefore aimed to measure self-reported camouflaging in autistic women (using a newly developed measure designed specifically for this purpose) and to investigate how their social behaviours are viewed by non-autistic peers, to determine whether their camouflaging is successful and/or if they present less atypically than autistic males. The study was divided into two parts. Part 1 explored gender differences in the use of self-reported camouflaging in autistic versus non-autistic adults using the CAT-Q, and examined whether the use of camouflaging strategies was related to the AQ, EQ, EF, ToM, mental health diagnoses, or age of ASC diagnosis. Part 2 examined whether video clips of autistic males and females having social conversations were rated more or less favourably than non-

autistic males and females on a first-impressions survey, and whether these ratings correlated with self-reported camouflaging and age of ASC diagnosis.

#### **5.4.1. Part-one: Group and gender differences in self-reported**

**camouflaging.** In the first part of the study, self-reported camouflaging scores on the CAT-Q were compared between autistic females, autistic males, and a control group of non-autistic male and female participants. Additionally, correlations were examined between camouflaging and empathy, EF, ToM, age of ASC diagnosis, and analysis was also conducted to investigate if higher camouflaging led to more mental health issues. It was predicted that autistic females would score higher on self-reported camouflaging than autistic males, and that this would be associated with better EF, ToM, empathy, and a later age of diagnosis, with a greater likelihood of mental health problems. These hypotheses were not wholly supported by the results. Whilst autistic females were diagnosed significantly later than autistic males and were more likely to have mental health problems, there was no significant interaction between group and gender on the CAT-Q or the EQ. Instead, regardless of gender, the autistic group scored higher on camouflaging and lower on empathy than the non-autistic group, and this was true for both the cognitive empathy and emotional reactivity subscales of the EQ. Furthermore, there were no significant group differences on ToM or EF. CAT-Q scores were found to correlate positively with the AQ and negatively with the EQ (as well as both cognitive empathy and emotional reactivity separately) only when the whole sample was used, but not when looking at autistic and non-autistic groups separately. The significant positive correlation between the AQ and self-reported camouflaging across the sample most likely reflects the fact that most autistic participants reported strong use of camouflaging techniques. The correlation did not reach significance in the individual groups due to the smaller sample size. It is worth noting that there was a moderate (albeit not significant) correlation between AQ scores and self-reported camouflaging even in the

non-autistic group, which might mean that even neurotypical people with higher levels of autistic traits tend to socially interact in more effortful ways.

The findings from this study are inconsistent with those of Hull, Lai, et al. (2019), who found scores on the CAT-Q to be significantly higher in autistic females than autistic males. However, both Hull, Lai, et al. (2019) and the current study's findings had a similar effect size in the difference between autistic males and autistic females ( $d = 0.65$  and  $0.58$  respectively). The mean CAT-Q score for autistic females in Hull, Lai, et al.'s (2019) study was  $124.35$  ( $SD = 23.27$ ) and the mean CAT-Q scores for autistic males was  $109.64$  ( $SD = 26.50$ ), compared to the current study which found a mean score of  $123.20$  ( $SD = 28.76$ ) for autistic females and  $114.47$  ( $SD = 27.06$ ) for autistic males. This previous study sampled a greater number of participants in total ( $n = 778$ ) than the current study and therefore had more statistical power, leading to their significant findings. On the other hand, Cage and Troxell-Whitman (2019) also did not find a difference between autistic males ( $n = 111$ ) and autistic females ( $n = 135$ ) on the CAT-Q: autistic females scored on average  $118.90$  ( $SD = 18.83$ ) and autistic males scored on average  $114.25$  ( $SD = 21.36$ ). Findings regarding gender differences in camouflaging scores on the CAT-Q therefore continue to be inconsistent. It may be the case that both genders attempt to camouflage their autistic traits, but there may be subtle differences in how this is achieved, which are not captured using the CAT-Q. For example, Cassidy et al. (2018) also did not detect any differences between the percentages of autistic men and autistic women who attempted to use camouflaging. However, they used their own camouflaging questionnaire and not the CAT-Q. This scale asked participants if they had "ever tried to camouflage or mask [their] characteristics of ASC to cope with social situations? For example, have [they] ever tried to copy or mimic other people's behaviour to try and fit in, or tried to mask or hide [their] symptoms of ASC from other people?" If participants answered yes to this then

they were then asked to specify in which areas of their life they camouflaged, how frequent this was on a scale of 1 (never) to 6 (always), and lastly the overall amount of the day they spent camouflaging on a scale of 1 (none of my waking time) to 6 (all of my waking time). 89.2% of autistic females attempted to camouflage, which was similar to the 90.9% of autistic males. In contrast, the overall scores on the camouflaging scale were significantly higher for autistic females ( $M = 14.7$ ) than autistic males ( $M = 12.95$ ) which had a medium effect size ( $d = .47$ ). Moreover, they detected subtle gender differences in the quality of camouflaging, for example, autistic women camouflaged across more situations than autistic men. Unlike their scale, the CAT-Q may be unable to determine the quality of camouflaging behaviours and the success of these.

With increased media coverage of the topic of late diagnosis in autism and camouflaging, it is possible that more autistic people than before, both females *and* males, are employing camouflaging strategies or becoming aware that they already use them. The notion of the female autism phenotype started in the early 1990s (Kopp & Gillberg, 1992); however, the idea of camouflaging in autistic females only became popular over a decade ago, when autism professionals began to observe more autistic females than had been seen previously camouflaging their autistic traits (Attwood & Grandin, 2006). From this there grew an increasing body of autobiographical books and online blogs from women who were diagnosed with autism in adulthood, describing their attempts to ‘appear normal’ and to camouflage to fit in with others (Miller, 2003; Simone, 2010; Willey, 1999). Qualitative studies explored the experiences of these autistic women, where again camouflaging was flagged as a common theme (Hull, Petrides, et al., 2017; Tierney et al., 2016). The concept of camouflaging in autism, particularly in females, may have become a contagious concept. With increased publicity around the topic it is likely that many undiagnosed autistic women became more aware of their difficulties and social strategies and understood these better under

the concept of ‘camouflaging’. It is also possible that many young autistic females growing up have learnt about the behavioural strategy from reading about other girls’ experiences, and therefore are more likely to use camouflaging strategies themselves. In addition to this there has been an increase in social media use since the female phenotype of autism was first conceived, and socialisation has altered as a result; many people regularly ‘camouflage’ online, disguised as different people or present to others how they wish to be seen (Aiken, 2017). Therefore, the concept of the camouflaging of autistic traits may have changed since its conception. It is possible that it is not an exclusively female trait, and many autistic males may have also utilised the strategy, or themselves been diagnosed late because of it (as found in Part-Two of the current study). None of the qualitative studies conducted considered the ‘male’ experience of autistic camouflaging, and thus far this has only been framed from a female perspective. There are only a handful of quantitative studies that have explored camouflaging in both autistic men and women.

Further predictions for the current study that heightened camouflaging would be correlated with better EF, ToM, and empathy were also not supported. Previous research had suggested that autistic females may have sex-distinct cognitive abilities that enhance their ability to socialise and camouflage autistic behaviours (Bolte et al., 2011; Lai et al., 2012; Lenhardt et al., 2016). However, for the current sample this was not the case. Furthermore, whilst Livingston et al. (2018) found superior EF, along with higher IQ and greater anxiety, to be linked to a better ability to compensate for underlying deficits in ToM, no gender differences in compensation were found. The current study is the first to explore self-reported camouflaging behaviours and their link with EF, ToM, and empathy. Future studies should attempt to replicate these findings on larger samples of autistic people.

Finally, no support was found for the prediction that heightened camouflaging would be associated with a raised likelihood of mental health problems. This finding is inconsistent with previous literature which has found worse mental health in those who camouflage (Cage & Troxell-Whitman, 2019; Cassidy et al. 2018). For example, Hull, Mandy, et al. (2018) found mental health was positively correlated with the CAT-Q using the Social Anxiety Scale, Warwick-Edinburgh Mental Wellbeing Scale, Patient Health Questionnaire, and Generalized Anxiety Scale. However, the current study did find that autistic females were more likely to have a mental health issue than autistic males, which might indicate that rather than camouflaging being the direct cause of mental health issues in autistic females, it may instead be a consequence of other associated factors, such as later diagnosis and lack of support (Stagg & Belcher, 2019). However, the current study did not measure mental health traits in the same way as previous research, and instead relied on reporting of clinical diagnoses of mental health problems. Therefore, it is not possible to say whether camouflaging scores correlate with poorer mental health, only that those who are higher camouflagers are not more likely than low camouflagers to have other mental health diagnoses. Livingston et al. (2018) have suggested that camouflaging affects mental health because of the additional mental resources required, which again conflicts with the current findings. It may be the case that there is a ceiling effect in mental health issues caused as a result of camouflaging, and as the current study found camouflaging to be a uniquely autistic strategy, with most autistic participants using the strategy, it may not matter how high participants scored; rather it is just the fact that they feel they have to use the strategy at all.

**5.4.2. Part-two: Group and gender differences in first-impressions.** In the second part of the study, a sample of video clips of natural conversations involving the same participants used previously (participant-stimuli) were shown to non-autistic peers



(participant-raters). These participant-raters rated each video clip on the First- Impressions scale, and these results were compared within the four different groups (autistic females, autistic males, non-autistic females, and non-autistic males). It was predicted that autistic female participant-stimuli would be rated more favourably than autistic male participant-stimuli, due to their social presentation appearing more typical. Secondly, it was predicted that participant-stimuli's average first-impression scores would positively correlate with their camouflaging scores on the CAT-Q and age of ASC diagnosis.

The first prediction was supported by the findings. A group bias was observed, with autistic participant-stimuli being rated more negatively than non-autistic participant stimuli, and a gender bias was also observed, with males being rated more negatively than females. The gender of the participant-rater was also found to have an impact on the ratings. Male raters tended to rate participant-stimuli more harshly; however, they were harsher on autistic males than they were on any other participant-stimuli. Therefore, autistic males were rated significantly less favourably than autistic females, as they appeared to have a triple hit of being autistic, male, and rated more harshly by male raters. These findings are consistent with those of Sasson et al. (2017), who found that autistic people were rated less favourably than non-autistic people by their peers. In addition, by including equal numbers of autistic males and females as stimuli and by analysing the effects of rater gender, the current study yielded the novel finding that autistic males are rated less favourably than autistic females by their peers, due to gender and group biases in first-impressions.

Partial support was found for the prediction that first-impression scores for the participant-stimuli would correlate positively with both camouflaging scores on the CAT-Q and age of autism diagnosis. Although the findings did not show a correlation

between first-impression scores and the CAT-Q, a later age of ASC diagnosis was indeed associated with more positive first-impression scores. Taken together, this suggests that rather than autistic individuals evading diagnosis due to deliberately camouflaging their autistic traits, there may instead be a gender bias in the interpretation of autistic behaviours by others.

There are ramifications if, as this current study suggests, there is a gender bias in how autistic behaviours are viewed, with males being more likely than females to rate the behaviour of autistic males harshly. Autism is commonly diagnosed by a psychiatrist and until recently the majority of psychiatrists in the UK were male. For example, in 2009 55% of doctors specialising in psychiatry were male, whereas now 51% are female (NHS, 2018). This may have contributed to the historical bias of diagnosing males with autism earlier than females. First-impression scores in the current study were found to correlate positively with age of diagnosis, and whilst the inference of causality should be approached cautiously, this does support the theory that females are diagnosed later because they do not appear to others to be ‘autistic enough’ compared to males. Autistic females have been found to score lower than autistic males on the social communication elements of the ADOS (Lai et al., 2017; Rynkiewicz et al., 2016) but these studies did not consider the gender of the clinician scoring the participant’s social behaviour, which the current study suggests may affect observations of behaviour. The consequence of this is that autistic women may be more likely to miss a diagnosis of ASC when the clinician is male.

Taken together, the first and second parts of Study 3 demonstrate that despite autistic males and females scoring similarly on self-reported camouflaging, there was still a difference in the first-impressions they made to non-autistic peers, with autistic women being rated more favourably than autistic men. Camouflaging was not found to

be related to better EF or ToM, as had been predicted, and was correlated with age of ASC diagnosis only in males. These findings suggest that the self-report CAT-Q may not be successful in differentiating the presentation of autistic females and autistic males, whilst the non-autistic peers clearly perceived a difference in behavioural presentations between autistic males and females. Autistic participant-stimuli who were rated more favourably on first-impressions tended to also have received their ASC diagnosis later, suggesting that their behavioural traits may be viewed less ‘atypically’, and therefore negatively, by others, hindering earlier identification of autism. It would seem that autistic females are particularly vulnerable to this happening, as the current study found that generally females were rated more favourably than males and therefore had an advantage, which may explain consistent findings throughout this thesis and other literature that autistic females are diagnosed with ASC significantly later than autistic males.

**5.4.3 Strengths and limitations.** A particular strength of the current study is the sample used, which was derived from the general population rather than from an assessment clinic. This means that the study was able to engage autistic adults with later diagnoses and more non-traditional autistic diagnosis records than clinical studies have done previously. The participant advertisement purposefully did not mention that the study was exploring camouflaging behaviours, in order to avoid receiving a biased sample of only late diagnosed high camouflaging participants. This may explain why the current study did not find as great a difference in camouflaging between males and females as that seen in Hull, Lai, et al.’s (2019) study, which was advertised specifically as a study on camouflaging, for the purpose of validating the CAT-Q scale on those who used camouflaging strategies.

A second strength of this study is the use and further validation of the CAT-Q as a measure for camouflaging of autistic traits. Previous literature had relied on the discrepancy method to measure camouflaging, which involves looking at differences in self-reported autistic traits and clinician scores on observable social traits on the ADOS measure (Lai et al., 2017). However, this can be prone to bias as found in the second part of this study, with autistic males being rated more harshly than autistic females by observers. The CAT-Q allows insight into conscious social camouflaging strategies, and has also not previously been used to investigate the link between camouflaging and cognitive abilities.

Finally, a key strength of this study was that it adapted the methodology set out by Sasson et al. (2017), combining elements across their three separate studies to create a more ecologically valid test. For example, it used films of naturalistic conversations rather than recordings of participant-stimuli acting, and it showed 10 second video clips of these to participant-raters rather than photograph frames of the conversation. Therefore, the first-impression judgements were based on naturalistic interactions mimicking those in real life.

Nevertheless, there are several limitations to the current study. A key limitation to the research is the use of only one self-report measure for self-reported camouflaging. Whilst the CAT-Q has been shown to be a reliable and valid measure for determining how much someone consciously uses camouflaging strategies (Hull, Mandy, et al., 2018), it does not provide information on frequency in the use of the strategy, or the situations or circumstances in which it is used. This has been discussed in more detail in Chapter 6. Without knowing more about how and why the current participants used camouflaging as a strategy, the current study's interpretations should be understood with caution.

Additionally, the current study is limited by the low number of participant-stimuli used in the second part of the study. Only ten participants' video clips from each group were able to be used due to time and resource constraints of the participant-raters. It would have been beneficial to use all participant-stimuli so that a more detailed analysis of their average first-impression scores could be made with the CAT-Q scores and other measures. Despite this, the initial analysis of first-impression scores between groups used a within subjects design, with numbers comparable to Sasson et al.'s (2017) study, and the current study found robust and significant results with large effect sizes.

**5.4.4. Conclusions.** In conclusion, the current study has contributed novel findings on the topic of the FPT of autism. A gender and autism group bias was found in the first-impression ratings made by non-autistic autistic peers, demonstrating that autistic females may be perceived more favourably than autistic males. This was related to the age of diagnosis, with more favourable first-impression ratings associated with a later age of autism diagnosis. This may have consequences for the diagnosis of autism in females, and whilst significant findings were not made regarding gender differences in self-reported camouflaging, it does illustrate the potential for others to view the behaviour of autistic females as less 'atypical', suggesting some form of masking less favourable autistic traits.



## **CHAPTER 6**

### **General Discussion**

This thesis has described three studies which contribute to the knowledge of missed and late diagnosis of autistic women. The aims of this thesis were based on the unanswered questions outlined in section 2.3, which were formulated from the review of the literature undertaken in Chapters 1 and 2. The main findings from this review are outlined first with key questions and aims described next. This is followed by a description of the key findings and interpretation of each of these, a discussion on the findings regarding the role of gender in autism across the whole thesis, a critical review of the work undertaken, and finally implications and recommendations for future avenues of research.

#### **6.1. Key Findings from the Literature**

Initial figures suggested that autism was more common in males (e.g. Bryson, 1988), and theories suggested that this was because males were more genetically vulnerable to the condition as it was an extreme version of the male brain (Baron-Cohen, 1999). However, other research has suggested that rather than autistic females being less likely to have the condition, they are instead more likely to be missed as they have a different phenotype of autistic traits (Kopp & Gillberg, 1992). This was supported by findings that the gender ratio of males to females may decrease when possible cases of undiagnosed autistic people are included (e.g. Ehlers & Gillberg, 1993). Furthermore, autistic females are likely to receive their diagnoses later than autistic males (Bancroft, 2012; Begeer et al., 2013). Several researchers have found that autistic females may have superior social abilities, which are reflected in lower clinical observation scores for social deficits and less overt behavioural traits (Hiller et al., 2014; Lai et al., 2011; Rynkiewicz et al., 2016). In addition, there is an increasing body of literature which

suggests that many autistic girls may deliberately camouflage their autistic traits, compensating for deficits and masking autistic behaviours (e.g. Hull, Petrides, et al., 2017).

There are several reasons suggested in the literature as to why autistic females may have a different phenotype. Gender biases in diagnoses have been suggested, for example in order for girls to be diagnosed with autism they may require a greater number of external behavioural problems than boys (Dworzynski et al., 2012). Additionally, the socialisation pressures for autistic females to conform to gender norms may encourage behaviours which camouflage traditional autistic traits viewed as too masculine (Ratto et al., 2018). Thirdly, autistic females may have different cognitive strategies and abilities compared with autistic males, which might facilitate the development of better social awareness and skills (Livingston et al., 2018).

This different phenotype however, may lead to late or missed diagnosis, and therefore the lack of timely and correct support, as well as mental health difficulties thought to occur from the employment of camouflaging strategies (Livingston et al., 2018). This is supported by findings that the majority of autistic females have mental health problems (Baldwin & Costley, 2015), and that camouflaging is associated with mental health difficulties and suicidal behaviours (Cassidy et al., 2018; Hull, Mandy, et al., 2019).

A further issue identified in the literature is that of misdiagnosis. Autistic people are generally vulnerable to psychiatric conditions (Russell et al., 2016) and also suicidal behaviours (Cassidy et al., 2018). However, some psychiatric conditions may have overlapping features with ASC (Lai & Baron-Cohen, 2015). Of particular concern for autistic females is BPD, with one study finding 15% of 41 BPD patients fulfilled criteria for ASC (Ryden et al., 2008).



## 6.2 Thesis Predictions and Current Findings

What remained to be addressed in the literature was an exploration of the differences in profile between diagnosed autistic women and potentially autistic women. In particular, there was a need to compare these two groups on the occurrence of other psychiatric diagnoses, which was examined in Study 1 of this thesis, and to examine differences in social, emotional, and behavioural traits, which was examined in Study 2. It was predicted that greater psychiatric problems and advantages in social ability would be found in potentially autistic women, relative to diagnosed autistic women. This is in line with the FPT theory, which suggests that these women may have missed a diagnosis due to better camouflaging of their autistic traits and a different manifestation of autistic behaviours. What also remained to be answered was whether self-reported camouflaging was related to better EF and ToM abilities in autistic people, and whether this would correlate with age of diagnosis, which was examined in Study 3 (part-one). Finally, Study 3 (part-two) aimed to fill a gap in the literature by investigating whether autistic women would be rated more favourably by non-autistic peers based on first-impressions of them in social interactions compared with autistic males, and whether these scores would correlate with self-reported camouflaging and age of diagnosis. Both parts of Study 3 were motivated by the FPT theory, which suggests that if autistic females have different cognitive abilities that could enhance social abilities, then this should be related to the self-reported camouflaging scale. Also, if the female phenotype of autism does mean that autistic women behave less ‘atypically’ than autistic men, then other observers should be sensitive to this. Taken together, these three studies attempt to help explain why autistic females may remain unidentified and what factors are delaying their diagnoses. Note that each study had a number of other, more specific hypotheses and these are addressed within the relevant chapters (Chapters 3-5). The three key aims are outlined next, with an interpretation of the findings made.

**6.2.1. Comparison of diagnosed and potentially undiagnosed autistic women on other mental health diagnoses.** The first key aim of this thesis was to explore a gap in the literature regarding the potentially autistic women in the general population and their other psychiatric diagnoses. Studies 1 and 2 attempted to fill this gap, by screening nationwide for potential cases of undiagnosed autism in females, determined from severity of autistic traits as gauged by the AQ, and by collecting data on their mental health diagnoses. Study 1 predicted that more psychiatric diagnoses would be found in potentially autistic women than diagnosed autistic women, particularly conditions with overlapping features such as BPD. Study 2 predicted that diagnosed autistic women usually would receive their other psychiatric diagnoses before their ASC diagnoses, which would not be the case for diagnosed autistic men. Both of these predictions were motivated by the literature suggesting that delayed/missed autism diagnoses in women may be caused by misdiagnosis. That is, due to autistic women displaying less traditional autistic traits and presenting with more internalising problems, clinicians may be biased towards making other psychiatric diagnoses rather than ASC.

These predictions were partially supported for Study 1. It was not found that potentially autistic women were more likely to have other psychiatric diagnoses compared to diagnosed autistic women; the latter group had significantly more. However, there were significant differences in the types of other psychiatric diagnoses made. Whilst diagnosed autistic women were more likely to have conditions like OCD, ADHD, and affective disorders, potentially autistic women were more likely to have BPD. These findings do not align with the hypothesis that potentially autistic women have more mental health problems than those with a diagnosis due to the demands of hiding their autism (Livingston et al., 2018), but they do highlight specific vulnerabilities in potentially autistic women. The misdiagnosis of BPD in autistic

women has been discussed in the literature as being a particular concern, and which might delay diagnosis for autistic women (Bargiela et al., 2016; Lai & Baron-Cohen, 2015; Rabbitt et al., 2017; Ryden et al., 2008). Furthermore, these findings may hint at a gender bias in the diagnosis of certain conditions, with females being more likely to receive BPD diagnoses and males being more likely to receive an ASC diagnosis (APA, 2000). Where obvious autistic traits and difficulties may be hidden, professionals may see manifestations of a patient's struggles with these, such as self-harm and suicidal thoughts, as symptoms of mental disorder, further delaying diagnosis. These findings have been discussed and interpreted in more detail in section 3.4.

Predictions were supported for Study 2. Whilst, Study 1 did not find any differences between diagnosed autistic women and diagnosed autistic men in the likelihood of having another psychiatric diagnosis, Study 2 did find a difference; diagnosed autistic women were significantly more likely to have one. This second study did not find any difference between potentially autistic women and diagnosed autistic women, or between diagnosed autistic women and men, on the age of first psychiatric diagnosis. However, the study did reveal that diagnosed autistic women were more likely to receive other psychiatric diagnoses prior to their ASC diagnosis, and that for the majority the ASC diagnosis was the last to be made. This pattern was not observed for diagnosed autistic men. These findings further support the hypothesis that misdiagnosis with other conditions may result in a delayed autism diagnosis for women. For example, Bargeila et al. (2016) found that late diagnosed autistic women commonly reported clinicians not believing that their difficulties were due to autism, but instead often diagnosed other conditions. Even when these women suspected they might have ASC, their concerns were often dismissed. This may be due to autistic females presenting differently with ASC to the typical presentation that clinicians expect to see,

and which is more often observed in autistic males. These findings have been discussed and interpreted in more detail in section 4.4.

**6.2.2. Comparison of diagnosed and potentially undiagnosed autistic women on social and behavioural measures.** The second aim of this thesis was to explore a gap in the literature regarding differences between potentially autistic women and diagnosed autistic women in social abilities. This was tested in the nationwide study conducted in Study 1 and 2. It was predicted that potentially autistic women would perform better on measures of empathy, ToM, and social ability, but would have more traits of depression and anxiety as a result. It was also predicted that there would be correlations between these measures, such that greater empathy would positively correlate with better social ability, and that social ability would positively correlate with greater anxiety and depression. In those with a diagnosed ASC it was predicted that these variables would also correlate positively with age of ASC diagnosis. These predictions were made as it was found in previous studies that autistic females performed better socially than autistic males, and that many autistic girls camouflage their autistic traits. It was therefore hypothesised that this female phenotype would be even more pronounced in potentially autistic women.

These predictions were partially supported by findings from Studies 1 and 2. An empathy advantage was found for potentially autistic women in comparison to diagnosed autistic women, more specifically in cognitive empathy, and in Study 2 potentially autistic women also reported performing better on social functioning. However, no differences were found between the two groups on ToM, friendship quality and motivation, self-monitoring (a proxy measure for camouflaging), or in traits of depression and anxiety. Furthermore, whilst correlations were found in the expected directions between AQ, EQ, RMET, and FQ for both diagnosed and

potentially autistic women, empathy did not correlate with social ability measures, and social ability measures did not correlate with traits of anxiety and depression either. A weak significant, positive correlation was observed between self-monitoring and age of autism diagnosis when both diagnosed autistic males and females were combined, however, no other measures correlated with age of diagnosis for autistic males or females.

These findings suggest that autistic women who show better empathy and social functioning may miss being diagnosed. They align with previous findings that autistic girls require more overt behavioural problems and traits to gain a diagnosis compared to autistic boys (Dworzynski et al., 2012). However, findings from the second study only partially support the FPT because no differences in social abilities were found between the groups, and these did not relate to age of diagnosis or increased traits of anxiety or depression. As mentioned in section 4.4, the reason that potentially autistic women and diagnosed autistic women failed to differ in terms of ToM, friendship, self-monitoring, depression, and anxiety may be that the majority of diagnosed autistic females in this study were diagnosed in adulthood, and perhaps missed gaining a correct diagnosis due to presenting with less traditional manifestations of autistic traits.

**6.2.3. Self-reported camouflaging and peer-assessed judgements of social behaviours in autistic males and females.** The third aim of this thesis was to explore a gap in the literature regarding the differences between autistic males and autistic females in observable social behaviours and self-reported camouflaging. Study 3 administered a new and more direct measure of self-reported camouflaging to autistic females and autistic males, to see whether results predicted peer judgements of their social behaviours. It was predicted that autistic females would score higher than males on self-reported camouflaging, and that this would be related to better EF and ToM.

Furthermore, it was predicted that due to better camouflaging autistic females would be rated more favourably by non-autistic peers who viewed short clips of participants in social conversation. These predictions were made as previous literature has found that autistic females may camouflage more than autistic males (Hull, Lai, et al., 2019), and that better EF and ToM skills might aid camouflaging ability (Livingston et al, 2018) . However, self-assessments may be biased in autistic women who have more self-awareness of their impairments, and therefore a more objective measure of social camouflaging was needed.

The first prediction was not supported: Autistic males and autistic females performed similarly on the self-reported measure of camouflaging, and neither EF nor ToM were related to camouflaging or differed between the four groups. This does not align with previous research by Hull, Lai, et al. (2019) who found a gender difference. However, a similar effect size between autistic males and autistic females on the CAT-Q was found in the current study as was found in Hull, Lai, et al.'s (2019) study ( $d = 0.58$  versus  $0.65$ ). The current study may be underpowered for part-one by a lower number of participants.

However, despite there being supposedly no differences in self-reported camouflaging of autistic traits, the second prediction was supported; autistic females were found to be rated more favourably by non-autistic peers than were autistic males. These findings were robust, well powered, and had large effect sizes. Male raters were particularly harsh in their judgements of autistic male participants. Given that the raters did not know that any of the participants were autistic, this study suggests that the autistic females were in some way behaving differently and less 'atypically' than the autistic males. These first-impression scores did not correlate with autistic participant-stimuli's camouflaging scores but they did correlate positively with age of diagnosis;

the more favourable the first-impression rating scores were, the older the ASC diagnosis was made. These findings align with those made previously by Sasson et al. (2017), who found that autistic people were generally rated less favourably than non-autistic people on first-impressions.

The gender and diagnostic differences on first-impression scores, which were not correlated with self-reported camouflaging but were significantly correlated with age of diagnosis, suggests that the CAT-Q may not adequately quantify camouflaging strategies. It is also possible that whilst both autistic males and females attempt to camouflage, there are other factors which result in the different behavioural manifestation of autistic traits seen between the two genders. These findings have been interpreted in more detail in section 5.4 and are also discussed below.

### **6.3. A Reflection on the EMB and FPT Theories of Gender and Autism**

Gender can play a complex moderating role which should be considered by all relevant theories. The EMB theory is limited by only considering one aspect of this debate, which is that males are more likely to be diagnosed with autism because they are genetically more predisposed to it, therefore neglecting late diagnosed and missed autistic women (Krahn & Fenton, 2012). The FPT considers a more prominent role for environmental factors, for example autistic women may be diagnosed later due to socialisation pressures to camouflage behaviours, though they may also be better equipped with the cognitive strategies to do so too. Nevertheless, there are issues with the FPT theory as well, as by continuing to dichotomise and gender the different presentations of autism it risks excluding a large number of autistic people, for example autistic males, who may camouflage and who have been diagnosed late or missed.

The findings from the current study suggest that the EMB theory is not sufficient in explaining presentation differences between autistic males and females, or those

whose autism has not been diagnosed. For example, the theory states that empathy is more impaired in non-autistic males than females, and that it is even more impaired for autistic people. However, potentially undiagnosed women had an empathy advantage over diagnosed cases of autism, which suggests that there may be less impairment on this trait when undiagnosed cases of autism are included than previously thought.

Although, non-autistic females were found to score higher on the EQ than non-autistic males, and both autistic males and females showed a similar level of impairment on the scale. Potentially autistic women may have an empathy advantage over diagnosed autistic women, but they still show impairment on the EQ compared to non-autistic individuals. These studies were unable to contradict the EMB theory entirely, as they were underrepresented by autistic males and did not measure systemising or levels of foetal testosterone. According to the EMB theory, systemising ability is heightened in autistic people as a result of excess fT. Whilst it cannot be determined if these findings are due to the autistic participants having an extreme male brain, they do support those findings made previously in support of the EMB theory (Baron-Cohen & Wheelwright, 2004). This theory needs to be adapted to account for the manifestation of autistic traits seen in late diagnosed autistic people.

Findings from all three studies present some challenges for the FPT theory too. The current thesis found that autistic women are diagnosed significantly later than autistic men (all three studies), that social functioning is better in potentially autistic women compared to those with a diagnosis (Study 2), that autism women are rated more favourably on first impressions by observers than autistic men (Study 3), and that first-impression ratings positively correlated with age of diagnosis (Study 3). However, Study 2 did not find any differences between diagnosed and potentially autistic women on numerous social measures (friendship, ToM, or self-monitoring), and Study 3 did not find a difference between autistic males and females on self-reported camouflaging, or



that better EF and ToM ability was linked to camouflaging. Given that Study 2 was unable to reliably compare diagnosed and potentially autistic males and females, it cannot be determined from these findings that better social functioning is part of a *female* phenotype of autism. Results from the self-reported camouflaging measure would suggest instead that both autistic females *and* males may present with this phenotype.

To date, the evidence in support of the FPT has been largely based on the qualitative accounts of autistic women (e.g. Tierney et al., 2016). Studies are only now beginning to attempt to investigate experiences of camouflaging in autistic males via quantitative methods. Lai et al. (2011) suggested camouflaging was not necessarily specific to females and that there is considerable overlap in camouflaging scores between autistic males and females. Rather than looking at gender as a primary cause of differences in autism diagnosis and presentation, the most likely explanation is that there are multiple factors involved. Diagnostic delays may result from different factors and combinations of factors. It is limiting to describe autism presentations in terms of gender, when the differences between autistic males and females is very inconsistent and depends on many other factors. Females may indeed be more at risk of a late or missed diagnosis due to having more socialisation pressures of fulfilling gender roles to ‘fit in’ and consider others’ feelings. They therefore may modify their behaviour and hide autistic traits that others may dislike or which might upset others. Critically however, autistic males may also do this and many females may not experience this. Furthermore, many might attempt to do this but not be successful in concealing autistic traits due to other factors, such as impairments in the cognitive skills required to do so, or the presence of comorbid conditions. It is likely that females are more susceptible to delayed diagnosis due to increased vulnerability of these different factors, which are not all listed here and may yet be uncovered. However, we do not yet fully understand the

mechanisms involved in late diagnosis of autistic males. Recommendations for future research to address these gaps are discussed further in section 6.6.

#### **6.4. Limitations and Strengths**

There are several limitations of this thesis, which can also be considered as strengths in some aspects. The first is the use of self-report measures to determine autistic traits and impairments. A second is the over-representation of late diagnosed and potentially undiagnosed autistic women. Each of these points will be discussed in turn.

Firstly, the methodology in the first and second study relied solely on self-reported behaviours and traits which relies to a degree on self-assessment. These self-assessments rely on the level of insight the participant has into their own difficulties. Several studies now have suggested that autistic women report their autistic traits more harshly than autistic males, due to having more insight into their problems (Baron-Cohen et al., 2014; Lai et al., 2011; Lai et al. 2013; Lenhardt et al., 2016). However, it should be noted that in all three of the current studies no significant differences between autistic males and autistic females were found on self-reported autism traits, measured with the AQ. Furthermore, in both the first and second study potentially autistic females were compared with diagnosed autistic females, which would have controlled for this issue to some degree.

Despite this, there still might be issues with reliability in using a self-assessment measure to determine which participants may be potentially autistic. Both the first and second study relied on AQ scores and based on this measure it is not certain that the potential ASC group are autistic. It is likely that some of these potentially autistic participants would not qualify for an ASC diagnosis if they were to be formally assessed. Items for the AQ were initially developed using the typical autism

presentation of traits that relied heavily on the testing of autistic males. For example, Baron-Cohen et al. (2001) sampled a much larger number of autistic males than females (45 males vs. 13 females). Moreover, as mentioned in Chapter 2, the predictive value of the AQ has not been adequately explored for autistic males and females separately (Sizoo et al., 2016). Although Murray et al. (2016) established that the shorter version of the AQ-10 was accurate for both males and females, when testing 557 autistic females and 680 autistic males, these findings do not account for potentially autistic females, who may present with a less severe autism phenotype.

However, as discussed previously, the AQ is a well validated screening tool that has been shown to be accurate in over 70% of cases scoring above the clinical cut off, and it is also used as part of clinical assessments recommended by NICE guidelines (Baron-Cohen et al., 2001; NICE, 2011; Sizoo et al., 2015). The current study demonstrated impairments on the EQ, RMET, and FQ, as well as elevated depression and anxiety, for potentially autistic participants when compared to non-autistic controls, with similar scores on these measures to the diagnosed group of autistic participants. This provides further evidence that it is likely the majority of potentially autistic females were correctly labelled, and that they were very similar in profile to those females who had an ASC diagnosis.

Although, given that the first two studies discussed in this thesis categorised participants using AQ scores, it is likely that the potentially autistic women and diagnosed autistic women would be very similar as they present with similar autistic traits. Had a different method of identifying potentially autistic women been utilised, then a different cohort of potentially autistic women may have been sampled that could have presented very differently on the measures used. For example, it might be worthwhile in future studies to consider sampling women who self-identify as autistic,

particularly those who have not reached cut-offs for clinical assessments. Although it would be difficult to know if these women were actually autistic, it could provide important insights into the female phenotype of autism.

Findings from the third study that there were no gender differences on the CAT-Q may also raise concerns regarding the validity of using a self-report measure. However, other studies also did not find a gender difference on the CAT-Q itself, but did find gender differences in the quality of camouflaging and the situations in which it was used (Cage & Troxell-Whitman, 2019; Cassidy et al., 2018). These findings demonstrate the importance of collecting multiple strands of evidence rather than relying on a single measure or dimension; this could include the use of objective measures to support self-report findings, as in the third study.

Regardless of the problems that self-assessment tools present, they also have strengths. Whilst it was not possible to clinically test these potentially autistic participants to determine the proportion who met diagnostic criteria for ASC, an advantage of using self-assessment tools is the potential to administer them online to large numbers of participants. For example, using the AQ enabled over 5,165 individuals from across the UK to partake in the first study, with 834 individuals who were potentially undiagnosed being identified. The AQ has been used frequently as a screening tool in both clinical and non-clinical populations (e.g. Ruzich et al., 2015), and as mentioned previously, has been found to be an accurate measure in the majority of cases (Sizzo et al., 2015). It may have been beneficial to confirm cases using the ADOS, however, the ADOS itself may not be a suitable measure for undiagnosed autistic females given that diagnosed autistic women seem to perform better on social aspects of this measure (e.g. Lai et al., 2011; Rynkiewicz et al., 2016). Such measures may therefore miss the autistic presentation seen in undiagnosed autistic women.

The second key limitation of all three studies is the potential for sampling bias. For example, Studies 1 and 2 had an underrepresentation of autistic and potentially autistic males, and so gender differences could not be reliably determined in these studies. Attempts were made to recruit more males in general for these studies, for example, online adverts were adapted that specifically requested autistic male participants, and more adverts were sent to online groups with a heavy male presence, for example, specific university sport societies. Despite this, recruitment of males remained lower than females; this is a common problem in online survey research (Mulder & Bruijne, 2019; Saleh & Bista, 2017). This issue was mitigated in the results of Studies 1 and 2 by ensuring that any gender comparisons were analysed carefully, and that the conclusions that were derived regarding gender differences were discussed cautiously.

As well as this sampling bias, Study 1 and 2 tended to recruit autistic females *and* males with later ages of ASC diagnoses than those found in previous literature. The average age of diagnosis in the literature across genders is around 3-10 years (Daniels & Mandell, 2014), whilst the average age of diagnosis for males in the current two studies was 18 and 24 for females. This was likely the result of using a non-clinical sample from the general population, which would recruit more adults with later diagnoses who have ‘atypical’ autistic traits and impairments. Such issues have been identified by others using similar methodology (e.g. Cassidy et al., 2018). The strength of this sampling method is that it includes people that have not previously been understood in the research. Namely, to date research has relied on early diagnosed autistic individuals with more traditional presentations of autism, recruited from specific autism clinics (Halladay et al., 2015).

The main strength of this thesis has been the novel contribution to the literature of autistic females and issues relating to their later diagnosis. While previous studies using similar methodology have examined gender differences in high trait children (e.g. Baron-Cohen et al., 2001; Dworzynski et al., 2012), none to the author's knowledge have examined differences in social behaviours between diagnosed and potentially undiagnosed autistic women. Studies 1 and 2 identified a large number of potentially autistic women and were able to investigate similarities and differences between them and those who already had a diagnosis. Findings from this comparison have provided important insights into why autistic females may be missed, namely, empathy advantages and better social functioning in potentially autistic women compared to those with a diagnosis, as well a different profile of mental health disorders. The current research was also unique in asking participants to report the ages at which they received their various psychiatric diagnoses (Study 2). This improves our knowledge on the issues surrounding differential and co-morbid diagnoses in autistic women, supporting theories that autistic women have a history of misdiagnosis prior to receiving their autism diagnosis. Additionally, there was no evidence in the current investigation that receiving an autism diagnosis exacerbated mental health problems. These findings are important for clinicians to consider when they are assessing women presenting with multiple mental health diagnoses, which have overlapping features of autism.

The third study also offers several novel contributions to the literature. Firstly, testing of the CAT-Q is still in its infancy and has not been previously compared with EF in autistic populations. Secondly, no previous studies have examined differences between how the social behaviours of autistic females and autistic males are judged by non-autistic peers, or how these ratings relate to self-reported camouflaging and age of diagnosis. This provides important insights again into why autistic women may be diagnosed later than males, a finding that was also consistently discovered throughout

all three studies in the current thesis. For example, there appears to be a gender bias in how autistic males and autistic females are viewed by others, which is also dependent on the gender of the observer. These first-impression judgements related to age of diagnosis too, suggesting that autistic females may be diagnosed later because others do not judge their behaviour to be as 'atypical' or unfavourable as autistic males or those diagnosed earlier. This bias may explain findings made previously that autistic boys were more likely to spend time in solitary play than autistic girls (Dean et al., 2017), as they may be judged more harshly by their male peers. This harsher judgement may isolate them more, depriving them of close friendships in which to learn and develop social skills; thus highlighting there is a problem to parents, teachers, and health professionals more clearly than is seen in autistic females. Furthermore, these findings align with those from Study 2 which found moderate, positive correlations between friendship quality and motivation and self-monitoring, theory of mind, and social functioning. However, it is unclear whether these variables are the result of, or if they are the cause of, better friendship quality and motivation; it is likely both. These findings are therefore useful for clinicians, and education and health professionals, to be aware of as it may hinder their identification of autistic individuals. It is also useful in our understanding of how autistic people may be judged negatively by non-autistic people at least so far as first-impressions, which may support strategies to reduce the bullying and ostracism experienced by many autistic people (Roekel et al., 2010; Schroeder et al., 2014).

## **6.5. Implications**

Collectively, the three studies discussed in this thesis advance understanding of diagnostic issues affecting autistic women and the kinds of support they need. Autistic women are vulnerable to mental health problems, and late diagnosis of autism may have

an adverse effect on emotional wellbeing. For example, Howlin (1997) suggested that early interventions for autistic individuals can greatly improve their quality of life, and Fernell et al. (2013) pointed out that early diagnosis often results in the creation of a more autism-friendly environment around an autistic person. Qualitative studies have found that many autistic people feel relieved to receive their diagnosis, and that it has helped them to make sense of their world (Stagg & Belcher, 2019).

At the heart of this issue is one of authenticity and belonging. Whilst the current study did not find significant gender differences in camouflaging, or correlations between camouflaging, social deficits, and mental health difficulties, it did find that autistic people self-reported more camouflaging behaviours and were therefore more conscious of their struggle to ‘fit in’ socially. Cassidy et al. (2018) identified camouflaging to be a significant predictor of suicidal behaviours, and a more recent study by Cassidy et al. (2019) indicated that thwarted belonging may mediate this relationship, even in non-autistic people. Whilst learning to mimic others and adapt in social situations is considered a typical developmental strategy for forming social bonds with others (Bandura, 1971), Goffman (1970) warned that attempting to present oneself in a manner that one feels is in conflict with one’s ‘true self’ would lead to experiences of alienation. This may explain the difference between self-reports of camouflaging between autistic and non-autistic people. Whilst both may utilise camouflaging, it may come a lot more naturally to the latter group, and the differences between one’s ‘true self’ and one’s ‘presenter self’ may be far less discrepant than for an autistic person. In her biographical self-help guide, Willey (2014) suggested that autistic people, like herself, may lack the mechanisms needed to ‘fit in’ to social situations more naturally, thereby requiring greater resources; a theory supported by research from Livingston et al. (2018). Späth and Jongsma (2019) offered an alternative explanation as to why many autistic people lack a strong sense of their true self. They proposed that autistic people



actually place less value than non-autistic people on changing their own needs, values, and interests in order to conform. This may increase the conflict and negative consequences associated with camouflaging.

There is an argument that because some young autistic girls are better able to camouflage their autistic traits and are more motivated to form relationships with others they may be exposed to more social environments that further develop their social skills (Dean et al., 2017; Sedgewick et al., 2016). However, whilst camouflaging may have some success, and may over time lead to better quality friendships and relationships, it is likely that due to the strategy requiring conscious effort it is hard to maintain. The current study found no advantage for diagnosed autistic women on self-reported friendship quality when compared to potentially autistic women, who had evaded diagnosis, and previous studies similarly found no differences between autistic females and autistic males on friendship quality (Baron-Cohen & Wheelwright, 2003). Therefore, questions remain about the effectiveness and consequences of camouflaging long-term. Many late-diagnosed autistic adults report that when they finally received their diagnosis it actually led to a rediscovery of their ‘true selves’ and a reduction in attempts to ‘fit in’ with others (Leedham et al., 2019; Stagg & Belcher, 2019).

A particularly important aspect of gaining a diagnosis is the discovery of one’s identity (Leedham et al., 2019). Milton (2012) explains how a double empathy problem may exist between autistic and non-autistic people, whereby not only are autistic people impaired at recognising non-autistic people’s behavioural intentions and feelings, but non-autistic people find it hard to recognise the behaviours and feelings of autistic people too. After interviewing 20 autistic college students, Frost et al. (2019) found that many reported wanting to be understood and genuinely known by others. A recent book discussing the autism community by Kapp (2020) suggests that for many an autism

diagnosis has led to them finding a community of other autistic people, with a shared identity and understanding of each other. For example, there are now over one million members of Facebook groups created for autistic people, offering social companionship (Abel et al., 2019).

What is emerging from the research then is a clear need to help autistic people reduce the need to disguise their true selves, and instead to find ways to empower them to form connections with likeminded people, in an authentic way. The research conducted thus far on camouflaging and delayed diagnosis, including that reported in this thesis, does not suggest any positive outcomes from camouflaging autistic traits. Whilst the third study in this thesis suggests that those with a later diagnosis may be perceived more favourably by non-autistic people, hinting at some success in appearing 'less autistic', this does not mean that those autistic individuals are behaving in an authentic way, or that it is not causing them harm. Recent evidence is beginning to suggest that having an authentically autistic identity may instead be more beneficial for many autistic people.

The findings in this thesis also suggest a need for appropriate mental health support for autistic women. These findings, alongside others in the literature, demonstrate a heightened risk of psychiatric comorbidity and misdiagnosis. It is apparent from the findings that an earlier diagnosis of autism does not appear to reduce symptoms of anxiety and depression for women. It is likely that women are more vulnerable to mental health difficulties generally (McManus et al., 2016), and that the experience of autistic traits and perceiving oneself as different to others increases this regardless of diagnostic status. It is not clear from the findings in this thesis what role camouflaging and gender interpretation biases of autistic behaviour plays in misdiagnosis and susceptibility of other conditions. However, all these factors may

affect the support received. If therapists and clinicians are less aware of the female phenotype of autism, and therapies are not adapted to account for these communication and behavioural differences, then this may increase feelings of helplessness and isolation. Au-Yeung et al. (2018) reported that significantly more autistic participants than non-autistic adults disagreed with the mental health diagnoses they were given, and felt there was a lack of autism understanding and communication. Indeed, in the second study reported in the current thesis autism was often the last diagnosis made for autistic women, raising the possibility that many of their mental health conditions had been misunderstood. Camm-Crosbie et al. (2018) analysed responses from 200 autistic adults regarding their mental health needs, finding common themes around difficulties accessing support, a lack of understanding of autistic people's co-morbid mental health difficulties, and a lack of appropriate treatment for those difficulties. Recently there has been a drive for the participation of autistic individuals in autism research, and a priority area of research identified by the community is in improving mental health provisions (Benevides & Cassidy, 2020). In summary, the research in this thesis contributes to the growing body of evidence regarding the importance of tackling mental health problems linked with autism and improving the accuracy and timeliness of diagnoses for this population, particularly for autistic women.

## **6.6. Avenues for Future Research**

This thesis has highlighted several new findings regarding the profiles of late and undiagnosed autistic women, which may help in our understanding of the different presentations of autism. However, several key unanswered questions remain. Firstly, the current investigation assessed adults at one point in time only, and little is known about the long term effects of late diagnoses and of camouflaging. It would be beneficial to assess autistic individuals throughout their lives with those measures used in Study 2

and more direct measures of camouflaging. For example, whilst potentially autistic women show an empathy and social functioning advantage relative to diagnosed autistic women, this advantage does not correlate with a later age of diagnosis for the latter group. Instead, age of diagnosis was weakly, positively correlated with self-monitoring, and strongly, positively correlated to the ability to create a good first-impression. Additionally, friendship quality and motivation was found to correlate positively to empathy, ToM, self-monitoring, and social functioning, but not to age of ASC diagnosis in autistic women. Furthermore, mental health problems were more frequent in the autistic females compared to autistic males; occurring more frequently prior to ASC diagnosis. However, traits of anxiety and depression did not correlate with age of diagnosis or social performance measures. More research is needed to examine the developmental pathways in autistic females and males between empathy, social abilities, social functioning, friendship, and mental health problems.

It has also been highlighted in this thesis that there may be issues in the measurement of camouflaging in autistic individuals using the CAT-Q. In future research, it would be useful to include additional measures of camouflaging to check the null result found in Study 3 (Part-One) that autistic males and females did not differ in self-reported camouflaging traits. As mentioned previously, it may be useful to ask participants more questions about the kinds of situations they camouflage in, the quality/frequency of this (Cage & Troxell-Whitman, 2019; Cassidy et al., 2018), and to use the self-monitoring survey used in Study 2. Since conducting Study 3, a new measure of compensation in social situations has been developed, which may also be useful to test alongside these measures (Livingston et al., 2020). This compensation checklist includes a list of 32 characteristics that reflect four different strategies used in social situations. These include: (1) masking, for example strategies involving regulating social behaviours; (2) shallow compensation, for example strategies to

produce neurotypical behaviours that do not require fixing the impairment causing difficulty; (3) deep compensation, for example strategies that involve solving a cognitive difficulty in order to produce neurotypical behaviours; and (4) accommodation, for example strategies that accommodate for difficulties without altering a cognitive difficulty. Together these self-assessment measures may not only measure how much a person feels they are camouflaging in social situations, but also how often, where this is most likely to happen, how they monitor how they are behaving, and any other strategies to compensate for their difficulties that they may employ. Additionally, it would be useful to again test these measures in a longitudinal study, in order to better understand how these strategies may develop and also how they might change with age.

It is clear from the third study that there are social costs to being ‘atypical’, which may affect a person’s social environment and the interactions with others they have. Future research should therefore focus on experiences of camouflaging in autism, regardless of gender, to fully understand the mechanisms behind it and the impact it can have. It would be beneficial to repeat behaviour rating assessment studies with different cohorts of people who play a vital role in the early identification of autism, for example clinicians, parents, and school staff. It is also important that research now begins to investigate ways of helping autistic individuals who report camouflaging to support their mental health and wellbeing, and perhaps even start to reduce use of the strategy if it is causing mental health and self-esteem issues (Mandy, 2019). If autistic people are able to feel less judged by others for their expressions of behaviour then the need to camouflage could be significantly reduced. One way to achieve this could be to continue raising awareness of behavioural differences between autistic and non-autistic individuals, and also to encourage more openness around sharing diagnoses. Sasson and Morrison (2019) found negative first-impressions of autistic people by their peers

reduced significantly when they were aware of their diagnoses. Therefore, it would appear that when there is a reason for ‘atypical’ behaviour, observers may be more sympathetic and understanding of differences. This further highlights why earlier ASC diagnosis is important.

## **6.7. Conclusions**

This thesis aimed to explore the presentation of autistic traits and the use of camouflaging strategies in autistic women, both those with a diagnosis and those without. Studies 1 and 2 identified a large number of potentially autistic women who did not have a diagnosis. There were differences in the types of other psychiatric diagnoses they had, in particular potentially autistic women were more likely to have BPD. BPD has been suggested to be a common misdiagnosis for many autistic women, due to overlapping features, and therefore this finding might suggest that many in this group have missed an ASC diagnosis, with clinicians favouring a BPD diagnosis. Women in both groups appeared to have very similar impairments in terms of ToM, friendship motivation and quality, and problems with anxiety and depression, however, the undiagnosed women did show advantages in empathy and social functioning. Secondly, in the third study, autistic women were not found to be any different to autistic men in terms of self-rated camouflaging, with no evidence to support a relationship to better EF or TOM. However, autistic females were rated significantly more favourably than autistic males by non-autistic peers. In particular, non-autistic male raters were especially harsh in their judgements of autistic males. These findings suggest a gender bias in how the behaviour of autistic males and females are viewed by others, and that non-autistic peers may be more judgemental of the ‘atypical’ behaviours observed in men. This has implications for diagnosis, and may explain why autistic males are more likely to be identified and referred for diagnosis, whereas the behaviour

of autistic females may seem less 'atypical', and therefore may not be highlighted as a problem worthy of an ASC assessment by others. Future research should concentrate on how to improve the social stigma associated with 'atypical' behavioural presentations in ASC, how best to support the mental health of autistic people, and also how to prevent traits of anxiety and depression as well as the suicidal behaviours which autistic people are at particular risk of having.





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Appendix 1.

A hand-drawn poster on lined paper with various colorful arrows and illustrations. The text is written in a casual, hand-drawn style. The poster promotes a 'STUDENT SCREENING STUDY' where participants can 'WIN AN IPAD' and 'HELP WITH RESEARCH' for 'SPARE 20 MINS'. The website 'WWW.PSYCHSCREEN.CO.UK' is listed at the bottom. Illustrations include a brain, a thumbs up, an iPad, and a hand pointing.

PARTICIPANTS NEEDED

STUDENT SCREENING STUDY

WIN AN IPAD

HELP WITH RESEARCH

SPARE 20 MINS

[WWW.PSYCHSCREEN.CO.UK](http://WWW.PSYCHSCREEN.CO.UK)