The effects of employment on the mental health and executive functions of adults with autism spectrum disorder (ASD)

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Declaration

I, Lisa Clare Harkry, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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To all those involved in autism and employment: this thesis is for you.

Abstract

Recent government initiatives have addressed employment opportunities for adults with autism spectrum disorder (ASD). Employment for adults with ASD is now of legislative, clinical and financial concern. Supported employment has been shown to improve the economy and increase social networks and well-being for adults with ASD. This is pertinent considering adults with ASD report poor mental health and demonstrate an uneven profile of executive functioning skills. In the present thesis, three studies address the effects of employment on mental health and executive functions in adults with ASD. Study One shows adults with ASD report higher levels of anxiety, lower levels of well-being and lower levels of satisfaction with life compared to adults without ASD. Also, unlike adults without ASD, levels of anxiety remain high for adults with ASD whether employed or unemployed. Study Two shows no significant differences in group performance on executive function tasks post-employment compared to pre-employment and no adult with ASD demonstrates consistent meaningful improvement on executive function tasks post-employment compared to pre-employment. Also, adults with ASD report similar depression, anxiety, satisfaction with life and well-being scores pre- and post-employment. This demonstrates the heterogeneity within autism and suggests a certain profile of an adult with ASD may exist in autism and employment services e.g. fewer self-reported mental health problems than other adults with ASD. Study Three shows social support predicts an increase in job satisfaction and a decrease in anxiety for employed adults with ASD. The findings are discussed in relation to: co-occurring intellectual disability and clinical disorders; the use of measures and types of reports; task complexity and the range of executive function tasks; the focus on group rather than individual differences; the role of anxiety; neurodiversity; and the legislative, clinical and financial impact of employment as a means of social inclusion for adults with ASD.

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List of Abbreviations

ADHD	Attention deficit hyperactivity disorder
ADI-R	Autism Diagnostic Interview-Revised
ADOS-G	Autism Diagnostic Observation Schedule-Generic
AGN	Affective Go/No-go
ANOVA	Analysis of variance
AQ	Autism Spectrum Quotient
AQ-10	Autism Spectrum Quotient-10
ASD	Autism spectrum disorder
AST	Attention Switching Task
BADS	Behavioural Assessment of Dysexecutive Syndrome
BAI	Beck Anxiety Inventory
BDI	Beck Depression Inventory
BDI-II	Beck Depression Inventory-II
BLC	Big/Little Circle
BRI	Behavioural Regulation Index
BRIEF-A	Behaviour Rating Inventory of Executive Functioning-Adult version
CAMHS	Child and Adolescent Mental Health Services
CANTAB®	Cambridge Neuropsychological Test Automated Battery
COWAT	Controlled Oral Word Association Test
CV	Curriculum vitae
DCD	Developmental coordination disorder
D-KEFS	Delis-Kaplan Executive Function System battery
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
fMRI	Functional magnetic resonance imaging
GAD-7	Generalised Anxiety Disorder-7
GEC	Global Executive composite
GHQ-12	General Health Questionnaire
HADS	Hospital Anxiety and Depression Scale
HADS-A	Hospital Anxiety and Depression Scale-Anxiety
HADS-D	Hospital Anxiety and Depression Scale-Depression
HAM-A	Hamilton Anxiety Scale
ID	Intellectual disability
IED	Intra-Extra Dimensional Set Shift
IMS	Institute of Management Studies
IQ	Intelligence quotient
JSS	Job Satisfaction Scale

LDD	Least degree of difference
MARS	Maudsley Attention and Response Suppression battery
MCST	Modified Card Sorting Test
MDI	Major Depression Inventory
MFFT	Matching Familiar Figures Test
MI	Metacognition Index
MOT	Motor Screening Task
MP	Member of Parliament
NAS	National Autistic Society
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NLTS-2	National Longitudinal Transition Study-2
OCD	Obsessive compulsive disorder
PDDBI	Pervasive Developmental Disorder Behaviour Inventory
PDD-NOS	Pervasive developmental disorder-not otherwise specified
PHQ	Patient Health Questionnaire
PHQ-9	Patient Health Questionnaire-9
PRIME-MD	Primary Care Evaluation of Mental Disorders
RAVLT	Rey Auditory Verbal Learning Task
RRBs	Restrictive and repetitive behaviours
SOC	Stockings of Cambridge
SRS	Social Responsiveness Scale
SSP	Spatial Span
SST	Stop Signal Task
STAI	State Trait Anxiety Inventory
SWLS	Satisfaction With Life Scale
SWM	Spatial Working Memory
TMT	Trail Making Task
UK	United Kingdom
US	United States
WASI	Wechsler Abbreviated Scale of Intelligence
WEMWBS	Warwick-Edinburgh Mental Well-being Scale
WCST	Wisconsin Card Sorting Test
WDQ	Work Design Questionnaire
WFT	Word Fluency test
WHODAS 2.0	World Health Organisation Disability Assessment Schedule 2.0
WMS	Wechsler Memory Scale-III

Chapter One: General Introduction

Overview of Chapter One

Chapter One provides an overview of autism spectrum disorder (ASD) in adulthood; legislative issues concerning adults with ASD and employment; employment outcomes for adults with ASD; employment schemes for adults with ASD; and the effects of employment on adults with ASD with reference to mental health and executive functions. This is considered in relation to employment being seen as a route to social inclusion for adults with ASD. The aims of the thesis are then outlined with the importance of the research findings being applied to improve employment opportunities for adults with ASD.

Autism Spectrum Disorder (ASD)

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterised by impaired social communication and social interaction; and restrictive or repetitive behaviours, activities or interests (American Psychiatric Association, 2013). Individuals with ASD often display impairments in social communication and interaction through difficulty interacting with peers, difficulty taking turns in conversations and difficulty adjusting behaviours across different social contexts. Restrictive or repetitive behaviours are often expressed through excessive adherence to routine or high levels of resistance to change. Individuals with ASD may also display hypo- or hyper-sensitivity to sensory input, such as lighting, smells, noise or pain. It has been estimated that approximately 1.1% of the population in England have a diagnosis of ASD (Brugha et al., 2009) with the same study observing a higher rate in men (1.8%) than women (0.2%). This has been noted in previous studies with a male to female ratio of approximately 4:1 being reported (Chakrabarti & Fombonne, 2001). It should be noted that there is no single term used to describe autism in the United Kingdom (UK) which is universally accepted by the autism community (Kenny et al., 2016) and, in the present thesis, the term ‘ASD’ or ‘autism’ will be used throughout because these are the terms preferred by the academic community and the present thesis is a piece of academic work.

ASD in Adulthood

Despite most individuals with ASD being adults (Howlin, 2008) almost all ASD research focuses on children. Little research exists on ASD in adulthood. This is surprising considering ASD is a lifelong condition and impairments in socialisation consistently continue into adulthood (Magiati, Tay, & Howlin, 2014). Individuals often learn from others what may be considered socially acceptable or appropriate and it may be extremely difficult for individuals with ASD to interpret social cues or nonverbal behaviour. This means social inclusion for this group is limited (Howlin, 2013) and places adults with ASD at risk of marginalisation.

ASD is often considered an 'invisible disability' because it is difficult to tell if an individual has ASD based on outward appearance. However, this lack of research into adults with ASD (Chandrasekhar & Sikich, 2015; Shattuck & Roux, 2015), and lack of consideration given to social context in ASD (López, 2015), may increase the risk of social isolation for these individuals. This raises questions regarding how easily adults with ASD are placed in terms of accessing support and services. Many adults with ASD who have an intelligence quotient (IQ) of above 70 do not fit easily into either intellectual disability (ID) or mental health services and any existing support from Child and Adolescent Mental Health Services (CAMHS) is withdrawn at the age of 18. Educational or employment support is sparse and many adults with ASD end up relying on ageing parents for support (Howlin, 2008). This has financial and psychological consequences for the individual, their families and society.

Daily living skills are one way of assessing key outcomes for adults with ASD in order to gain insights about levels of functioning and the day-to-day activities of these individuals. A recent study of 417 adolescents with ASD in the United States (US) found that half identified as having difficulties with daily living skills. Although this study did not solely consider adulthood, the findings are concerning as autism traits, IQ, maternal education, age and sex accounted for only 10% in predicting difficulties in daily living skills (Duncan & Bishop, 2013). The mental health of participants may have affected these findings but considering the wide range of difficulties observed means there may be huge variability in outcomes for adults with ASD – particularly in terms of employment, friendships and independence (Pellicano, 2012). This means it is important to attempt to explain this variability and why such broad differences exist for adults with ASD.

ASD and Employment

Employment is one route to social inclusion for adults with ASD and this has recently been an area of increasing interest within academia and the wider community.

Employment for adults with ASD is of legislative concern. Recent government initiatives have addressed social inclusion through employment opportunities for adults with ASD. This was, in part, initiated by charity campaigns and subsequent local media coverage. In February 2008, The National Autistic Society (NAS) ran a campaign called 'I Exist' which focused on improving the lives of adults with ASD. The campaign was based on a survey of over 1,400 adults with ASD and their parents and carers; qualitative interviews with adults with ASD; and surveys of Primary Care Trusts and local authorities. The findings have highlighted the lack of support for adults with ASD, with a third experiencing severe mental health problems as a result. Moreover, the survey found only 15% of adults with ASD are in full-time employment, despite many more being able and willing to work (Rosenblatt, 2008).

Cheryl Gillan MP took forward a private member's Bill on autism in parliament as a consequence of the 'I Exist' campaign. In November 2009, this Bill received Royal Assent and The Autism Act was passed as the first disability-specific law in England. The Act placed a legal duty on the government to produce an adult autism strategy and on the National Health Service (NHS) and councils to provide relevant services for adults with ASD. Subsequently, the Adult Autism Strategy, entitled 'Fulfilling and Rewarding Lives', was introduced in 2010 stating the government must ensure help for adults with ASD to find employment. The strategy outlined employment as one of five key areas for central government, local authorities, the NHS and Jobcentre Plus to focus on and included seven commitments to enable more adults with ASD into work. However, an independent National Audit Office (2012) report reviewed the progress of the Adult Autism Strategy and found *'It is not clear what impact the commitments have had in helping adults with autism into work'* (p. 20). The strategy was reviewed and, as a result, the Think Autism strategy was implemented in April 2014, with employment identified as one of 15 priority challenges for action. On 2nd April 2014 (World Autism Awareness Day), the government announced £1.2 million of funding would be put towards an Innovation Fund to support the development and replication of new services. This reflected the growing awareness of a need for autism-specific employment services for adults with ASD. In March 2015, new statutory guidance was issued stating the NHS and local authorities must now include employment in needs assessments. This reflected the growing concern for the effects of unemployment on adults with ASD.

Employment for adults with ASD is of clinical concern. In June 2012, the National Institute for Health and Care Excellence (NICE) issued guidelines specifically related to employment for adults with ASD. The guidelines suggested individual supported employment programmes should be considered for adults with ASD who struggle to obtain or maintain employment. This includes pre-employment support (help with writing a CV or preparing for an interview and training for the identified job role), individually matching the adult with ASD to the job and continuing employment support (advising employers about reasonable adjustments and providing autism awareness training). The NICE guidelines continue to recommend individual supported employment as a psychosocial intervention for adults with ASD (National Institute for Health and Care Excellence, 2012). However, little is known about the extent to which these guidelines are successfully implemented.

Employment for adults with ASD is of financial concern. There are economic consequences associated with adults with ASD struggling to obtain or maintain suitable employment. The aggregate national cost of supporting adults with ASD in the UK has been estimated at £25 billion each year, with 36% of this total due to lost employment for the individual with ASD. The largest cost for adults with ASD without ID was for lost employment, with £19,785 being the average annual cost per capita (Knapp, Romeo, & Beecham, 2009). Previous estimated costs have also highlighted the high costs associated with lost productivity, with £137,100 being the approximate average lifetime cost for an adult with ASD without ID (Järbrink & Knapp, 2001). More recent research suggests the costs for adults with ASD are much higher than previously thought, with 42% of the total cost for individuals with ASD in the UK due to lost employment. The mean individual productivity loss totalled £21,797 for adults with ASD without ID and this was the largest cost in adulthood for this group. The increase in costs could be due to more recent accurate estimates of costs being published regarding the effects of ASD on individual and parental productivity loss (Buescher, Cidav, Knapp, & Mandell, 2014). This means the difficulty with adults with ASD not being independent or employed is an economic, as well as a legislative and clinical issue.

Many studies have highlighted the financial burden experienced by families with children with ASD. One recent study found 52% of parents of children with ASD and ID and 39% of parents of children with ASD without ID experience financial burden. Moreover, 46% of parents of children with ASD and ID and 25% of parents of children with ASD without ID reported giving up employment completely because of the disability (Ouyang et al., 2014). This is reflected in national data where findings from the 2009-2010 National Survey of Children with Special Health Care Needs revealed caregivers

of children with ASD were more likely to report financial, employment and time-related burden compared to caregivers of children with other developmental disabilities, such as Down syndrome, ID or cerebral palsy or mental health conditions such as attention deficit hyperactivity disorder (ADHD), anxiety or depression. Caregivers of children with ASD were more likely to leave their job because of their child's condition than any other developmental group (Vohra, Madhavan, Sambamoorthi, & St Peter, 2014). A smaller survey involving 161 families of children with ASD also showed 43% of respondents reported stopping work, reducing working hours or changing jobs because of their child or children having ASD (Gnanasekaran et al., 2015). Although these studies focus on the parents of children with ASD, it is worth noting the impacts are at least as high in adulthood as these children with ASD grow up to be adults with ASD. This is also discussed further later in this section.

This sense of financial burden is still an issue for those parents who do stay employed. Mothers of children with ASD have been shown to earn 35% less than mothers of children with other health problems and 56% less than mothers of children with no health problems. Mothers of children with ASD are also 6% less likely to be employed than mothers of children with no health problems (Cidav, Marcus, & Mandell, 2012). This study found no statistical differences for fathers' financial outcomes but the total economic burden was felt throughout the family, as family earnings of children with ASD were 21% lower than those of children with other health problems. Further research has shown that families of children with ASD are seven times more likely to indicate that childcare problems affect their employment chances than other families, with this effect being three times larger than the effect of poverty (Montes & Halterman, 2008).

The concerns outlined in these studies relate to costs of children with ASD without considering potential increasing financial burden as the child grows up into adolescence and adulthood. One recent study found almost 90% of the median family cost of ASD was due to a loss of income from employment, whether the ASD diagnosis of the child with ASD was delayed or not (Horlin, Falkmer, Parsons, Albrecht, & Falkmer, 2014). This reflects the cumulative costs of ASD and the financial difficulties associated with developmental disorders. The authors of this study argue support which allows family members to work would reduce the financial burden and increase well-being for all family members. However, they also note that the financial strain may be more for parents of adults with ASD which will now be discussed in more detail. Less is known about the non-financial effects on parents of adults with ASD although parents of adults with ASD may have even less support than parents of children with ASD. Strong associations have been found between parental emotional distress and unmet needs, in

terms of respite breaks, planning for the future and information about available services (Hare, Pratt, Burton, Bromley, & Emerson, 2004). The authors also suggest grandparents might be involved in helping the family with children with ASD but more autism-specific services are needed for adults with ASD. However, another study showed few differences in levels of parental stress and psychological well-being across parents of young children, adolescents and adults with ASD (Pozo & Sarriá, 2015). This suggests qualitative differences exist between families when considering caregivers of children or adults with ASD.

ASD and Current Research on Employment

Despite employment in adults with ASD now being of legislative, clinical and financial concern, there exists a surprisingly low amount of academic literature on this. Howlin (2013) notes an imbalance in autism research with the majority focusing on children rather than adults. However, it is also unclear how research findings are able to improve employment services for adults with ASD. A recent study showed 56% of UK autism research funding from 2007-2011 went towards projects in the areas of brain, biology and cognition while only 5% of funding went towards services for adults with ASD and their families (Pellicano, Dinsmore, & Charman, 2013). The recent Innovation Fund announced by the government suggests a step towards established links between academia and services for adults with ASD. This is of particular importance as qualitative interviews and focus groups with adults with ASD and their parents have highlighted employment as a priority area for research (Pellicano, Dinsmore, & Charman, 2014b). This emphasises the need for autism research to focus more on adults and employment in order to channel resources to services which need them most.

Recent research has uncovered findings regarding low levels of employment for adults with ASD. Shattuck et al. (2012) investigated post-secondary employment outcomes for young adults with ASD using data from the National Longitudinal Transition Study-2 (NLTS-2), a 10-year national survey of young adults in receipt of special educational services in the US. Employment outcomes for young adults with ASD were compared across other disability groups, namely: individuals with ID; mental retardation; and speech/language impairment (these category labels are consistent with the NLTS-2 terminology used at the time). The authors found young adults (aged 19 or over) with ASD had lower levels of employment relative to those in the other disability groups. Only 55.1% of adults with ASD had held any kind of paid employment outside of the family in the first six years since leaving high school, with individuals with ASD having the highest risk of being completely disengaged from any post-secondary employment or

educational opportunities. The findings suggest many young adults with ASD struggle with the transition from education to employment and are particularly vulnerable in the unstructured time after school and before work. The authors concluded individuals with ASD are *'uniquely at high risk'* (p. 1047) for social exclusion.

Further analysis using separate data from the NLTS-2 showed the odds of ever having paid employment since leaving high school were significantly higher in the ID, mental retardation and speech/language impairment comparison groups. Young adults with ASD not only had the lowest rates of employment but significantly lower wages compared to the other disability groups (Roux et al., 2013). It is worth noting that any individual in the comparison groups who had ever received a diagnosis of ASD was excluded, suggesting it is the autism features which impact employment outcomes. In addition, the confidence intervals reported in this study suggest some adults with ASD were working below the minimum wage of $7.25 per hour (Howlin, 2013).

Differences have been noted between adults with ASD and ID and adults with ASD without ID. Individuals with ASD and ID have been found to have higher levels of employment compared to individuals with ASD without ID (Cimera & Cowan, 2009). This reveals the gaps between support services as individuals with ASD and ID can access vocational support from ID services but individuals with ASD without ID do not fit into either ID or mental health services, despite reporting difficulties securing employment independently. Further studies have also revealed differences between those with ASD with and without ID. Taylor and Seltzer (2011) considered employment opportunities for 66 young adults with ASD who had recently left high school. They found low levels of employment for young adults with ASD leaving high school. However, they noted those with ASD without ID were three times more likely to have no daytime activities compared to those with ASD and ID. Only 18% of those with ASD without ID were receiving employment support compared to 86% of those with ASD and ID. The authors argue this reflects a lack of autism-specific services as adults with ASD without ID are vulnerable to falling in gaps between ID and mental health services. This is an additional disadvantage to the difficulty securing employment after leaving education and places adults with ASD without ID at risk within unstructured, or transitional, environments.

Employment Outcomes for Adults with ASD

Adults with ASD who are successful in finding employment tend to have poorer outcomes compared to typical employed adults. For instance, many adults with ASD who are employed earn less and work fewer hours than those in the general population

(Burgess & Cimera, 2014). The authors of this study also note there has been an increase in the number of adults with ASD accessing vocational rehabilitation services over the last ten years but an increase in employment has not been seen. For instance, 67% of adults did not achieve employment in 2011 compared to 62% in 2002, demonstrating a 5% increase in the number of adults with ASD failing to achieve employment from 2002 to 2011. The high incidence of part-time employment in adults with ASD has been noted in other studies (Cimera & Cowan, 2009) but it remains unclear as to why this is and more research is needed to uncover why so few adults with ASD are employed full-time.

Unfavourable outcomes for employed adults with ASD have further been observed. One study which took place in Australia investigated employment experiences in 130 employed adults with ASD. Almost half (45%) of adults with ASD were overqualified for their jobs which the authors argue is more than double estimated within the typical population. Adults with ASD were also found to be underrepresented in senior or managerial positions within companies. Interestingly, earning money did not make a difference to adults with ASDs' perceptions of job satisfaction (Baldwin, Costley, & Warren, 2014). This implies that employment has intrinsic value and offers individuals with ASD the opportunity to apply their knowledge, skills and interests within an environment promoting social usefulness. Employment therefore offers a sense of personal worth, as the rewards are not only financial.

The issue of adults with ASD being employed in jobs below their skill or education level has been termed 'malemployment' (Romoser, 2000). This term also includes individuals working within a role which is wholly unsuitable. The author provides a personal example of this, as he was diagnosed by Leo Kanner and later graduated from Yale University but was previously placed in a telemarketing job role where he was unable to stay for longer than one and a half days. Adults with ASD who are employed may, therefore, be at increased risk for having an uneven job profile where many different or unsuitable jobs are seen within one individual's employment history. This could reflect an uneven profile of cognitive and social abilities which result in diverse employment needs. This means unstable employment, chequered employment histories and fewer opportunities to work are observed in these individuals (Lawer, Brusilovskiy, Salzer, & Mandell, 2009).

Post-secondary education and employment outcomes have also been considered in some longitudinal research. Taylor, Henninger, and Mailick (2015) looked at outcomes over twelve years for 73 adults with ASD without ID. Although two-thirds of

the sample participated in post-secondary education or competitive employment, fewer than 25% maintained this over the twelve year period. Only 16.4% were consistently engaged in post-secondary education or employment for over ten hours per week and 9.6% for over 30 hours per week. This difficulty in maintaining activities over time also raises the question of why so few adults with ASD were working full-time. The authors also found that adults with post-secondary education qualifications entered community jobs which were entry-level and non-skilled meaning their further education did not necessarily improve their employment prospects. These findings align with research showing adults with ASD may have difficulties finding work which matches their abilities and report troubles in sustaining employment (Hurlbutt & Chalmers, 2004).

Employment Schemes for Adults with ASD

Supported employment is currently recommended within NICE guidelines in working with adults with ASD. Supported employment refers to individualised job placements, support in applying for work (instead of facing assessments and interviews alone) and assistance within the work environment. This aligns with current research showing supported employment services for adults with ASD are more cost effective when compared to standard care services in the UK (Mavranezouli et al., 2014). Therefore, supported employment can contribute towards an improved economy, as well as promoting social inclusion opportunities for adults with ASD.

Research into supported employment schemes for adults with ASD suggest that they look promising. A two-year study into an autism supported employment scheme, Prospects, in London found adults with ASD in this scheme were more successful in gaining employment, were in work for a greater percentage of the time and received a higher salary than adults with ASD not in supported employment. The findings showed supported employment had high start-up costs initially, with the highest cost (in terms of finance and time) being liaisons with employers in building up relationships and closely matching adults with ASD to an appropriate job. However, these high initial costs decreased over time (Mawhood & Howlin, 1999). An eight year follow-up of Prospects found 68% of individuals with ASD had found employment with the majority being permanent contracts in administrative, technical or computing work. The findings showed Prospects clients contributed more tax, claimed fewer benefits and experienced a rise in salary (Howlin, Alcock, & Burkin, 2005). Non-financial benefits, such as employer satisfaction, were also found although the authors admit these were difficult to quantify.

Another autism supported employment scheme, Project SEARCH plus ASD Supports, has shown similar positive outcomes. Project SEARCH is a US internship model which aims to place young adults with developmental disabilities in work placements embedded within a community business, such as a hospital, government department or bank. A randomised controlled trial of Project SEARCH plus ASD Supports showed those in the treatment group had higher employment outcomes in non-traditional jobs and higher than minimum wage incomes than those in the control group. In total, 87.5% of participants in the treatment condition achieved employment compared to 6.25% in the control condition (Wehman et al., 2014). The authors suggest possible reasons for success include close collaboration between the administration team, classroom and the business with highly trained staff specific to the needs of individuals with ASD. High levels of retention were further confirmed in a similar study with commitment from management being critical to job retention for the employee with ASD (Wehman et al., 2016).

A difference must be drawn here between supported employment and sheltered employment. Supported employment refers to individual job matching profiles, on-the-job coaching and employer training (Vogeley, Kirchner, Gawronski, Tebartz van Elst, & Dziobek, 2013). These jobs are based within the community, often with few other employees with ASD. Sheltered employment refers to work placements generally not in community settings and only with disabled co-workers. The distinction may be important as one study found improved quality of life for individuals with ASD in supported employment and no improvement in quality of life for those in sheltered employment (Garcia-Villamisar, Wehman, & Diaz Navarro, 2002). A more recent study found adults with ASD achieve better vocational outcomes if they are not involved in sheltered workshops before taking part in a supported employment scheme. The findings showed those in sheltered workshops earned significantly less per week and cost significantly more to serve than individuals in a non-sheltered workshop comparison group (Cimera, Wehman, West, & Burgess, 2012). Thus, the work environment is important to enable adults with ASD to develop – it should be supported but also within the community as more independent vocational activities are associated with behavioural improvements (Taylor, Smith, & Mailick, 2014). This emphasises the importance of supported employment, rather than sheltered work programmes, as a preferred route to employment for adults with ASD.

Factors Related to Successful Employment for Adults with ASD

Although it is important to highlight the disadvantage adults with ASD report with regards to employment experiences, few studies have assessed the reasons underlying poor employment rates for these individuals. Müller, Schuler, Burton, and Yates (2003) argue securing employment for adults with ASD is particularly difficult due to the social and communication impairments characterised by ASD. All participants in that study were adults with ASD (aged 18 years or over) without ID and who had spent at least one year in employment. The qualitative interviews revealed four main themes as obstacles to successful employment. First, the job application process was an area of difficulty for many adults with ASD. Participants reported not knowing how much detail to provide on job applications, confusion over what employers were really looking for, not knowing how to answer interview questions, avoidance of using the telephone (which limited the job application process) and difficulties in organising and initiating a job search. Second, new job routines were problematic for adults with ASD. These were reported as taking longer to learn and with a greater forceful effort as participants reported being slower than others in learning new tasks. Third, communication was a struggle for many adults with ASD. Participants reported difficulties with reading 'between the lines', struggling to keep up when co-workers spoke quickly, difficulty understanding instructions and asking too many questions. Finally, the most frequently mentioned area of difficulty was social interaction. Participants reported confusion with co-workers' and managers' tone of voice and facial expressions, making or understanding small talk at work and finding an appropriate time to end a conversation. Some participants reported tolerating feeling different while others felt isolated and stigmatised. However, all participants knew the difficulties with social interaction were hindering them from succeeding at work even when they fulfilled their job description. One individual illustrated this by saying *'I look at my friends who work at workplaces, and to me they're like social geniuses. I feel like somebody who's had a stroke and forgotten how to walk. You know, that's the closest metaphor I can get'* (p. 169).

Social interaction difficulties have previously been highlighted in other research studies. Mawhood and Howlin (1999) found many difficulties in the workplace for adults with ASD were around social understanding. These included problems such as inappropriate dress, talking too much or too little, associated anxiety and demonstrating rigidity rather than adjusting to the demands of the job itself. However, few problems were reported by employers and no employee was dismissed. This could partly reflect societal trends for a shift away from a medical model approach (with a focus on deficits and curing or treating people) to a focus on ability and social inclusion within the workplace. In a detailed literature review, Unger (2003) found employers value

dependable employees and may be willing to overlook the quality of work, to an extent, in order to retain a loyal and reliable worker. Employers' concerns about the work potential of disabled employees commonly reflect myths rather than direct experience with disabled workers. This has led to a renewed enthusiasm about hiring disabled employees in order to improve an employer's image within a community and to increase a sense of corporate social responsibility by retaining a diverse workplace. Romoser (2000) similarly argued many adults without ASD will move on from a job after six months – a move he terms the *'Silicon Valley shuffle'* (p. 247) whereas those with ASD will be loyal to an employer.

Positive reports about adults with ASDs' workplace performance have also been noted in further research studies. Hillier et al. (2007) followed nine adults with ASD through two years of supported employment. Employers rated their employees with ASD highly on punctuality, knowing the job, starting a task when asked, reliability and following directions. However, they rated employees with ASD lower on asking for help, checking work for mistakes and moving independently onto a new task. Despite this, employees with ASD improved over time on the tasks they received lower ratings for. Participants with ASD reported slightly different difficulties in the workplace such as problems socialising outside of work with colleagues and struggling to make friends in the workplace. Participants with ASD also reported high levels of job satisfaction and happiness although these decreased over time, possibly due to the job becoming less challenging. It was also noted that participants had unrealistic job expectations pre-employment. However, co-workers spoke positively of employees with ASDs' adherence to rules, attention to detail, honesty and reliability. The authors also noted participants improved in their abilities to problem solve, communicate and work as part of a team throughout the duration of their employment.

Further positive reports were noted in an Australian study which looked at the employment experiences of 40 adults with ASD. Three factors were identified for successful employment in employees with ASD: commitment to work; motivation when the job is right; and confidence in a structured workplace environment. However, the three factors identified from an employers' perspective were slightly different: reliance on external support for the employee with ASD; provision of internal support; and a need for the employee to work out what to do when opportunities arise (Scott, Falkmer, Girdler, & Falkmer, 2015). These differences suggest more communication is needed between the employer and the employee.

The Effects of Employment on Adults with ASD

Employment can provide a wage, less dependency on benefits and a social and personal identity for many adults with ASD (Nicholas, Attridge, Zwaigenbaum, & Clarke, 2014). Supported employment has also been shown to improve the economy and increase social networks and well-being for adults with ASD (Mavranezouli et al., 2014). Adults with ASD have further reported significant improvements in quality of life after a period of employment supported by a health professional (Katz, Dejak, & Gal, 2015). However, little else is known about the effects of employment on the mental health of adults with ASD.

Mental health in adults with ASD. The risk of social isolation and lack of available specialist services means mental health must be explored in adults with ASD. Most research involving mental health has focused on children and adolescents but the focus in this chapter will be on mental health in adults with ASD (with one adolescence study highlighted as it is of particular relevance). Mental health is particularly important when considering adults with ASD report significantly higher levels of perceived stress and a poorer ability to cope with everyday life stresses (Hirvikoski & Blomqvist, 2015). The same study also found associations between ASD traits and stress and coping across both the ASD and non-ASD groups which has implications for undiagnosed adults with ASD living in the community, particularly as these traits may affect an individuals' ability to ask for help or seek social support.

A recent study using national data taken from the largest paid healthcare delivery system in the US looked at overall mental health difficulties of 1507 adults with ASD, who were matched across age and gender to 15,070 non-ASD participants. This revealed that adults with ASD had significantly increased rates of depression, anxiety, bipolar disorder, obsessive compulsive disorder (OCD), schizophrenia and suicide attempts (Croen et al., 2015). The authors further noted that adults with ASD may be less likely to communicate discomfort or seek medical help. This study demonstrates the importance of prioritising the mental health of adults with ASD in research.

Depression in adults with ASD. Depression is evidently a problem for many adults with ASD but there is not enough rigorous research to accurately assess the extent of the problem (Chandrasekhar & Sikich, 2015). Depression may be masked by verbal and non-verbal communication skills which are common areas of difficulty in ASD. Also, depression could be expressed differently within adults with ASD. For instance, ASD traits, such as repetitive behaviours, could decrease during a depressive episode which may be observed as a positive indication of good mental health. However, if an

individual with ASD withdraws from their usual repetitive behaviours or specialist interests then this might indicate a problem. Likewise, if an individual with ASD increases their repetitive behaviours or fixation on areas of specialist interest during times of stress then this could also indicate a problem. Combined with a lack of validated measures for assessing depression in this population (Stewart, Barnard, Pearson, Hasan, & O'Brien, 2006) means it may be very difficult to accurately report mental health difficulties in adults with ASD, other than to observe any changes in usual behaviours or routines. Measures for assessing mental health in adults with ASD will be discussed in further detail in Chapter Two.

Further difficulties arise when considering a lack of reliability between self- and informant-reports. Adults with ASD may under-report (White, Schry, & Maddox, 2012) or over-report (Moss, Howlin, Savage, Bolton, & Rutter, 2015) their difficulties compared to informant-reports. This mismatch could depend on whether the individual is able or willing to accurately report their own mood but it could also depend on insight or correct identification of mental health symptoms (White et al., 2012). Use of self- and informant-reports in adults with ASD will also be discussed in further detail in Chapter Two.

However, despite these methodological difficulties, other studies also align with national data reporting higher levels of depression in adults with ASD. Increased rates of OCD, depression and general anxiety have been reported when compared to general population data (Russell et al., 2016). One online survey of 255 adults with ASD (age 18-71 years) found three-quarters reported symptoms of depression and three-quarters also reported symptoms of anxiety (Gotham et al., 2015). Strong associations between loneliness and depression exist for adults with ASD, even after controlling for the effects of ASD traits (Mazurek, 2014). This places adults with ASD who desire social inclusion at a higher risk of depression, particularly as the same study found friendship was associated with a decrease in loneliness after controlling for the effects of ASD traits. These point towards the importance of more population-based or longitudinal research to accurately assess the extent of depression in adults with ASD. These further highlight the importance of a meaningful social network and access to community-based services for adults with ASD.

Anxiety in adults with ASD. Most research on mental health in adults with ASD has focused on anxiety but estimates of the prevalence of anxiety in adults with ASD vary between studies. Research from national data in the US shows 29% of adults with ASD have been diagnosed with anxiety (Croen et al., 2015). However, smaller studies show higher rates of anxiety symptoms in adults with ASD. In one study, 17 adults with

ASD completed a structured psychiatric interview. Of these adults, 77% reported symptoms which met criteria for an anxiety disorder (Mazefsky, Folstein, & Lainhart, 2008). A clinical sample of 13 patients with ASD and ID matched to 40 inpatients without ASD with ID showed anxiety disorders in 62% of adults with ASD. Only 38% of adults without ASD reported symptoms of anxiety (Charlot et al., 2008). A similar study matched 34 adults with ASD and ID to 20 adults without ASD with ID and found adults with ASD were almost three times more anxious than the comparison group (Gillott & Standen, 2007). In a community sample of 42 adults and adolescents with ASD around 50% said they regularly felt anxious (Balfe & Tantam, 2010). Adults with ASD have previously reported significantly higher levels of anxiety than adults without ASD, with associated anxiety factors being high volumes of self-focus, worries about everyday events and periods of rumination lasting for longer than ten minutes (Hare, Wood, Wastell, & Skirrow, 2014).

However, many studies do not report whether the adults with ASD in their samples have ID and this may affect the findings. For instance, Underwood, McCarthy, Tsakanikos, Howlin, and Craig (2012) argue that adults with ASD and ID may not be more vulnerable to psychiatric disorders than those without ASD with ID. They found that key factors associated with poor mental health were: severity of ID; social skills; and adaptive behaviour skills. However, social skills are a core diagnostic area of impairment for many adults with ASD.

Since adults with ASD may experience difficulties with social communication means some studies have specifically explored social anxiety in these individuals. Maddox and White (2015) found 50% of adults with ASD met diagnostic criteria for social anxiety disorder. These participants desired social interaction but also feared negative evaluation by others. Those who had ASD but not social anxiety did not desire social interaction as much. However, another study compared individuals with ASD to individuals without ASD and also those with social anxiety disorder. The authors found differences in the type of social anxiety experienced by those with ASD and those with social anxiety disorder. Individuals with social anxiety disorder feared they were socially incompetent but realised they have good social skills whereas individuals with ASD showed social awkwardness whether they feared being socially incompetent or not (Bejerot, Eriksson, & Mortberg, 2014). In this sense, small talk on a one-to-one basis with adults with social anxiety disorder can generally go well whereas it may still be difficult with adults with ASD. Therefore, high levels of social anxiety might be reported in adults with ASD but this could depend on levels of insight or social functioning.

Despite the differences in the prevalence of anxiety symptoms, the studies do reveal high levels of anxiety for many individuals with ASD both in clinical and community settings. Higher levels of anxiety might be expected from clinical samples as these individuals have accessed support or treatment from services for their difficulties. However, high levels of anxiety in community samples are worrying when many adults with ASD are at risk of social isolation. It is unclear whether adults with ASD do not access services because of their ASD traits, because they are choosing not to access support or because services cannot offer autism-specific support. Adults with ASD may also not know where to go to access such support (Jones, Goddard, Hill, Henry, & Crane, 2014). This raises questions about the day-to-day activities of adults with ASD in the community who may be at risk of mental health difficulties.

Quality of life in adults with ASD. It has been estimated that four out of five adults with ASD are still dependent on their parents (Mottron, 2011) which suggests many individuals with ASD could have day-to-day functioning difficulties. This has implications for an individual's quality of life and is worth investigating further. Few studies have considered quality of life for adults with ASD but many researchers have addressed this issue by attempting to assess social participation or vocational activities.

Adults with ASD without ID report significant functional impairments compared to healthy, nonclinical participants. These impairments include interacting or communicating with others and participating in society, school and work. Adults with ASD also report less life satisfaction compared to nonclinical participants (Schmidt et al., 2015). Importantly, these authors found that participating in society was the only factor identified in predicting life satisfaction for adults with ASD. Some examples of participation include joining a sports club or community group where the individual can benefit from social inclusion without any of the difficulties around communication. This could be particularly effective if the participation is an activity involving a specialist interest.

Individuals with ASD also report lower quality of life across all ages – young, adolescence, adulthood and elderly, than individuals without ASD (van Heijst & Geurts, 2014). Most participants in that study received an ASD diagnosis in adulthood which suggests many years passed before support could be formally accessed. Little is known about the well-being of many individuals with ASD. This may be because many adults with ASD are living in the community undiagnosed. It may also be because very limited post-diagnostic support is available for those who are diagnosed (Jones et al., 2014).

In summary, the mental health of adults with ASD is of concern and clinicians need to be aware of mental health difficulties in these individuals (Boyd, Woodbury-Smith, & Szatmari, 2011). Some research has explored depression or anxiety in adults with ASD but little is known about overall life satisfaction or general well-being. Individuals with ASD may be at greater risk of social isolation and may not know how to access any autism-specific support or whether this support exists. This has implications for outcomes in adulthood.

Executive functions in adults with ASD. Adults with ASD report much variability in terms of mental health and employment outcomes. However, another additional area which has received attention in autism research is the influence of executive functions in ASD. Executive function research has mostly focused on children but the focus in this chapter will be on executive functions in adults with ASD. 'Executive function' is often considered an umbrella term for higher-order cognitive functions such as working memory, inhibition, set-shifting or cognitive flexibility, initiating responses, planning, impulse control and action monitoring (Stuss & Knight, 2002). In order to use these functions, there is a need to disengage from the immediate environment so actions can be monitored, influenced and guided. Impairments in executive functions are usually seen in patients with acquired neurological injury to the frontal lobes. However, impairments may also be seen in a range of neurodevelopmental disorders such as ADHD, OCD, schizophrenia, phenylketonuria and Tourette syndrome (Hill, 2004). It is important to understand to what extent executive function impairments exist in adults with ASD as this will have implications for outcomes including diagnosis and interventions (Hill & Bird, 2006) for these individuals.

Cognitive-behavioural studies of executive functions in adults with ASD. When reviewing executive function research for adults with ASD, mixed findings emerge depending on the tasks and comparison groups used. The next section will focus on the following executive functions of *adults* with ASD: response initiation/suppression or inhibition; working memory; cognitive flexibility; planning; and initiation/generativity.

Response initiation/suppression or inhibition. When the Hayling sentence completion test (Burgess & Shallice, 1997) is used to assess response initiation/suppression or inhibition, Zimmerman, Ownsworth, O'Donovan, Roberts, and Gullo (2016) found adults with ASD performed worse than non-ASD participants matched on age, gender and years of education. Using the same Hayling test, Hill and Bird (2006) found adults with ASD were slower and showed more difficulties than a non-ASD group matched on full-scale IQ (and age and gender where possible). However,

when using the Stroop test (Trenerry, Crosson, DeBoe, & Leber, 1989) as a measure of inhibition, the same authors also found adults with ASD showed fewer difficulties with inhibition than other executive function tasks. Ambery, Russell, Perry, Morris, and Murphy (2006) also found that adults with ASD did not perform worse on the Stroop test than a non-ASD group matched on verbal IQ, performance IQ, age and gender. Adults with ASD have also performed the same as a non-ASD group matched on performance IQ, age and gender (Lopez, Lincoln, Ozonoff, & Lai, 2005) on the California Stroop test (Delis, Kaplan, & Kramer, 1996).

Working memory. When assessing working memory, adults with ASD have performed worse on a letter number sequencing (Wechsler, 2008) test compared to non-ASD participants matched on age, gender and years of education (Zimmerman et al., 2016). Adults with ASD have also performed worse on the Spatial Span subscale from the Wechsler Memory Scale-III (Wechsler, 2002) than a non-ASD group matched on full-scale IQ, age and gender (Geurts & Vissers, 2012).

Cognitive flexibility. Geurts and Vissers (2012) found adults with ASD did not perform worse on either the Modified Card Sorting Test; MCST (Nelson, 1976) or the Trail Making Task; TMT (Reitan & Wolfson, 1985) than a non-ASD group matched on full-scale IQ, age and gender. Bogte, Flamma, van der Meere, and van Engeland (2008) also found adults with ASD did not perform worse on a computerised variant of a response bias paradigm (Sternberg, 1969) than a non-ASD group matched on verbal IQ, performance IQ and age but participants with ASD were slower. Hill and Bird (2006) also found adults with ASD were more impaired on the TMT than a non-ASD group matched on full-scale IQ (and age and gender where possible) but only in terms of psychomotor processing and visual search skills rather than in terms of any executive function skills. However, Lopez et al. (2005) found adults with ASD did perform worse on the California TMT (Delis et al., 1996) and the Wisconsin Card Sorting Test; WCST (Heaton, Chelune, Talley, Kay, & Curtiss, 1993) compared to a non-ASD group matched on performance IQ, age and gender.

Planning. Davids, Groen, Berg, Tucha, and van Balkom (2016) found adults with ASD did not perform worse on the German version of the Tower of London (Tucha & Lange, 2004) task or on the Zoo map of the Behavioural Assessment of Dysexecutive Syndrome; BADS (Wilson, Alderman, Burgess, Emslie, & Evans, 1996) in terms of executive function skills but adults with ASD were slower on the Tower of London task than the non-ASD group matched on full-scale IQ, age, gender and level of education. Adults with ASD have also shown unimpaired performance on the Tower of London

(Culbertson & Zillmer, 2001) task when compared to a non-ASD group matched on full-scale IQ, age and gender (Geurts & Vissers, 2012). Similarly, Bramham et al. (2009) found adults with ASD were not less accurate but were slower on the Zoo map of the BADS when compared to a non-ASD group matched on age and gender. However, Hill and Bird (2006) found adults with ASD were impaired on the Zoo map, and the Six Elements test, of the BADS than a non-ASD group matched on full-scale IQ (and age and gender where possible). Likewise, Lopez et al. (2005) found adults with ASD performed worse on the Tower of California (Delis et al., 1996) task than a non-ASD group matched on performance IQ, age and gender.

Initiation/generativity. Adults with ASD have demonstrated difficulties on a Verbal Fluency (Strauss, Sherman, & Spreen, 2006) test compared to a non-ASD group matched on age and gender (Bramham et al., 2009). Difficulties, and slowness, with initiation have also been observed on a Verbal Fluency test when compared with a non-ASD group matched on full-scale IQ, and age and gender where possible (Hill & Bird, 2006). Further difficulties with generativity have been observed on a Controlled Oral Word Association Test; COWAT (Benton & Hamsher, 1989) when compared to a non-ASD group matched on verbal IQ, performance IQ, age and gender (Ambery et al., 2006).

To summarise, adults with ASD show good performance in response suppression/inhibition tasks but they may show difficulties in tasks assessing response initiation, working memory and initiation/generativity. For studies assessing cognitive flexibility or planning, adults with ASD may show difficulties but this could be because they are slower, rather than less accurate, on these tasks. This is also summarised in Table 1.1.

Table 1.1

Summary of executive function studies in adults with ASD without ID.

Study	Participants	Age (years)	Executive function tasks used	ASD impaired?
Zimmerman et al. (2016)	42 ASD 40 non-ASD Matched on age, gender and years of education	ASD: 18-66 Non-ASD: 18-62	Response initiation/suppression Hayling test Working memory Letter number sequencing	Y Y
Davids et al. (2016)	36 ASD 36 non-ASD Matched on full-scale IQ, age, gender and level of education	ASD: 50-84 Non-ASD: 50-79	Cognitive flexibility/planning German version of the Tower of London Planning/priority setting Zoo Map of BADS	N (not less accurate but were slower) N
Geurts and Vissers (2012)	23 ASD 23 non-ASD Matched on full-scale IQ, age, gender and educational level	ASD: 63.6 (mean) Non-ASD: 63.7 (mean)	Working memory Spatial Span Cognitive flexibility MCST and TMT Planning Tower of London	Y N N

Study	Participants	Age (years)	Executive function tasks used	ASD impaired?
Bramham et al. (2009)	45 ASD 31 non-ASD Matched on age and gender	ASD: 32.76 (mean) Non-ASD: 32.81 (mean)	Initiation Verbal Fluency test	Y
			Planning Zoo Map of BADS	N (not less accurate but were slower)
Bogte et al. (2008)	23 ASD 32 non-ASD Matched on verbal IQ, performance IQ and age	ASD: 20-39 Non-ASD: 19-39	Cognitive flexibility Computerised variant of a response bias paradigm	N (not less accurate but were slower)
Hill and Bird (2006)	22 ASD 22 non-ASD Matched on full-scale IQ and age and gender where possible	ASD: 31.09 (mean) Non-ASD: 33.45 (mean)	Response initiation/suppression Hayling test	Y
			Inhibition Stroop test	N
			Cognitive flexibility TMT	N (not less accurate but were slower)
			Planning Zoo Map and Six Elements test of BADS	Y

Study	Participants	Age (years)	Executive function tasks used	ASD impaired?
			Initiation/generativity	Y
			Verbal Fluency	
Ambery et al.	27 ASD	ASD: 19-67	Inhibition	N
(2006)	20 non-ASD	Non-ASD: 21-58	Stroop test	
	Matched on verbal IQ,			
	performance IQ, age and		Initiation/generativity	Y
	gender		COWAT	
Lopez et al.	17 ASD	ASD: 19-42	Inhibition	N
(2005)	17 non-ASD	Non-ASD: 18-45	California Stroop test	
	Matched on performance			
	IQ, age and gender		Cognitive flexibility	Y
			California TMT and WCST	
			Planning	Y
			Tower of California	

Note. BADS = Behavioural Assessment of Dysexecutive Syndrome; COWAT = Controlled Oral Word Association Test; ID = intellectual disability; IQ = intelligence quotient; MCST = Modified Card Sorting Test; N = no; TMT = Trail Making Task; WCST = Wisconsin Card Sorting Test; Y = yes.

The relationship between ASD and executive functions. The relationship between ASD and executive functions is worthy of further exploration. Studies focusing on non-ASD populations have attempted to measure the link between autistic traits and executive function impairments but these have mixed findings. Ridley, Homewood, and Walters (2011) issued 44 students with the Autism Spectrum Quotient; AQ (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) alongside neurological motor tasks and subscales from the Delis-Kaplan Executive Function System battery; D-KEFS (Delis et al., 1996). Correlations between autistic traits and verbal set-shifting abilities were found, alongside correlations between autistic traits and motor function scores. Although this has not been looked at in an ASD sample, this suggests verbal and motor abilities could affect performance on executive function tasks. Likewise, Christ, Kanne, and Reiersen (2010) found links between autistic traits and executive control impairments. After accounting for ADHD at the group and individual level, autistic traits explained a significant amount of variance in individuals' overall level of executive functioning as well as within most individual executive domains. If applied to adults with ASD, this suggests the more impaired an individual is by autism traits, the worse their performance on executive function tasks. However, more recent research looking at inhibition, working memory and cognitive flexibility, has found no significant relationships between autistic traits and executive function tasks in a non-ASD sample (Maes, Vissers, Egger, & Eling, 2013).

Despite this, some studies have looked at the relationship between ASD and executive functions with participants with ASD. Ambery et al. (2006) found adults with ASD demonstrated impairments in cognitive flexibility by producing more perseverative errors on the WCST. Therefore, poorer performance on tasks assessing cognitive flexibility has been linked to perseverative behaviours. Also, Bramham et al. (2009) found executive function impairments (as assessed through impaired performance on verbal fluency and slow performance on the Zoo map of the BADS) were linked to stereotyped, repetitive behaviours .

ASD, executive functions and neuroimaging. Further attempts to uncover the relationship between ASD and executive functions have been made using neuroimaging techniques. In a study by Schmitz et al. (2006), ten adults with ASD and twelve non-ASD participants matched on full-scale IQ, age, and gender completed three (Go/No-go test, Stroop test and Switch test) tasks taken from the Maudsley Attention and Response Suppression battery; MARS (Rubia et al., 2005). These tasks were adapted for functional magnetic resonance imaging (fMRI) and designed to assess inhibition and cognitive flexibility. Differences were seen in the ASD group with significant increases in brain

activation in: the left inferior and orbital frontal gyrus (for motor-inhibition); the left insula (for interference-inhibition); and the parietal lobes (for cognitive flexibility), despite no behavioural impairments being observed in the ASD group. However, Gilbert, Bird, Brindley, Frith, and Burgess (2008) found slightly different results when 15 adults with ASD, who were matched across full-scale IQ and age to a non-ASD group of 18 adults without ASD, completed two executive function tasks while undergoing fMRI. In a classic executive function task (random response generation), brain activation differed between the two groups in the cerebellum but not the frontal lobes. In a novel executive function task (selection between stimulus-oriented and stimulus-independent thought) the ASD group had significantly greater activity in the medial rostral prefrontal cortex, despite no behavioural impairments being observed in the ASD group. These results support the idea of an uneven profile of executive function performance in adults with ASD but this may also depend on the task used. Methodological issues in assessing executive functions in adults with ASD will be explored more fully in Chapter Two in this thesis.

In summary, a varied, uneven profile of executive functions in adults with ASD may exist. Importantly, this has implications for daily life activities such as time-keeping, planning journeys and initiating vocational activities and merits future investigation. It is more important to focus on how executive functions impair everyday life as this has implications for outcomes such as employment and friendships (Ambery et al., 2006). Taken together, with concerns about the mental health of adults with ASD and impairments in social communication, suggests social inclusion must be regarded as a priority for adults with ASD.

Mental health, executive functions and employment in adults with ASD. In 2007, a study was run which assessed 44 adults with ASD at the beginning and end of an employment programme. Two groups of participants were included: a supported employment group and an unemployed group (these were individuals on a waiting list who only participated in non-competitive vocational activities). The two groups did not differ on any cognitive measures at the start of the programme. However, after an average length of 30 months in community employment, the supported employment group showed improvements on a variety of cognitive measures. These were assessed using the Cambridge Neuropsychological Test Automated Battery; CANTAB® (Cambridge Cognition, 1996) and included: the Spatial Span Task (span length recalled); the Spatial Working Memory Task (strategy); and the Planning task ‘Stockings of Cambridge’ (problems solved in minimum moves and mean planning time). Improvements were also seen on other tasks such as the TMT (time on part B) and the Matching Familiar Figures (Kagan, 1966) Test; MFFT (first answer and errors). The

unemployed group showed no change in cognitive performance over time (Garcia-Villamisar & Hughes, 2007). This suggests employment affects cognition in a way vocational activities do not. However, little else is known about the effects of employment on the executive functions of adults with ASD.

Employment can provide a wage, less dependency on benefits and a social and personal identity for many adults with ASD (Nicholas et al., 2014). Supported employment has also been shown to improve the economy and increase social networks and well-being for adults with ASD (Mavranezouli et al., 2014). Adults with ASD have further reported significant improvements in quality of life after a period of employment supported by a health professional (Katz et al., 2015). However, little else is known about the effects of employment on the mental health of adults with ASD.

Thesis Aims

Despite employment in adults with ASD being of legislative, clinical and financial concern, little research has been carried out in this area. More specifically, little is known about the effects of employment on the mental health or executive functions of adults with ASD and the relationships between these, particularly when considering employment as a route to social inclusion and also when considering the financial impact on society (Buescher et al., 2014; Knapp et al., 2009). Therefore, the major research aims and questions which will be addressed in this thesis are:

1. What are the relationships between employment and mental health in adults with ASD (Study One)?

2. What are the relationships between employment, mental health and executive functions in adults with ASD (Study Two)?

3. What work characteristics are related to job satisfaction and anxiety in employed adults with ASD (Study Three)?

Thesis Structure

Chapter One outlined legislative issues around employment for adults with ASD. Mental health and executive functions were considered separately and, then, together in relation to employment for adults with ASD. Chapter Two will address various methodological issues when conducting research

involving adults with ASD including: how to assess ASD in participants; dealing with co-occurrences of ID and clinical disorders; matching participants; how decisions were made to include various measures which assessed executive functions and mental health in adults with ASD; and ethical challenges faced. Chapter Three will use self-report measures to assess the mental health of a large sample of employed and unemployed adults with ASD. These adults with ASD will be closely matched on age and gender to a non-ASD group. Chapter Four will use self-report measures, plus cognitive-behavioural tasks, to assess the mental health and executive functions of a smaller sample of adults with ASD, pre- and then post-employment in a longitudinal research approach. Chapter Five will use self-report measures to assess which work characteristics are related to job satisfaction and anxiety in employed adults with ASD. Finally, Chapter Six will consider the findings from the three studies in relation to each other with suggestions for future applied research in autism and employment.

Chapter Two: Methodological Issues

Overview of Chapter Two

Various methodological issues must be considered when conducting research involving adults with autism spectrum disorder (ASD). Chapter Two presents an overview of how these issues contributed to the design of the three studies included in the present thesis. This includes: the measure used to assess ASD in participants; dealing with co-occurrences of intellectual disability (ID) and clinical disorders; matching participants; and how decisions were made to include various measures which assessed executive functions and mental health in adults with ASD. Finally, the ethical challenges which were faced are discussed.

There are many methodological considerations which must be taken into account when conducting research involving adults with autism spectrum disorder (ASD) and these key principles will be outlined in this chapter. Autism is heterogeneous and encompasses a wide range of individuals which means participant characteristics must be carefully considered. Some data collection methods, such as online questionnaires, can complicate formally establishing an ASD diagnosis in participants. Other characteristics, such as co-occurring intellectual disability (ID) or clinical disorders means it may be more difficult to assign research findings to autism in isolation. The methodology of studies must also be carefully considered. Matching participants with ASD to a non-ASD group, on either a group or individual basis, is seen as essential to autism research. The choice of materials and tasks is also important as different findings may emerge depending on which materials or tasks are used. Measures assessing mental health must also be taken into account to ensure the items are relevant to the autism population. Finally, ethical issues involving consent and general ability means the research findings must be considered in relation to the wider autism population.

Participant Characteristics

The main purpose of this section is to provide an overview of the importance of participant characteristics when conducting autism research. This is to establish how ASD diagnosis was checked, how co-occurring ID was managed and how the influence

of co-occurring disorders was handled in the present thesis, across Study One, Study Two and Study Three.

Diagnosis of ASD in adulthood. ASD is diagnosed based on behaviour rather than any known genetic or biological marker (American Psychiatric Association, 2013) and a number of instruments have been developed to assess ASD in both children and adults. The Autism Diagnostic Observation Schedule-Generic; ADOS-G (Lord, Rutter, DiLavore, & Risi, 1999) is one such assessment tool. This instrument is composed of four modules where two modules are based on observation and two modules are based on a conversational interview format. The ADOS-G is considered the 'gold standard' measure for assessing and diagnosing individuals with ASD, particularly when combined with the semi-structured clinical instrument, the Autism Diagnostic Interview-Revised; ADI-R (Lord, Rutter, & Le Couteur, 1994).

Ideally, the ADOS-G and ADI-R would both have been used to confirm participants' diagnosis of ASD in the present thesis. However, a trained assessor would have been needed to administer these instruments and this was not possible given the time and financial constraints of the present research. Also, both the ADOS-G and ADI-R are less specific when used with adults, compared to children, and with individuals who are considered to have higher functioning skills (Lord & Risi, 1998). In addition, Study One and Study Three were predominantly accessed online and it would not have been possible to confirm the presence of ASD using these measures. Therefore, an alternative measure was needed.

The Autism Spectrum Quotient; AQ (Baron-Cohen et al., 2001) is a 50-item self-report questionnaire which assesses levels of autistic traits in adults without an associated ID. Participants are asked to rate their behaviours in five different areas: attention switching; attention to detail; communication; imagination; and social skill. Respondents are presented with four response categories: 'definitely agree'; 'slightly agree'; slightly disagree'; and 'definitely disagree'. A score of 32 or above on this questionnaire is indicative of a clinical level of autistic traits and a referral for diagnosis is recommended. The AQ has excellent test-retest reliability (Baron-Cohen et al., 2001) and it is also free, fast and easy to administer. However, more recent research suggests AQ self-report scores do not significantly predict receipt of an ASD diagnosis (Ashwood et al., 2016). Also, as a self-report measure, it does have common flaws such as social desirability bias or participants exaggerating or minimising their responses. It also requires respondents to have good levels of insight into their behaviour and to have average or above average intelligence. Despite this, the AQ has been used as a

screening measure to confirm participants' formal diagnosis of ASD for research purposes (Ashwin, Wheelwright, & Baron-Cohen, 2006; White, Hill, Winston, & Frith, 2006).

To provide a shorter version of the AQ, the Autism Spectrum Quotient-10; AQ-10 (Allison, Auyeung, & Baron-Cohen, 2012) was developed. This is a ten-item questionnaire with the same four response categories as the AQ: 'definitely agree'; 'slightly agree'; slightly disagree'; and 'definitely disagree'. A score of seven or above on this questionnaire is considered indicative of a clinical level of autistic traits and a referral for diagnosis is recommended. There is a low level of loss in discriminative power between the full AQ and the AQ-10 and it is considered a suitable alternative to the AQ, if there is not enough time to complete the whole AQ (Booth et al., 2013). Therefore, the AQ-10 was selected as an appropriately short measure to characterising participants' diagnostic status in the present thesis. While there are many issues around recruitment of adults with ASD, not least to online surveys, in the current thesis reporting an ASD diagnosis was fundamental to inclusion in the ASD group. The AQ-10 was used to confirm that there was indeed a group difference in the number of self-reported autistic traits between the ASD and non-ASD groups in Study One.

The criteria for inclusion in the present thesis for those with ASD also included a formal diagnosis of ASD from a psychologist or psychiatrist. For instance, in Study Two participants with ASD were mainly recruited through autism-specific services and this diagnosis was confirmed by each individual service. There were no restrictions imposed on the precise diagnosis received by participants and those with Asperger syndrome, autism, autism spectrum disorder, autistic disorder, childhood disintegrative disorder and pervasive developmental disorder-not otherwise specified (PDD-NOS) were included. The AQ-10 was included to confirm participants still met criteria for a diagnosis of ASD in adulthood. However, this is interpreted with caution as recent research suggests self-reported AQ scores do not significantly predict receipt of an ASD diagnosis (Ashwood et al., 2016).

Co-occurring ID in adults with ASD. ID is broadly defined as an individual having an intelligence quotient (IQ) score of below 70. Estimates of adults with ASD and co-occurring ID vary widely. It has been suggested that between 20% and 33% of adults with ID also have ASD in England (Emerson & Baines, 2010) and national data from the United States shows between 19% and 20% of adults with ASD have ID (Croen et al., 2015). The most recent research suggests almost two in five adults with moderate to

profound ID have ASD but only 1% of adults with no or mild ID have ASD in England (Brugha et al., 2016).

In the present thesis, adults without ID were included. Study One and Study Three required adults with ASD to complete an online (or paper, if requested) survey and it was therefore not feasible to assess IQ through these methods of data collection. However, it may be assumed that data provided by adults with ASD, who were computer literate and able to finish the survey(s) to completion, were acceptable to include in the overall analyses. Study Two required adults with ASD to complete a series of cognitive tasks which meant a minimum general ability was required. Previous researchers have only included participants with an IQ score of above 70 (i.e. two standard deviations below the mean) in order to ensure that adults with ASD can adequately complete the cognitive tasks. In Study Two, the Wechsler Abbreviated Scale of Intelligence; WASI (Wechsler, 1999) was used at the beginning of each testing session to determine whether the participant would continue with the cognitive tasks. Three, out of 19, participants did not reach the cut-off IQ score of above 70 and, therefore, the session was stopped and they were thanked for their time.

Co-occurring clinical disorders in adults with ASD. Other clinical disorders regularly co-occur with ASD, For instance, Chapter One discussed the varying co-occurrence of depression (26-70%), anxiety (12-36%), bipolar disorder (1-13%), obsessive compulsive disorder (6-18%) and schizophrenia (1-10%) in adults with ASD (Chandrasekhar & Sikich, 2015; Croen et al., 2015; Moss et al., 2015; Russell et al., 2016). Many other medical and psychological or psychiatric disorders have also been reported to co-occur alongside ASD, including Down syndrome (Capone, Grados, Kaufmann, Bernad-Ripoll, & Jewell, 2005), attention deficit hyperactivity disorder or ADHD (Thomas, Lycett, Papadopoulos, Sciberras, & Rinehart, 2015), epilepsy (Smith & Matson, 2010) and Tourette syndrome (Baron-Cohen, Scahill, Izaguirre, Hornsey, & Robertson, 1999) although the prevalence of these has been more difficult to quantify in adulthood. The presence of a co-occurring disorder means research findings may be a consequence of a known or previously unknown co-occurring condition which would affect the conclusions drawn from the data. Co-occurring disorders could also mean participants are taking medication which could further affect the findings. This is particularly relevant in autism research and requires further attention.

One method of accounting for all co-occurring disorders is to exclude all participants with any additional diagnoses in order to provide a ‘purer’ sample of adults with ASD. However, if co-occurrence is as vast as previous studies suggest, then this

smaller group of adults with ASD would not be representative of the wider autism community. There may also be difficulties in screening for additional diagnoses as many measures have not been validated in adults with ASD, so it may not be justified to exclude participants on this basis.

In the present thesis, questions were included which asked participants about any co-occurring disorders and the approximate dates these were diagnosed. Questions were also asked about any currently prescribed medication. Participants with dyslexia, attention deficit hyperactivity disorder (ADHD) or developmental coordination disorder (DCD) were excluded from the cognitive tasks in Study Two as deficits in executive functions have been noted in these populations (Rosenblum, 2013; Tiffin-Richards, Hasselhorn, Woerner, Rothenberger, & Banaschewski, 2008). Further detail on the questions asked within each study are provided in Chapter Three (Study One), Chapter Four (Study Two) and Chapter Five (Study Three).

Research Methodology

The main purpose of this section is to provide an overview of the importance of research methodology when conducting autism research. This is to establish how matching participants was managed in the present thesis and is further discussed in Study One and Study Three.

Matching participants. A well-matched control group is considered essential for progress in autism research (Hill, 2004). This means researchers must decide whether to match participants on a group or individual basis. When participants are matched on a group basis, the mean scores of the ASD group must not significantly differ from the mean scores of a non-ASD group. When participants are matched on an individual basis, each participant in the ASD group is matched to an individual in the non-ASD group on selected criteria, such as age or gender. This enables a more precise comparison because it reduces variability in performance on a particular measure. However, it is a time-consuming process and could result in a large loss of data. Group matching allows more data to be included but also results in higher variability between the groups.

In the present thesis, participants were individually matched according to age, gender and occupation status in Study One. When matching across age, 100% of participants were matched within two years of their age. Participants in Study Three were similarly matched according to age and gender. Participants in Study Two consisted of only adults with ASD and more information can be found in Chapter Four.

Materials/Tasks

The main purpose of this section is to provide an overview of the importance of the materials and tasks chosen when conducting autism research. This is to establish how the executive function tasks (in Study Two) and mental health measures (in Study One, Study Two and Study Three) were chosen. Chapter Three provides further details of the underlying reasons why varying estimates of mental health problems are reported in adults with ASD. Chapter Four provides further details of the underlying reasons why varying performance on executive function tasks is reported. Chapter Five provides further details on legislative issues affecting employed adults with ASD and how this affects workplace support and, in turn, job satisfaction and/or anxiety.

The choice of executive function tasks. Chapter One outlined the different executive function tasks which have been included in studies. The term 'executive functions' is a vague concept but many tasks have been developed and used in research to try and tap into different aspects of executive functions. Table 2.1 outlines studies which have previously assessed executive functions in adults with ASD by using cognitive-behavioural tasks. All participants in these studies included adults with ASD without ID.

A number of issues must be considered when selecting executive function tasks for an adult ASD sample. These include task complexity, differences between 'classic' or 'newer' tasks and the ecological validity of executive function tasks.

In considering task complexity, it has been suggested that many 'classic' executive function tasks tend to be complex and often produce one outcome measure which actually comprises a number of different measures. For example, the Tower of London task (Shallice, 1982) is often used as a measure of planning but each move involves working memory and inhibition of inefficient but more automatic sub-goal moves (Hill & Bird, 2006). Task complexity must be considered when executive function tasks, such as the Wisconsin Card Sorting Test; WCST (Heaton et al., 1993) tap into multiple complex processes and not just flexibility alone (Hill, 2004). Therefore, there may be a need for challenging but novel tasks which can accurately capture the change from controlled to automatic actions. However, this means executive function tasks may have poor reliability and be multi-componential (Hughes & Graham, 2002).

In addition to task complexity, differences may exist between 'classic' (or 'traditional') executive function tasks and 'newer' tasks. Traditional executive function tasks might be insensitive to developmental impaired executive function performance rather than acquired impaired executive function performance (Hill & Bird, 2006). Therefore, the choice to include traditional or newer executive function tasks may influence the findings as one study has previously demonstrated. Gilbert et al. (2008) ran a neuroimaging study which included 15 adults with ASD without ID who were matched across full-scale IQ and age to a non-ASD group of 18 adults without ASD without ID. Both groups completed a classic (random response generation) executive function task and a newer (selection between stimulus-oriented and stimulus-independent thought) executive function task while undergoing functional magnetic resonance imaging (fMRI). In the classic executive function task, levels of brain activation differed between the two groups in the cerebellum but not the frontal lobes. However, in the newer executive function task, the ASD group had significantly greater signal change in the medial rostral prefrontal cortex. The authors concluded that executive function performance in ASD is associated with task-specific functional change. Therefore, while the findings support the idea of an uneven profile of executive function performance in adults with ASD, they also highlight the variation in performance depending on which task is being used.

Burgess et al. (2006) further argued that many traditional executive function tasks may not be suitable and there is a need for tasks which assess the interaction between the individual and the situation context. This focus on a 'function-led' approach means tasks need to be developed for clinical application rather than merely adapting existing procedures. This relates to ecological validity as the focus must be on how representative the task is of daily difficulties and the extent to which the findings can be generalised outside of the laboratory.

Burgess et al. (2006) also discussed how clinicians are interested in the function level or the daily life interactions between the individual and their environmental context. In this sense, executive function tasks like the WCST have uncertain predictive validity because it is unknown what it is measuring within everyday life situations. We also know that executive function tasks like the Tower of London are more complex than initially thought and it is unlikely one task taps into one aspect of cognition (such as planning) alone. Therefore, these tasks may not be originally designed for the purpose to which they are often put and there may be a need for more ecologically valid executive function tasks. This is relevant for adults with ASD who struggle to communicate socially and interact day to day. If adults with ASD demonstrate impairments in executive function tasks then this has implications for real-world adaptive functioning including employment

e.g. through difficulties in completing job interview or initiating a job search – both of which use social communication skills.

Therefore, in the present thesis, a variety of executive function tasks were chosen very carefully based on tasks which have been previously been used in adult autism research and which evaluate a range of executive functions. In part, these decisions were based on the practical constraint of assessing executive functions pre- and then post-employment (in Study Two), rather than having continuous days of testing. Chapter Four, Table 4.4 describes the executive function tasks used. As mixed findings have emerged regarding cognitive flexibility in adults with ASD, the Trail Making Task; TMT (Reitan & Wolfson, 1985) was included as a classic executive function measure. The newer Hayling and Brixton Tasks (Burgess & Shallice, 1997) were chosen, particularly as the Hayling test may be a good measure of inhibition in an autism sample (Hill & Bird, 2006). A Word Fluency test (Thurstone, 1938) was also included as a measure of generativity. Based on Garcia-Villamisar and Hughes (2007), various tasks from the Cambridge Neuropsychological Test Automated Battery; CANTAB® (Cambridge Cognition, 1996) were included. The Behaviour Rating Inventory of Executive Functioning-Adult version; BRIEF-A (Roth, Isquith, & Gioia, 2005) was also included as a self-report measure of how executive function skills influence everyday behaviours in the environment for adults with ASD.

Table 2.1

Summary of executive function tasks in studies involving adults with ASD without ID.

Study	Participants	Age (years)	Executive function tasks used	Main findings of the ASD group
Zimmerman et al. (2016)	42 ASD 40 non-ASD Matched on age, gender and years of education	ASD: 18-66 Non-ASD: 18-62	<u>Response initiation/suppression</u> Hayling sentence completion test; Hayling test (Burgess & Shallice, 1997) <u>Working memory</u> Letter number sequencing (Wechsler, 2008) <u>Emotion recognition</u> The awareness of social-inference test-revised (McDonald et al., 2006)	Poorer performance on all executive function tasks.
Davids et al. (2016)	36 ASD 36 non-ASD Matched on full-scale IQ, age, gender and level of education	ASD: 50-84 Non-ASD: 50-79	<u>Executive functions in everyday environment</u> BRIEF-A <u>Cognitive flexibility/planning</u> German version of the Tower of London (Tucha & Lange, 2004)	Self-reported impairments in planning/organising (Plan/Organise subscale), working memory (Working Memory subscale) and initiating/generativity (Initiate subscale) from the BRIEF-A but did not perform any worse on executive function tasks (except for more time needed on Tower of London

Study	Participants	Age (years)	Executive function tasks used	Main findings of the ASD group
			Planning/priority setting Zoo Map of BADS (Wilson et al., 1996) Semantic memory/divergent thinking Semantic verbal fluency test and phonetic verbal fluency test i.e. short versions of Dutch COWAT (Benton, Hamsher, & Sivan, 1983; Schmand, Groenink, & van den Dungen, 2008)	task which was unrelated to the complexity of the task).
Geurts and Vissers (2012)	23 ASD 23 non-ASD Matched on full-scale IQ, age, gender and educational level	ASD: 63.6 (mean) Non-ASD: 63.7 (mean)	Working memory Spatial Span subscale from WMS (Wechsler, 2002) Cognitive flexibility MCST (Nelson, 1976) and TMT (Reitan & Wolfson, 1985) Planning Tower of London (Culbertson & Zillmer, 2001)	Impairments observed in attention, working memory and fluency but not in processing speed, cognitive flexibility, planning or visual or verbal memory.

Study	Participants	Age (years)	Executive function tasks used	Main findings of the ASD group
			Verbal fluency Adaptation of COWAT (Benton & Hamsher, 1976) Verbal memory Dutch version of RAVLT (Rey, 1964; van den Burg, Saan, & Deelman, 1985)	
Bramham et al. (2009)	45 ASD 31 non-ASD 53 ADHD Matched on age and gender	ASD: 32.76 (mean) Non-ASD: 32.81 (mean) ADHD: 31.04 (mean)	Initiation Verbal Fluency test (Strauss et al., 2006) Planning Zoo Map (BADS) Strategy formation Key Search test (BADS)	Difficulties with initiation, planning and strategy formation. Slower on Zoo Map and Key Search tests although not less accurate.
Gilbert et al. (2008)	15 ASD 18 non-ASD Matched on full-scale IQ and age	ASD: 38 (mean) Non-ASD: 32 (mean)	Random response generation test Classic random keypress generation test 'Alphabet test' Newer test modified from Task 3 of Gilbert, Frith, and Burgess (2005)	No impairments observed.

Study	Participants	Age (years)	Executive function tasks used	Main findings of the ASD group
			involving selection between stimulus-oriented (SO) and stimulus-independent (SI) thought	
Bogte et al. (2008)	23 ASD 32 non-ASD Matched on verbal IQ, performance IQ and age	ASD: 20-39 Non-ASD: 19-39	Cognitive flexibility Computerised variant of a response bias paradigm (Sternberg, 1969)	No impairments in cognitive flexibility but were slower when completing the task.
Garcia-Villamisar and Hughes (2007)	44 ASD	Supported work group: 25.52 (mean) No supported work group: 24.32 (mean)	CANTAB® (Cambridge Cognition, 1996): Psychomotor speed Big Circle/Little Circle (BLC) Visual/spatial recognition memory Spatial Recognition Memory (SRM) Working memory Spatial Span (SSP) Set/attention shifting	Pre- and post-employment data only available. Supported employment group showed improvements on CANTAB in SSP (span length recalled); SWM (strategy); SOC (problems solved in minimum moves and mean planning time); TMT (time for part B); and MFFT (first answer and errors). Unemployed group showed no change in cognitive performance.

Study	Participants	Age (years)	Executive function tasks used	Main findings of the ASD group
			Intra-dimensional/Extradimensional (IED) <u>Retain spatial information/location</u> Spatial Working Memory (SWM) <u>Planning</u> Stockings of Cambridge (SOC) <u>Cognitive flexibility</u> TMT <u>Reflection-impulsivity</u> MFFT (Kagan, 1966) <u>Verbal fluency</u> WFT (Miller, 1984)	
Hill and Bird (2006)	22 ASD 22 non-ASD Matched on IQ and	ASD: 31.09 (mean) Non-ASD: 33.45 (mean)	Full BADS: <u>Mental flexibility</u> Rule Shift Cards test	Impaired on newer executive function tasks (the Action Program, Zoo Map and Six Elements subtests of the BADS as well as the Hayling test). Also impaired on the classic executive function TMT but

Study	Participants age/gender where possible	Age (years)	Executive function tasks used	Main findings of the ASD group
			Novel problem solving Action Program test Problem solving Key Search test Cognitive estimation Temporal Judgement test Planning Zoo Map test Planning/organisation/monitoring of behaviour Six Elements test Response initiation/suppression Hayling test Mental flexibility MCST	only in terms of psychomotor processing and visual search skills rather than in terms of executive functions. Slower and showed difficulties in response initiation and intentionality rather than inhibition/strategy formation.

Study	Participants	Age (years)	Executive function tasks used	Main findings of the ASD group
			Inhibition of a dominant verbal response Stroop test (Trenerry et al., 1989) Psychomotor speed/visual scanning and cognitive flexibility TMT Generativity Verbal Fluency test issued using instructions from Lezak (1995)	
Ambery et al. (2006)	27 ASD 20 non-ASD Matched on verbal IQ, performance IQ, age and gender	ASD: 19-67 Non-ASD: 21-58	Response inhibition Stroop test (Trenerry et al., 1989) Flexibility of thought WCST (Heaton et al., 1993) Generativity COWAT (Benton & Hamsher, 1989)	Impairments in flexibility of thought (more perseverative errors on WCST) and generativity (produced fewer words on verbal fluency) but not response inhibition.
Schmitz et al. (2006)	10 ASD 12 non-ASD	ASD: 38 (mean)	Three tasks from MARS (Rubia et al., 2005):	No impairments observed.

Study	Participants	Age (years)	Executive function tasks used	Main findings of the ASD group
	Matched on full-scale IQ, age and gender	Non-ASD: 39 (mean)	<u>Motor inhibition</u> Go/No-go task <u>Cognitive interference-inhibition</u> Spatial stroop task <u>Set-shifting</u> Switch task	
Lopez et al. (2005)	17 ASD 17 non-ASD Matched on performance IQ, age and gender	ASD: 19-42 Non-ASD: 18-45	Tasks from D-KFES (Delis et al., 1996) <u>Cognitive flexibility</u> California TMT and WCST <u>Nonverbal fluency</u> California Design Fluency test <u>Verbal fluency</u> California Verbal Fluency test	ASD group had deficits in cognitive flexibility and planning but performed same as non-ASDs on response inhibition. However, did not differ on any of the executive function tasks when controlled for verbal intellectual abilities[1].

[1] The authors note that this could be due to a lack of statistical power.

Study	Participants	Age (years)	Executive function tasks used	Main findings of the ASD group
			Planning Tower of California test	
			Response inhibition California Stroop test	

Note. BADS = Behavioural Assessment of Dysexecutive Syndrome; BRIEF-A = Behaviour Rating Inventory of Executive Functioning-Adult version; CANTAB® = Cambridge Neuropsychological Test Automated Battery; COWAT = Controlled Oral Word Association Test; D-KFES = Delis-Kaplin Executive Function Scales; ID = intellectual disability; IQ = intelligence quotient; MARS = Maudsley Attention and Response Suppression battery; MCST = Modified Card Sorting Test; MFFT = Matching Familiar Figures Test; RAVLT = Rey Auditory Verbal Learning Task; TMT = Trail Making Task; WCST = Wisconsin Card Sorting Test; WFT = Word Fluency test; WMS = Wechsler Memory Scale-III.

To summarise, adults with ASD show good performance in response suppression/inhibition tasks but they may show difficulties in tasks assessing response initiation, working memory and initiation/generativity. For studies assessing cognitive flexibility or planning, adults with ASD may show difficulties but this could be because they are slower, rather than less accurate, on these tasks. This is also summarised in Chapter One, Table 1.1.

The methodology of studies assessing executive functions. The nature of autism itself means individual differences can be large in ASD but research often focuses on group, rather than individual, differences (Pellicano, 2012). Huge variability can exist when comparing an ASD group to a control group and there may also be overlap between the two groups (Hill & Bird, 2006). Therefore, a well-matched control group is essential for progress in research (Hill, 2004).

Previous studies have also included adolescents as well as adults in their sample but by studying only adults with ASD, any issues with late maturation of the frontal lobes can be avoided (Hill & Bird, 2006). Therefore, in the present thesis, only adults with ASD aged 18 years or over were included. A well-matched non-ASD group was included wherever possible and individual differences, as well as group differences, were looked at in order to fully explore the data where appropriate.

Methodological considerations in assessing mental health in adults with ASD. Chapter One outlined some of the main methodological difficulties in mental health research with adults with ASD and these will be explored in more detail here.

Inconsistencies in the reported prevalence of mental health problems of adults with ASD raise methodological questions around the most appropriate data collection methods. First, there may be a lack of reliability between self- and informant-reports. For instance, research which looked at adolescents (aged 12-17 years) with ASD showed adolescents under-reported anxiety difficulties compared to parent and clinician reports (White et al., 2012). The authors noted uncertainty over whether this reflected a lack of insight, an unwillingness to report symptoms honestly or confusion around identifying anxiety symptoms. However, that study used a clinical sample and the age range of participants may not reflect the responses from the participants in the present thesis. Nonetheless, it is a consideration when a more recent study showed adults with ASD over-reported very severe mental health problems compared to informant-reports (Moss et al., 2015). Due to a lack of reliability between self- and informant-reports, and that

previous research has shown adults with ASD are able to use self-report measures (Berthoz & Hill, 2005), only self-report measures were included in the present thesis.

Second, it has been noted that research with adults with ASD is often of poor quality and inconsistencies in the rates and type of mental health problems reported may depend on the sample and measures used (Howlin & Taylor, 2015). In order to provide the highest quality research when working with adults with ASD, a well-matched non-ASD group was included wherever possible in the present thesis. The participant matching procedure for Study One is discussed in Chapter Three and for Study Three in Chapter Five.

Third, there are no available measures specifically for depression (Stewart et al., 2006) or anxiety (White et al., 2012) in individuals with ASD. This general lack of validated mental health measures – validated for those with ASD, may also have consequences for the quality of autism research in adulthood (Moss et al., 2015). The measures to be included in the present thesis were carefully considered by choosing measures with good validity and reliability, as an attempt to reduce any existing ambiguity around items that adults with ASD may experience when participating. These measures are outlined below.

Measuring depression in adults with ASD. Multiple measures of depression exist so the advantages and disadvantages of commonly used self-report measures were carefully considered before selecting an appropriate measure for the current thesis. Table 2.2 outlines various measures which assess depression through self-reports. The Patient Health Questionnaire-9; PHQ-9 (Kroenke, Spitzer, & Williams, 2001) was eventually chosen as a measure of depression. The PHQ-9 is a shortened version of the Patient Health Questionnaire; PHQ (Spitzer, Kroenke, & Williams, 1999) which derives from the Primary Care Evaluation of Mental Disorders; PRIME-MD (Spitzer et al., 1994). The PRIME-MD was the first measure designed for use in primary care services which can diagnose specific disorders using diagnostic criteria taken from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; DSM-IV (American Psychiatric Association, 1994). In summary, the PHQ-9 was chosen because of its strong continuous correlation with the Beck Depression Inventory-II; BDI-II (Beck, Steer, & Brown, 1996b) and because it is free and easy to administer (Kung et al., 2013).

The PHQ-9 is a nine-item questionnaire designed to assess symptoms of depression over the last two weeks. Respondents are presented with four response categories: ‘not at all’; ‘several days’; ‘more than half the days’; and ‘nearly every day’.

Responses for this scale are summated and can be classified into one of five categories: no depression; mild depression; moderate depression; moderately severe depression; and severe depression.

Table 2.2

Advantages and disadvantages of depression measures considered for inclusion in the present thesis.

Measure	Advantage	Disadvantage
Patient Health Questionnaire; PHQ-9 (Kroenke et al., 2001)	The PHQ-9 was compared with the BDI-II for inpatients and outpatients in a mood disorder setting. Strong correlations between both measures were observed with stronger correlations for outpatients. The PHQ-9 and BDI-II scores were closely correlated as continuous, rather than categorical, variables. The PHQ-9 and BDI-II can be considered essentially interchangeable but the PHQ-9 has practical applications as it is shorter and free (Kung et al., 2013).	Although the PHQ-9 does not show bias for gender or educational background, bias was observed for age (Cameron, Crawford, Lawton, & Reid, 2013).
	The nine items assessing depression from the PHQ are taken directly from depression criteria of the DSM-IV (Spitzer et al., 1999).	The PHQ-9 does not measure sleep, appetite change, punishment of feelings, crying, indecisiveness, irritability or libido which are measured by the BDI-II (Kung et al., 2013).
	The BDI-II is usually used in psychiatric settings and the PHQ-9 is usually used in medical settings. The PHQ-9 is faster to administer than the BDI-II (nine vs. 21 items) and it is free. The PHQ-9 and BDI-II were highly correlated so indicate good convergent validity of depression. Both	Although research suggests the PHQ-9 is a reliable and valid measure of depression severity (Kroenke et al., 2001), more recent literature shows the Hospital Anxiety and Depression Scale-Depression; HADS-D (Zigmond & Snaith, 1983) places patients in a milder severity of

Measure	Advantage	Disadvantage
	measures are equally recommended (Dum, Pickren, Sobell, & Sobell, 2008).	depression and the PHQ-9 and BDI-II place patients in a more severe category (Cameron et al., 2011; Hansson, Chotai, Nordstom, & Bodlund, 2009).
	A reliable and valid unidimensional measure of depression in the general population. This is based on longitudinal data where five-year household surveys were conducted in Germany with 5018 participants (Kocalevent, Hinz, & Brahler, 2013).	Although initial research suggests the PHQ-9 is sensitive in detecting changes in depression outcome over time (Lowe, Kroenke, Herzog, & Grafe, 2004), more work needs to be done to assess the sensitivity of the PHQ-9 over time (Cameron, Reid, & Lawton, 2010).
	Diagnostically superior to the HADS-D (Haddad et al., 2013). Valid and reliable for depression screenings in Asian primary care settings (Sung, Low, Fung, & Chan, 2013). A population-based study in Brazil showed the PHQ-9 is appropriate for screening major depressive episodes in the community (Santos et al., 2013). Valid and reliable for administering over the telephone (Farzanfar et al., 2013). Works well as a screening instrument but not as diagnostic criteria for depression (Reynolds, 2010; Wittkampf et al., 2009).	Participants may have difficulties fitting their experiences into the response options (Malpass et al., 2016).

Measure	Advantage	Disadvantage
	There is strong support for the PHQ-9 discriminating depressed from non-depressed individuals in the general population (Martin, Rief, Klaiberg, & Braehler, 2006).	
Beck Depression Inventory; BDI (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) or Beck Depression Inventory-II; BDI-II (Beck et al., 1996b)	High internal consistency of 1961 version of BDI (Beck & Steer, 1984).	Post-acute myocardial infarction patients did not report significantly higher levels of somatic symptoms compared to a non-medically ill control group (Thombs et al., 2010). This may be because somatic items are presented at the end of the BDI where it becomes implicitly clear it is a depression measure. If concerns exist about patients with chronic medical conditions completing somatic items on the BDI then this may be problematic for adults with ASD for two reasons: 1. There are large co-occurrences between alexithymia and ASD (Bird et al., 2010). This suggests adults with ASD might be less able to distinguish the physical symptoms of depression from medical conditions which are non-depression related. 2. Somatic items are presented at the end of the BDI so participants complete this with the implicit understanding that it is a depression measure. However, this has only

Measure	Advantage	Disadvantage
		been demonstrated in typical adults (Schwarz, 1999) and it cannot be assumed adults with ASD will respond to the somatic items with the understanding that these implicitly relate to mental (rather than physical) health. This is important considering adults with ASD report difficulties in the cognitive processing of emotions (Hill, Berthoz, & Frith, 2004).
	Potential to apply across cultures e.g. BDI-II is reliable and valid for measuring depression symptoms in suicidal African American individuals (Joe, Woolley, Brown, Ghahramanlou-Holloway, & Beck, 2008). Post-myocardial infarction patients with major depressive disorder reported significantly higher levels of somatic symptoms in comparison to psychiatric outpatients with major depressive disorder (Delisle et al., 2012). The groups in Thombs et al. (2010) were not correctly matched. The BDI-II may be a better measure as it contains three fewer somatic symptoms items and asks for symptoms present for a minimum of two weeks, rather than one week as in the BDI.	

Measure	Advantage	Disadvantage
	The BDI has been used in previous research with adults with ASD (Hill et al., 2004) with no difficulties reported by the authors in using this measure.	
Hospital Anxiety and Depression Scale-Depression; HADS-D (Zigmond & Snaith, 1983)	The HADS-D excludes somatic symptoms in order to determine whether changes in appetite or fatigue are the result of depression or a medical illness (Zigmond & Snaith, 1983).	The HADS-D does not translate easily across cultures as it uses British colloquial expressions such as 'butterflies in the stomach' (Coyne & van Sonderen, 2012). The cut-off scores are not clear. For instance, when recommended cut-offs are used to select patients for follow-up interviews, the HADS anxiety subscale might better predict diagnosis of depression than the HADS depression subscale (Mitchell, Meader, & Symonds, 2010). The HADS might be measuring a single dimension of general psychological distress rather than anxiety and depression separately (Cosco, Doyle, Watson, Ward, & McGee, 2012b).

Measure	Advantage	Disadvantage
		Systematic review showing the full HADS scale is consistently unable to differentiate between anxiety and depression (Cosco, Doyle, Ward, & McGee, 2012a) suggesting the depression subscale is not appropriate to use. The HADS-D is inaccurate when categorising the severity of depression symptoms (Cameron et al., 2011).
Major Depression Inventory; MDI (Bech, Rasmussen, Olsen, Noerholm, & Abildgaard, 2001)	When comparing the MDI with the BDI in current inpatients with depression or schizo-affective disorder, the MDI performed well and is sufficient to use as a measure of depression for psychiatric inpatients (Konstantinidis, Martiny, Bech, & Kasper, 2011). A good, brief self-report measure that is valid for use in psychiatric outpatients (Cuijpers, Dekker, Noteboom, Smits, & Peen, 2007).	The cut-off scores may be highly subjective (Forsell, 2005).

Measure	Advantage	Disadvantage
	Adequate internal and external validity when used in patients (Olsen, Jensen, Noerholm, Martiny, & Bech, 2003).	

Note. DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; HADS = Hospital Anxiety and Depression Scale.

Measuring anxiety in adults with ASD. Multiple measures of anxiety exist so the advantages and disadvantages of commonly used self-report measures were again carefully considered. Table 2.3 outlines the reasons for choosing the Generalised Anxiety Disorder-7; GAD-7 (Spitzer, Kroenke, Williams, & Lowe, 2006) as a measure of anxiety in Study One. The GAD-7 uses items directly derived from the diagnostic criteria of the DSM-IV and was originally developed as measures of anxiety were generally not being previously used in clinical practice. In summary, the GAD-7 was chosen because it reliably distinguishes symptoms of anxiety from symptoms of depression and because it is free and easy to administer (Spitzer et al., 2006).

The GAD-7 is a seven-item questionnaire designed to assess symptoms of anxiety over the last two weeks. Respondents are presented with four response categories: 'not at all'; 'several days'; 'more than half the days'; and 'nearly every day'. Responses for this scale are summated and can be classified into one of four categories: no anxiety; mild anxiety; moderate anxiety; and severe anxiety.

Table 2.3 also outlines the reasons for choosing the State Trait Anxiety Inventory; STAI (Spielberger, 1983) as a measure of anxiety in Study Three. As Study Three only considered anxiety (whereas Study One also considered depression, life satisfaction and well-being), the STAI was chosen as a more thorough measure in differentiating between state and trait anxiety.

The STAI is a 40-item questionnaire designed to assess present (state) feelings of anxiety and general (trait) feelings of anxiety. The state scale contains 20 items relating to present feelings and respondents are presented with four response categories: 'not at all'; 'somewhat'; 'moderately so'; and 'very much so'. This considers anxiety in the context of a given moment in time. The trait scale contains 20 items relating to general feelings and respondents are presented with four response categories: 'almost never'; 'sometimes'; 'often'; and 'almost always'. This considers individual differences in perception of stressful events. Responses for the state and trait scales are summated separately, with higher scores indicating higher levels of anxiety.

Table 2.3

Advantages and disadvantages of anxiety measures considered for inclusion in the present thesis.

Measure	Advantage	Disadvantage
Generalised Anxiety Disorder; GAD-7 (Spitzer et al., 2006)	Although generalised anxiety and depression symptoms often co-occur, factor analysis confirmed them as distinct dimensions in the GAD-7 (Spitzer et al., 2006). Acceptable in identifying generalised anxiety at cut-off scores 7-10 with evidence through a systematic review (Plummer, Manea, Trepel, & McMillan, 2016). Accurate for diagnosing generalised anxiety disorder (Swinson, 2006). A community or household sample of 5030 participants in Germany completed the GAD-7. Evidence supports the reliability and validity of the use of GAD-7 as a measure of anxiety in the general population (Lowe et al., 2008). Validity demonstrated across cultures including in Spain (Garcia-Campayo et al., 2010) and Malaysia (Sidik, Arroll, & Goodyear-Smith, 2012). The Dutch web-based version of the GAD-7 is reliable and valid (Donker, van Straten, Marks, & Cuijpers, 2011).	May be culturally biased as Black-African American participants with high generalised anxiety scored lower than other participants with similar symptoms (Parkerson, Thibodeau, Brandt, Zvolensky, & Asmundson, 2015).

Measure	Advantage	Disadvantage
	Strong correlations found between GAD-7 and other anxiety measures including the clinician-rated HAM-A (Hamilton, 1959), $r = 0.852$, $p < 0.001$ and between the GAD-7 and WHODAS 2.0 (Ustun et al., 2010), $r = 0.704$, $p < 0.001$ (Ruiz et al., 2011). Useful for screening for anxiety in clinical populations such as within addiction services (Delgadillo et al., 2012). Valid measure for anxiety in elderly populations (Wild et al., 2013).	
Beck Anxiety Inventory; BAI (Beck & Steer, 1990)	Intent is to purely measure anxiety independent of depression. The focus is on somatic symptoms as a way of distinguishing anxiety from depression (Beck, Epstein, Brown, & Steer, 1988). Identifies presence of anxiety indicators and has a limited usefulness in screening for social anxiety disorder (de Lima Osorio, Crippa, & Loureiro, 2011) suggesting the BAI can be used to distinguish anxiety from social anxiety.	Correlation ($r = 5.66$, $p < .01$) observed between the BAI and the BDI-II in psychiatric outpatients with various disorders. It is ambiguous whether these measures can distinguish between anxiety and depression (Beck, Steer, Ball, & Ranieri, 1996a). Due to the focus on somatic symptoms, the BAI may overlap with some medical conditions and scoring should be carefully interpreted. For instance, the BAI is not an appropriate measure for patients with insomnia due to overlapping symptoms (Carney, Moss, Harris, Edinger, & Krystal, 2011).

Measure	Advantage	Disadvantage
		The BAI is best used as a severity indicator for anxiety. It could not distinguish between anxiety and depression in a primary care population, as the BAI reflected severity of depression as well (Muntingh et al., 2011). Responsive to change over time in psychiatric populations, such as patients with panic disorder (Brown, Beck, Newman, Beck, & Tran, 1997; Leyfer, Ruberg, & Woodruff-Borden, 2006) but this implies the BAI is measuring panic rather than anxiety (Cox, Cohen, Direnfeld, & Swinson, 1996). Also responsive to change over time in medical populations, such as patients with psoriasis (Lee, Park, Kwon, Kim, & Kim, 2010). Does not include primary symptoms of anxiety, e.g. worry, so may be a limited measure of anxiety (Julian, 2011). Mainly focuses on cognitive and somatic aspects (two factors) whereas other studies show anxiety is constructed of multiple factors (Osman, Kopper, Barrios, Osman, & Wade, 1997). Limited construct validity of the HADS (Zigmond & Snaith, 1983) and the BAI in some clinical populations, such as those with Parkinson's Disease (Leentjens et al., 2011).

Measure	Advantage	Disadvantage
		The BAI may not be culturally sensitive e.g. it does not provide the best fit for African American or European American undergraduate students (Chapman, Williams, Mast, & Woodruff-Borden, 2009). The BAI may be useful as a self-report measure for anxiety in older adults but because of the emphasis on somatic symptoms, the discriminant validity may be lower in comparison to younger or healthier participants (Morin et al., 1999).
State Trait Anxiety Inventory; STAI (Spielberger, 1983)	Brief to administer and takes around ten minutes to complete, so good for general use. The STAI has been used widely as a measure of general anxiety and is available in many languages (Julian, 2011).	The STAI may be limited in separating anxiety from depression. The STAI trait scale correlates highly with depression, in comparison to other measures of anxiety (Kabacoff, Segal, Hersen, & Van Hasselt, 1997).
	Psychometric properties validated in 1036 adults. Adequate psychometric properties and is sensitive to changes in environment that might increase stress (Guillen-Riquelme & Buela-Casal, 2011). Useful measure for detecting mental health problems in older people (Kvaal, Ulstein, Nordhus, & Engedal, 2005).	The STAI does not clearly differentiate anxiety from depression. A mixture of self-reports and interviewer ratings would be preferable (Kennedy, Schwab, Morris, & Beldia, 2001). The STAI state scale is biased in elderly inpatients and a higher state score relates to reduced well-being rather than anxiety (Kvaal, Laake, & Engedal, 2001).

Measure	Advantage	Disadvantage
	Internal consistency was high and ranged from 0.86 for high school students to 0.95 for military recruits (Spielberger, 1983).	The STAI has poor validity in differentiating the STAI trait scale from depression. The STAI trait scale is designed to be a longstanding trait so clinicians may not be able to detect changes in this scale over a short period of time (Julian, 2011).
	Adequate psychometric properties (Ortuno-Sierra, Garcia-Velasco, Inchausti, Debbane, & Fonseca-Pedrero, 2016).	Test-retest coefficients were lower for the STAI state scale, compared to the STAI trait scale. However, this may be expected as the STAI state scale tends to detect more transient states (Spielberger, 1983). In some populations e.g. the elderly the STAI did not discriminate between individuals with and without anxiety disorders (Kabacoff et al., 1997).
Hospital Anxiety and Depression Scale-Anxiety; HADS-A (Zigmond & Snaith, 1983)	Brief and easy to administer (Julian, 2011).	Limited validity of the full HADS scale as it may over-diagnose anxiety in non-clinical populations. HADS not to be used as a diagnostic tool until norms and cut-offs can be established (Roberts, Fletcher, & Merrick, 2014).
	Can be recommended when working with patients with chronic obstructive pulmonary disease (Phan et al., 2016).	Target population is general medical outpatients. Provides evidence of generalised anxiety symptoms rather than specific anxiety disorders (Julian, 2011).

Measure	Advantage	Disadvantage
		Systematic review showing the HADS is consistently unable to differentiate between anxiety and depression (Cosco et al., 2012a) suggesting the anxiety subscale is not appropriate to use. Best used as a measure of general distress rather than measuring symptoms of anxiety and depression separately (Norton, Cosco, Doyle, Done, & Sacker, 2013).

Note. HADS = Hospital Anxiety and Depression Scale; HAM-A = Hamilton Anxiety Scale; WHODAS 2.0 = World Health Organisation Disability Assessment Schedule 2.0.

Measuring life satisfaction in adults with ASD. Fewer measures exist which capture overall satisfaction with life or mental well-being and there was a need to include these measures in the present thesis to try and capture a broader sense of the experiences of adults with ASD. The Satisfaction With Life Scale; SWLS (Diener, Emmons, Larsen, & Griffin, 1985) was identified as the most predominant measure used in research. It is focused on assessing global life satisfaction without tapping into related constructs such as positive affect or loneliness. As such, the SWLS was considered appropriate for adults with ASD in the present thesis. While arguably a subjective measure, the SWLS has been shown to be a valid and reliable measure of life satisfaction which is suitable for use across ages. It is also fast to administer and saves resources compared to other measures of life satisfaction (Pavot, Diener, Colvin, & Sandvik, 1991). The SWLS has good psychometric properties in assessing life satisfaction across a diverse range of groups including Iranian women who are infertile (Maroufizadeh, Ghaheri, Omani Samani, & Ezabadi, 2016), individuals with Parkinson's disease (Lucas-Carrasco, Den Oudsten, Eser, & Power, 2014; Rosengren, Jonasson, Brogardh, & Lexell, 2015), individuals with Multiple Sclerosis (Lucas-Carrasco, Sastre-Garriga, Galan, Den Oudsten, & Power, 2014), first-episode psychosis patients (Hochwalder, Mattsson, Holmqvist, Cullberg, & Rosenbaum, 2013) and caregivers of clinically-referred youths (Athay, 2012). It has also demonstrated good reliability and validity across different cultures including amongst outpatients in Malaysia (Aishvarya et al., 2014) and within a representative sample of the Spanish population (Vazquez, Duque, & Hervas, 2013). In summary, the SWLS was chosen because of its previous use across diverse samples and its efficiency and ease of use (Laranjeira, 2009).

The SWLS is a five-item questionnaire designed to assess current satisfaction with life. Respondents are presented with seven response categories: 'strongly disagree'; 'disagree'; 'slightly disagree'; 'neither agree nor disagree'; 'slightly agree'; 'agree' and 'strongly agree'. Responses for this scale are summated and can be classified into one of seven categories: extremely dissatisfied; dissatisfied; slightly dissatisfied; neutral; slightly satisfied; satisfied; and extremely satisfied.

Measuring mental well-being in adults with ASD. A measure of mental well-being was also included in the present thesis to try and capture a broader sense of mental health outside of only depression and anxiety. The Warwick-Edinburgh Mental Well-being Scale; WEMWBS (Tennant et al., 2007) was included as this was developed to measure mental well-being using only positively worded items. This was important as negatively phrased items have been associated with increased variance and error in other measures, such as in the General Health Questionnaire; GHQ-12 (Goldberg &

Williams, 1988) and could cause additional confusion for participants with ASD. The WEMWBS is a short and psychometrically robust scale with no ceiling effects in a population sample. Although it is a relatively new measure, its use is promising for monitoring mental well-being at a population level (Tennant et al., 2007). The WEMWBS has been shown to be valid and reliable across a range of populations including secondary care mental health service users (Bass, Dawkin, Muncer, Vigurs, & Bostock, 2016), Pakistani and Chinese communities (Taggart et al., 2013) and family carers of individuals with dementia (Orgeta, Lo Sterzo, & Orrell, 2013). It has also shown good psychometric properties in its Brazilian (Santos et al., 2015) and Spanish (Castellvi et al., 2014) versions.

The WEMWBS is a 14-item questionnaire designed to assess current levels of mental well-being. Respondents are presented with five response categories: 'none of the time'; 'rarely'; 'some of the time'; 'often'; and 'all of the time'. Responses for this scale are summated, with higher scores indicating higher levels of mental well-being. Although cut-off scores have not been developed on the WEMWBS, the scale has been validated in population data from Scotland and England. The United Kingdom population mean score is 51 (Tennant et al., 2007).

Ethical Issues

The main purpose of this section is to provide an overview of the importance of ethical considerations when conducting autism research. The research carried out in the present thesis was in accordance with the British Psychological Society Code of Ethics and Conduct (British Psychological Society, 2009). Ethical approval was granted from the Research Ethics Committee at the Department of Psychology and the Institute of Management Studies which are both based within Goldsmiths, University of London. However, some of the complexities around consent and IQ are now discussed.

Ethical considerations. Data were collected through online questionnaires for Study One, Study Two and Study Three in the present thesis, although some participants opted to complete a paper version. Consent was taken when participants confirmed they had read the consent page by clicking their agreement. This meant participants understood their contribution was voluntary, anonymous and they could leave the study at any time without giving a reason. Participants were given full researcher contact details at the beginning and end of the surveys, in case there were any questions relating to this. The information sheet and consent form were embedded in the online survey.

Study Two involved face-to-face meetings with participants where they were sent the online survey to complete in advance. For those who had difficulty with this, an 'autism friendly' version of the information sheet and consent form was made available, both of which were easily repeatable (see Appendix One and Appendix Two). A session timetable was also designed so participants could monitor their progress throughout the tasks and to reduce any uncertainty about the length of each task (see Appendix Three). Data were stored under a unique identification number to ensure information remained anonymous and that participants could not be identified from their data. Perhaps the most challenging part of the research was ensuring that participants with an IQ score of below 70 on the WASI were not included in Study Two. Only participants without ID were included as the WASI was administered first and then scored while participants took a break from the tasks. This was to ensure that only participants with a substantial understanding of the research took part in the study and that the findings were not influenced by level of general ability.

All participants were sent an overview of the research findings after all three studies were completed, if they wished to receive them.

Chapter One and Chapter Two have highlighted the importance of employment for adults with ASD and the complexities in assessing mental health and executive functions in adults with ASD. The following chapters will now turn towards the data collected in the present thesis.

Conclusions

Chapter Two highlighted various methodological issues which are important to consider when conducting research involving adults with ASD. These included how to assess ASD in participants; dealing with co-occurrences of ID and clinical disorders; matching participants; how decisions were made to include various measures which assessed executive functions and mental health in adults with ASD; and ethical challenges faced when planning and conducting the research. Chapter Three will present the first empirical study on the relationships between mental health and employment in adults with ASD in this thesis. This study aimed to assess whether being in employment positively affected mental health for adults with ASD, using the measures outlined in Chapter Two.

Chapter Three (Study One): Mental Health and Employment in Adults with Autism Spectrum Disorder (ASD)

Overview of Chapter Three

This chapter presents Study One which used an online survey to assess the relationships between mental health and employment in adults with autism spectrum disorder (ASD). Adults with ASD reported higher levels of anxiety, lower levels of well-being and lower levels of satisfaction with life compared to adults without ASD. The findings also revealed a significant interaction between group and employment status for anxiety. The effects of being employed were not the same for adults with ASD as for adults without ASD – levels of anxiety remained high for adults with ASD whether employed or unemployed. These mixed findings are discussed with reference to existing mental health research, workplace support for adults with ASD and the role of anxiety in autism.

Introduction

Autism spectrum disorder (ASD) has often been misdiagnosed as a mental health problem but it can bring its own mental health issues (Gould, 2009), with significant impact. However, estimates of the prevalence and type of mental health difficulties experienced by adults with ASD vary and the underlying reasons for why these individuals may be particularly at risk have been difficult to define. The following introduction will outline recent research concerning mental health in adults with ASD; potential reasons for discrepancies between studies; and the role of employment in the mental health of adults with ASD.

One of the largest and most recent studies looking at mental health in adults with ASD took place in the United States (US) using national data. Inpatient and outpatient records from the largest paid healthcare delivery system in the US were analysed and included 1507 adults with ASD and 15,070 adults without ASD matched on gender and age. In comparison to their non ASD peers, Croen et al. (2015) found that the adults with ASD had significantly increased rates of depression (25.8%), anxiety (29.1%), bipolar disorder (10.6%), obsessive compulsive disorder ([OCD] 7.6%), schizophrenia (7.8%) and suicide attempts (1.8%) although the extent to which these overlapped is unclear.

This study included individuals with intellectual disability (ID) and, despite the data emerging from clinical records, studies with sample sizes this large are fairly uncommon in ASD research. Thus this study highlights the range of mental health difficulties in this population as well as the broader extent of their impact. A more recent study in the United Kingdom (UK) that looked at retrospective case reviews of 859 adults referred for an ASD diagnosis compared 474 adults who met the criteria with 385 who did not meet the criteria. The authors did not include individuals with ID. The prevalence of anxiety was significantly higher in adults with ASD compared to adults without ASD and, when compared to general population data, increased rates of OCD (17.9%), depression (15.8%) and anxiety (39.2%) were observed (Russell et al., 2016). However, this pattern was also observed in the adults without ASD (i.e. the group who were referred for an ASD diagnosis but did not meet the criteria) when compared to general population data although the study does highlight the influence in anxiety in ASD.

Overlap is common among mental health difficulties and/or diagnoses and the extent to which mental health difficulties co-occur often varies between studies. Mazefsky et al. (2008) assessed 17 adults with ASD who completed a structured psychiatric interview. Of these adults, 35.3% and 76.5% reported a mood disorder and an anxiety disorder respectively. However, in a similar clinical sample, Charlot et al. (2008) matched 13 adults with ASD and ID with 40 adults without ASD with ID and found anxiety disorders were present in 62% of adults with ASD. A similar matching procedure was used by Gillott and Standen (2007) which revealed adults with ASD and ID were almost three times more anxious than the comparison group of adults without ASD with ID.

Taken together, these studies suggest a range of mental health difficulties within adults with ASD although the estimates vary between studies. This is likely for a variety of reasons including: the influence of associated ID; the use of measures; the type of reports; the role of stress; and further factors. Possible reasons for the varied outcomes of the studies outlined above and how these influenced the design of the present study are considered below.

i) The influence of associated ID. Croen et al. (2015) estimated 19.2% of adults with ASD in their sample had an associated ID. This has implications for carrying out research as well as consideration of the findings. The severity of ID has been associated with poor mental health (Underwood, McCarthy, & Tsakanikos, 2010) so mental health may be dependent on the extent to which an individual has an ID. However, the same authors showed social skills and adaptive behaviour skills were also associated with poor

mental health, so it is unclear which factors hold the most influence for adults with ASD. Mental health problems, such as depression can often be masked by impaired verbal or non-verbal communication skills (Stewart et al., 2006) and these are areas both adults with ASD and adults with ID may struggle with. Furthermore, not all studies including adults with ASD measure intellectual ability so the extent to which this influences findings is unknown.

ii) The use of measures. Estimates of mental health may differ between studies depending on which measures are used. There are no validated measures to assess depression (Stewart et al., 2006) or anxiety (White et al., 2012) within the ASD population.

iii) The type of reports. Differences may emerge in reported mental health depending on whether it is the individual with ASD responding or somebody else responding on their behalf. Moss et al. (2015) found 44% and 45% of adults with ASD experienced no mental health problems in adulthood when informant- and self-reports were used respectively. However, informant-reports estimated only 5% of adults with ASD had very severe problems but self-reports estimated 27% had very severe problems in adulthood. Just over a third of participants with ASD could report on their own mental health in that study. This also raises clear methodological issues when considering mental health in adults with ASD.

iv) The role of stress. Stress is correlated with high anxiety for adults with ASD, particularly the ability to cope with change or sensory stimuli (Gillott & Standen, 2007). The more anxious the individual with ASD, the more difficulty they would have coping with events like these. This places emphasis on the importance of considering an individual's current state of depression and anxiety when participating in research.

v) Further factors. Sampling techniques must also be examined when considering inconsistencies in rates of mental health problems as findings can vary depending on whether a clinical or community sample is used (Moss et al., 2015). There may also be differences depending on where the research took place. For instance, national healthcare systems are funded differently in the UK than in the US and this can affect who is referred for clinical support and, therefore, who takes part in the research study. Furthermore, research on adults with ASD has often been found to be of poor quality (Howlin & Taylor, 2015) with well-matched non-ASD groups missing. However, after only reviewing the studies with non-ASD comparison groups (as above), what is

clear is that research findings to date are consistent in the view that mental health in adults with ASD is an area of importance and is in need of careful consideration.

It is also worth examining factors that could improve the lives of adults with ASD. One recent study assessed the day-to-day lives of 43 adults with ASD without ID who were matched across age, gender and years of education with 44 healthy non-ASD participants. Adults with ASD reported significant functional impairments in participating in society, interacting with others, work, communication and understanding. They also reported less life satisfaction compared to non-ASD participants. The authors found these adults were no different from non-ASD participants in daily living skills, such as self-care but, importantly, that participating in society was the only factor identified in predicting life satisfaction for adults with ASD (Schmidt et al., 2015). The importance of social inclusion is particularly pertinent given many adults with ASD struggle with social interaction.

Further associations have been found between recreational activities and a higher quality of life in adults with ASD and ID (Billstedt, Gillberg, & Gillberg, 2011). Also, a five-year longitudinal study of adults with ASD showed greater levels of engagement and vocational independence were associated with fewer maladaptive behaviours and improvements in daily living activities (Taylor et al., 2014). The authors of this study suggested the work environment is important for adults with ASD, as support is necessary but it is also important the workplace is situated within the community. They further noted that many studies have considered the effects of employment or unemployment on adults without disabilities but not adults with ASD.

This raises the question of what the effects of employment are on adults with ASD, particularly considering the positive outcomes associated with vocational activity. Employment can provide financial independence, promote social inclusion as well as improve self-esteem (Nicholas et al., 2014) and it can positively contribute to social well-being (Roux et al., 2013) in adults with ASD. Employment is also seen as a priority area for research by adults with ASD and their families (Pellicano et al., 2013). Therefore, the research hypotheses for the current study were:

1. Adults with ASD will report higher levels of depression and anxiety, and lower levels of satisfaction with life and well-being compared to adults without ASD.

2. Employed adults with ASD will report higher levels of depression and anxiety, and lower levels of satisfaction with life and well-being compared to employed adults without ASD but lower levels of depression and anxiety, and higher levels of satisfaction with life and well-being compared to unemployed adults with ASD.

Method

Participants. Participants with ASD were recruited from an autism participant database previously held at Goldsmiths, University of London, the National Autistic Society (including Network Autism, Asperger United and regional autism social groups), Research Autism, Care Trade, AS Mentoring, Genius Within, Autism West Midlands, Auticon and Resources for Autism.

Participants without ASD were recruited from various websites including Twitter, Reddit, Facebook, Craigslist, LinkedIn, Gumtree and Call for Participants. Various universities also helped distribute the study including Birmingham City University, University of Bradford, University of Bristol, University of Cambridge, Goldsmiths, University of Kent, School of Oriental and African Studies, University of Edinburgh, University of Oxford, University of Portsmouth and University of Warwick.

A total of 517 adults (age 18 years and above) took part in the online survey. However, three (0.6%) were removed due to large amounts of missing data, seven (1.4%) for duplicating previously completed responses, four (0.8%) for failing to answer if they had an ASD diagnosis and one (0.2%) for being aged under 18 years. This left a total of 502 participants who were included in the study. Participant characteristics for the sample are shown in Table 3.1.

For participants in the ASD group, 70.2% met the autism referral criteria on the AQ-10 while only 6.1% of participants in the non-ASD group met these criteria. These participants were kept in the sample as the AQ-10 is a screening aid rather than a diagnostic tool and self-report scores do not necessarily predict receipt of an ASD diagnosis (Ashwood et al., 2016). No figures have been reported for the number of adults without ASD who meet the autism referral criteria so some caution must be exerted when interpreting the AQ-10 results (see Chapter Two for further discussion of methodological issues). However, participants with ASD (M = 7.36, SD = 2.08) scored significantly higher than the non-ASD group (M = 2.95, SD = 2.01) on the AQ-10, $t(500) = 23.75$, $p < .001$

and the group average score was above the clinical cut-off which would usually trigger a referral to autism diagnostic services.

Table 3.1

Participant characteristics of the full sample.

		ASD group (Σn = 205)		Non-ASD group (Σn = 297)	
		n	%	*n*	%
Gender	Male	101	49.3	125	42.1
	Female	95	46.3	170	57.2
	Other	8	3.9	2	0.7
	Missing	1	0.5	0	0.0
Ethnicities (self-defined)	White	187	91.2	239	80.5
	Black	5	2.4	17	5.7
	Mixed	9	4.4	9	3.1
	Asian	2	1.0	31	10.4
	Missing	2	1.0	1	0.3
Age (years)	Mean (*SD*; range)	205	36.8 (14.4.; 18-75)	297	34.3 (13.6; 18-72)
Age of ASD diagnosis (years)	Under 18	49	24.8	-	-
	18 or above	141	66.9		
	Missing	15	8.3		
Additional diagnoses (self-defined)*	Sch. spectrum disorders	4	1.4	0	0.0
	Bipolar and related disorders	4	1.4	2	0.7

		ASD group (Σn = 205)		Non-ASD group (Σn = 297)	
		n	%	*n*	%
	Depressive disorders	82	28.1	59	17.9
	Anxiety disorders	68	23.3	40	12.2
	Obs. compulsive disorders	8	2.7	5	1.5
	Trauma-related disorders	12	4.1	6	1.8
	Feeding and eating disorders	3	1.0	6	1.8
	Neurocognitive disorders	7	2.4	4	1.2
	Neurodevelopmental disorders	37	12.7	8	2.4
	None	61	20.9	192	58.4
	Missing	6	2.0	7	2.1
Employment status	Full-time employment	63	30.7	102	34.3
	Part-time employment	43	21.0	40	13.5
	Student/part-time work	10	4.9	32	10.8
	Student	17	8.3	43	14.5
	Retired	8	3.9	12	4.0
	Unemployed	64	31.2	68	22.9
Highest qualification	Left school before GCSEs	1	0.5	4	1.3
	GCSEs, O-Levels or equivalent	17	8.3	12	4.0
	Vocational qualifications	39	19.1	22	7.4

		ASD group (Σ*n* = 205)		Non-ASD group (Σ*n* = 297)	
		n	%	*n*	%
	A-Levels or equivalent	38	18.5	59	19.9
	Undergraduate degree	62	30.2	112	37.7
	Postgraduate degree	33	16.1	63	21.2
	Doctorate/PhD	10	4.9	25	8.5
	Missing	5	2.4	0	0.0
Length of employment in current job (months), if employed full- or part-time	Mean (*SD*; range)	90	115.38 (155.08; 1-624)	130	120.1 (142.3; 1-597)
	Missing	16		12	
Length of unemployment (months), if unemployed	Mean (*SD*; range)	60	73.22 (80.12; 1-324)	58	22.7 (43.3; 1-264)
	Missing	4		10	
Past or present employers ever received any ASD training?	Yes	31	15.1	27	9.1
	No	134	65.4	198	66.7
	Unsure	29	14.1	52	17.5
	Missing	11	5.4	20	6.7
Individual ever received any employment support?	Yes	43	21.0	14	4.7
	No	156	76.1	273	91.9
	Missing	6	2.9	10	3.4

Note. Obs. = obsessive; Sch. = schizophrenia.
*These additional diagnoses total more than the total number of participants as some participants reported more than one additional diagnoses. The categories are taken from the DSM-V (American Psychiatric Association, 2013).

Materials. Data were collected through an online survey accessed via Unipark. The survey contained open-ended and closed questions regarding background information and included a variety of other published measures which are shown in Table 3.2. These measures were carefully chosen to ensure questions were clear and to try and distinguish anxiety, depression, well-being and satisfaction with life as separate domains (see Chapter Two for a more detailed discussion around methodological issues). Permission was sought for the published measures to be used in an online survey and are listed in the 'Measures' column of Table 3.2.

Table 3.2

Details of materials used in the online survey.

Demographic information and diagnoses *(open-ended questions)*	Developmental history *(open-ended questions)*	Employment history *(open-ended questions)*	Measures *(closed questions)*
- Age	- Childhood speech, motor or social difficulties	- Highest level of qualification(s)	- Generalised Anxiety Disorder; GAD-7 (Spitzer et al., 2006)
- Gender	- Notable childhood illnesses	- Current occupation status	- Patient Health Questionnaire; PHQ-9 (Kroenke et al., 2001)
- Ethnicity	- Notable schooling problems	- Whether any past or present employers have received ASD awareness training	- Warwick-Edinburgh Mental Well-being Scale; WEMWBS (Tennant et al., 2007)
- Postcode		- Whether participant has ever received employment support training	- Satisfaction with Life Scale; SWLS (Diener et al., 1985)

Demographic information and diagnoses *(open-ended questions)*	Developmental history *(open-ended questions)*	Employment history *(open-ended questions)*	Measures *(closed questions)*
- ASD diagnosis (age received)		- Current duration of employment or unemployment	- Autism Spectrum Quotient-10; AQ-10 (Allison et al., 2012)
- Any other diagnosed physical, mental or neurological health disorders (age received)		- Details of any recent study, voluntary work or travel during period of unemployment	
- Family members diagnosed with physical, mental or neurological health disorders		- Whether would like to start any paid or voluntary employment in the following twelve months	
- Details of any prescribed medication		- Details of current or last main paid job	
		- Estimate of average annual household income	

Procedure. Ethical approval was granted from the Research Ethics Committee at the Department of Psychology, based within Goldsmiths. The online survey link could be accessed openly. This was distributed via email amongst potential participants and displayed on various websites assisting with the research study and listed in the 'Participants' section. The information sheet and consent form were embedded in the first page of the survey. Consent was taken when participants confirmed they had read the consent page by clicking their agreement. This meant participants understood their contribution was voluntary, anonymous and they could leave the study at any time without giving a reason. Participants were given full researcher contact details at the beginning and end of the survey. A paper version of the survey was also printed out and some participants (for instance, some individuals through Asperger United or the social

groups and some students through the Goldsmiths Research Participation Scheme) completed the survey in this format.

Data analysis. The effect of the two main independent variables (group and employment) on the four main dependent variables (anxiety, depression, well-being and satisfaction with life) are reported throughout.

All analyses used SPSS version 22. Data for the anxiety, depression, well-being and satisfaction with life scales were pro-rated to deal with any missing values. The dataset was not checked for outliers because they were likely to reflect the experiences of the clinical (ASD) group. Therefore, it was decided that all outliers would be kept in the analysis.

First, correlations were run between the AQ-10 and anxiety, depression, well-being and satisfaction with life measures.

Second, a multivariate analysis of variance (MANOVA) was performed to help protect against inflating the Type 1 error rate. However, prior to conducting the MANOVA, a series of Pearson correlations were performed between all of the dependent variables in order to test the MANOVA assumption that the dependent variables would be correlated within a moderate range of 0.2 to 0.9 (Field, 2009) and therefore ensure absence of multicollinearity. Table 3.3 shows a meaningful pattern of correlations which was observed amongst the dependent variables, suggesting MANOVA was appropriate to use (these are separate from the correlations mentioned in the paragraph above and are only reported in Table 3.3 to demonstrate that MANOVA was appropriate to use).

Table 3.3

Pearson correlations of anxiety, depression, well-being and satisfaction with life.

	Anxiety	Depression	Well-being	Satisfaction with life
Anxiety	1.00			
Depression	.81*	1.00		
Well-being	-.64*	-.72*	1.00	
Satisfaction with life	-.50*	-.57*	.68*	1.00

* $p < .001$

The anxiety ($p < .001$), depression ($p < .001$), well-being ($p < .050$) and satisfaction with life ($p < .001$) data were not normally distributed. This was not considered to be particularly concerning as ANOVAs are typically robust to violations of normality (Schmider, Ziegler, Danay, Beyer, & Buhner, 2010). Additionally, the Box's Test of Equality of Covariance Matrices value of 81.59 was associated with a *p* value of less than .001 but Box's Test has been criticised for being susceptible to deviations from multivariate normality (Field, 2009). To account for this sensitivity, Pillai's Trace was interpreted instead of Wilks' Lambda (Tabachnick & Fidell, 2013). In addition, the linear relationship between each pair of dependent variables across each level of the independent variables was checked using matrix scatterplots. These confirmed that all of the dependent variables were linearly related to each other.

The MANOVA was followed up with stepdown analysis (Roy & Bargmann, 1958) which allowed for a level of control over the correlations between the dependent variables. This required the dependent variables to be placed in the model, in order, based on hypothetical associations between the dependent variables and independent variables. Apart from the first analysis, each stepdown analysis included the preceding dependent variable as a covariate in the subsequent stepdown analysis. Anxiety was entered into the model first, depression second, well-being third and satisfaction with life fourth. The MANOVA was also repeated for a closely matched, subset sample.

Finally, the frequency of participant responses to the question '*If you are currently unemployed, would you like to start a paid or voluntary job in the next 12 months?'* are presented. These are from unemployed and part-time employed adults with and without ASD.

Results

Anxiety, depression, well-being and satisfaction with life scores of adults with and without ASD. Cut-off scores for the anxiety, depression, well-being and satisfaction with life measures are presented in Table 3.4, as well as the number of participants who fell within each sub-category. The cut-off scores are the published norms for each measure. For participants with ASD, 75.2% reported some level of anxiety compared to 46.8% of participants without ASD. Similarly, 81.0% of participants with ASD reported some level of depression compared to 51.8% of participants without ASD. Only 11.2% of participants with ASD reported at or above levels of well-being compared to 34.7% of participants without ASD. In addition, only 23.9% of participants

with ASD reported that they were satisfied with their life compared to 53.3% of participants without ASD.

Table 3.4

Cut-off scores for anxiety, depression, well-being and satisfaction with life by group.

			ASD group (Σn = 205)		Non-ASD group (Σn = 297)	
	Range	Cut-off	*n*	%	*n*	%
Anxiety	0-21					
No anxiety		0-4	51	24.8	158	53.2
Mild anxiety		5-9	58	28.3	82	27.6
Moderate anxiety		10-14	44	21.5	37	12.5
Severe anxiety		15+	52	25.4	20	6.7
Depression	0-27					
No depression		0-4	39	19.0	143	48.2
Mild depression		5-9	57	27.9	69	23.2
Moderate depression		10-14	46	22.4	38	12.8
Moderately severe depression		15-19	26	12.7	30	10.1
Severe depression		20+	37	18.0	17	5.7
Well-being	14-70	51 (mean)				
Below population mean		-	182	88.8	194	65.3
At or above population mean		-	23	11.2	103	34.7
Satisfaction with life	5-35					
Extremely dissatisfied		5-9	54	26.3	31	10.4
Dissatisfied		10-14	53	25.9	42	14.1
Slightly dissatisfied		15-19	38	18.5	46	15.5
Neutral		20	11	5.4	20	6.7
Slightly satisfied		21-25	23	11.2	55	18.5
Satisfied		26-30	19	9.3	78	26.3
Extremely satisfied		31-35	7	3.4	25	8.5

Associations between AQ-10 scores and anxiety, depression, well-being and satisfaction with life. There were significant correlations between AQ-10 scores

and anxiety (r_s = .19, p < .001) and AQ-10 scores and depression (r_s =.22, p < .001). The higher participants scored on the AQ-10, the more anxious and depressed they reported to be. There were also significant negative correlations between AQ-10 scores and well-being (r_s = -.30, p < .001) and AQ-10 scores and satisfaction with life (r_s = -.20, p < .001). The higher participants scored on the AQ-10, the lower their well-being and satisfaction with life. These findings are shown in Figure 3.1.

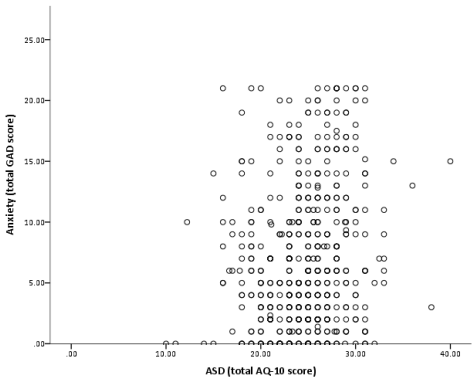

Figure 3.1a. Scatterplot showing AQ-10 correlated with anxiety (r_s = .19, p < .001)

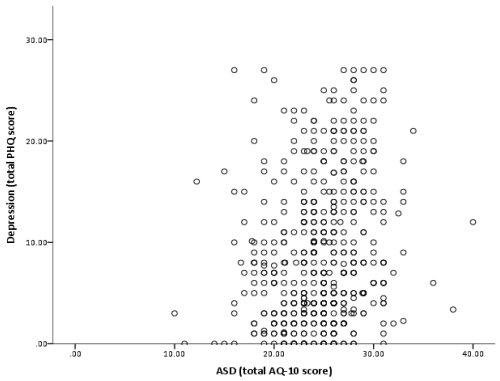

Figure 3.1b. Scatterplot showing AQ-10 correlated with depression (r_s = .22, p < .001)

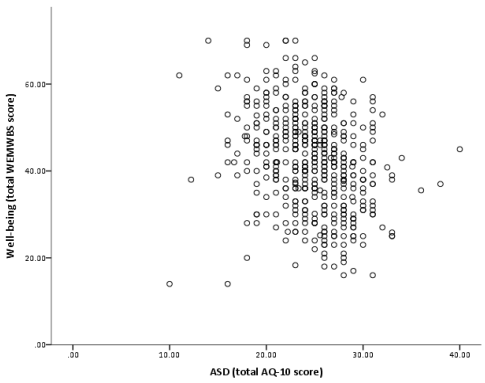

Figure 3.1c. Scatterplot showing AQ-10 correlated with well-being (r_s = -.30, p < .001)

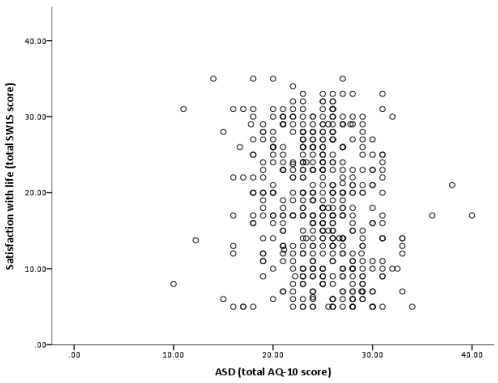

Figure 3.1d. Scatterplot showing AQ-10 correlated with satisfaction with life (r_s = -.20, p < .001)

Figure 3.1. Scatterplots showing Spearman's rank-order correlations of AQ-10 scores with anxiety, depression, well-being and satisfaction with life.

The effects of group and employment status on anxiety, depression, well-being and satisfaction with life. A two-way MANOVA was conducted that examined the effects of group and employment status on anxiety, depression, well-being and satisfaction with life. A significant interaction was revealed between the effects of group

and employment status on anxiety, depression, well-being and satisfaction with life V = .02, $F(4, 495) = 2.80$, $p = .025$ ($\eta p^2 = .02$)[2].

The MANOVA also revealed a significant main effect of group V = .16, $F(4, 495) = 23.07$, $p < .001$ ($\eta p^2 = .16$) and a significant main effect of employment status V = .07, $F(4, 495) = 8.67$, $p < .001$ ($\eta p^2 = .07$).

A subsequent step-down analysis revealed that the interaction between the effects of group and employment status was significant only for anxiety $F(1, 498) = 8.29$, $p = .004$ ($\eta p^2 = .89$). However, the effect of employment status was not the same for adults with ASD as for adults without ASD. The interaction graph (see Figure 3.2) showed that the expected effect of employment status on anxiety occurred only for adults without ASD. This effect was not seen for adults with ASD.

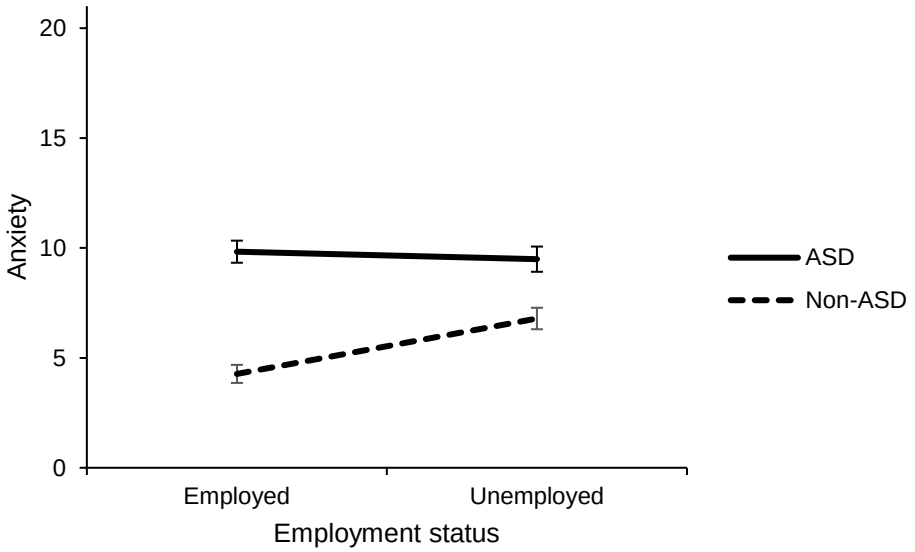

Figure 3.2. MANOVA results showing the mean anxiety scores reported by participants with and without ASD, and when employed and unemployed. Error bars represent standard error of the mean, with 95% confidence interval.

The step-down analysis also showed that adults with ASD reported higher levels of anxiety $F(1, 498) = 69.04$, $p < .001$ ($\eta p^2 = .12$), lower levels of well-being $F(1, 496) = 11.60$, $p = .001$ ($\eta p^2 = .92$) and lower levels of satisfaction with life $F(1, 495) = 8.46$, $p = .004$ ($\eta p^2 = .89$) than adults without ASD. Furthermore, the step-down analysis showed that employed adults reported lower levels of anxiety $F(1, 498) = 4.84$, $p = .028$, ($\eta p^2 =$

[2] A MANOVA was also run which included the AQ-10 as a covariate but there were no differences in the findings.

.01), lower levels of depression $F(1, 497) = 11.50$, $p = .001$ ($\eta p^2 = .03$), higher levels of well-being $F(1, 496) = 6.99$, $p = .008$ ($\eta p^2 = .04$) and higher levels of satisfaction with life $F(1, 495) = 10.61$, $p = .001$ ($\eta p^2 = .06$) than unemployed adults. The effect sizes reveal group had a larger impact than employment status.

Subset sample. In a subset sample, 176 participants with ASD were matched to 176 participants without ASD. Participants were closely matched across age, gender and occupation status. When matching across age, 100% of participants were matched within two years of their age. When matching across gender, male or female participants were matched exactly to either males or females. When matching across employment status, participants were matched exactly according to being: employed; unemployed; retired; a student only; or a student in part-time work. These categories were chosen a priori to ensure every participant who completed the survey could fall within one of these groups. These categories were later collapsed into 'employed' (including those in full-time employment; part-time employment; and students in part-time work) and 'unemployed' (including those unemployed; retired; and students only). Participant characteristics for the matched sample are shown in Table 3.5.

For participants in the ASD group, 71.0% met the autism referral criteria on the AQ-10 while only 6.8% of participants in the matched non-ASD group met the autism referral criteria. These participants were kept in the sample as the AQ-10 is a screening aid rather than a diagnostic tool and self-report scores do not necessarily predict receipt of an ASD diagnosis (Ashwood et al., 2016). No figures have been reported for the number of adults without ASD who meet the autism referral criteria so some caution must be exerted when interpreting the AQ-10 results (see Chapter Two for further discussion of methodological issues). However, participants with ASD ($M = 7.35$, $SD = 2.09$) scored significantly higher than the matched non-ASD group ($M = 2.97$, $SD = 2.02$) on the AQ-10, $t(350) = 19.99$, $p < .001$.

Table 3.5

Participant characteristics of the subset sample.

		ASD group (Σn = 176)		Matched non-ASD group (Σn = 176)	
		n	%	*n*	%
Gender	Male	93	52.8	93	52.8
	Female	83	47.2	83	47.2
Ethnicities (self-defined)	White	162	92.0	145	82.4
	Black	4	2.3	7	4.0
	Mixed	7	4.0	6	3.4
	Asian	1	0.6	18	10.2
	Missing	2	1.1	0	0.0
Age (years)	Mean (*SD*; range)	176	36.9 (14.5; 18-75)	176	36.9 (14.4; 18-72)
Age of ASD diagnosis	Under 18	48	27.2	-	-
(years)	18 or above	124	70.6		
	Missing	4	2.2		
Additional diagnoses	Sch. spectrum disorders	3	1.2	0	0.0
(self-defined)*	Bipolar and related disorders	5	2.0	2	1.0
	Depressive disorders	67	27.2	32	16.6
	Anxiety disorders	55	22.4	25	13.0

		ASD group (Σn = 176)		Matched non-ASD group (Σn = 176)	
		n	%	*n*	%
	Obs. compulsive disorders	7	2.8	5	2.6
	Trauma-related disorders	9	3.7	3	1.6
	Feeding and eating disorders	1	0.5	4	2.0
	Neurocognitive disorders	3	1.2	1	0.5
	Neurodevelopmental disorders	35	14.2	3	1.6
	None	57	23.2	114	59.1
	Missing	3	1.6	3	2.0
Employment status	Full-time employment	52	29.9	62	35.6
	Part-time employment	37	20.9	27	15.3
	Student/part-time work	9	5.1	9	5.1
	Student	14	7.9	14	7.9
	Retired	8	4.6	8	4.5
	Unemployed	56	31.6	56	31.6
Highest qualification	Left school before GCSEs	1	0.6	2	1.1
	GCSEs, O-Levels or equivalent	15	8.5	9	5.1
	Vocational qualifications	35	19.8	18	10.2
	A-Levels or equivalent	33	19.2	36	20.3

		ASD group (Σn = 176)		Matched non-ASD group (Σn = 176)	
		n	%	*n*	%
	Undergraduate degree	50	28.2	57	32.8
	Postgraduate degree	27	15.3	38	21.5
	Doctorate/PhD	10	5.6	16	9.0
	Missing	5	2.8	0	0.0
Length of employment in current job (months), if employed	Mean (*SD*; range)	74	105.5 (139.7; 1-564)	82	138.6 (156.0; 2-597)
	Missing	15		7	
Length of unemployment (months), if unemployed	Mean (*SD*; range)	52	66.4 (73.0; 1-324)	48	24.0 (46.9; 1-264)
	Missing	4		8	
Past or present employers ever received any ASD training?	Yes	29	16.4	18	10.2
	No	116	66.1	111	63.3
	Unsure	22	12.4	34	19.2
	Missing	9	5.1	13	7.3
Individual ever received any employment support?	Yes	41	23.2	11	6.2
	No	132	75.1	160	91.0
	Missing	3	1.7	5	2.8

Note. Obs. = obsessive; Sch. = schizophrenia.
*These additional diagnoses total more than the total number of participants as some participants reported more than one additional diagnoses. The categories are taken from the DSM-V (American Psychiatric Association, 2013).

Subset sample: results. A two-way MANOVA was conducted that examined the effects of group and employment status on anxiety, depression, well-being and satisfaction with life. A significant interaction was revealed between the effects of group and employment status on anxiety, depression, well-being and satisfaction with life V = .05, $F(4, 303) = 3.75$, $p = .005$ ($\eta p^2 = .05$)[3].

The MANOVA also revealed a significant main effect of group V = .15, $F(4, 303) = 12.98$, $p < .001$ ($\eta p^2 = .15$) and a significant main effect of employment status V = .09, $F(4, 303) = 7.64$, $p < .001$ ($\eta p^2 = .09$).

A subsequent step-down analysis revealed that the interaction between the effects of group and employment status was significant only for anxiety $F(1, 306) = 8.73$, $p = .003$ ($\eta p^2 = .90$). However, the effect of employment status was not the same for adults with ASD as for adults without ASD. The interaction graph (see Figure 3.3) showed that the expected effect of employment status on anxiety occurred only for adults without ASD. This effect was not seen for adults with ASD.

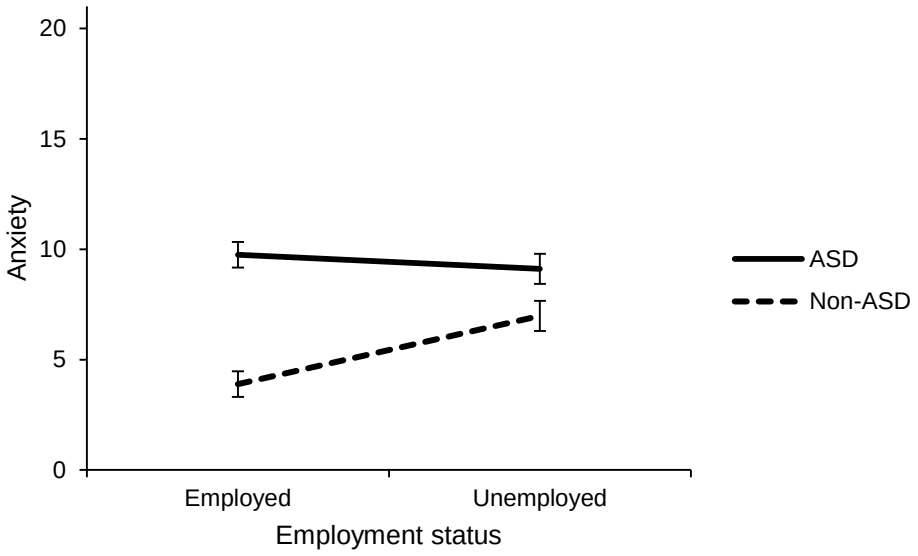

Figure 3.3. MANOVA results showing the mean anxiety scores reported by participants with and without ASD, and when employed and unemployed (matched subset sample). Error bars represent standard error of the mean, with 95% confidence interval.

The step-down analysis also showed that adults with ASD reported higher levels of anxiety $F(1, 306) = 40.08$, $p < .001$ ($\eta p^2 = .98$) and lower levels of well-being $F(1, 304)$

[3] A MANOVA was also run within the subset sample which included the AQ-10 as a covariate but there were no differences in the findings.

= 8.17, p = .005 (ηp^2 = .89) than adults without ASD. Furthermore, the step-down analysis showed that employed adults reported lower levels of depression F(1, 305) = 10.50, p = .001 (ηp^2 = .91), higher levels of well-being F(1, 304) = 4.81, p = .029 (ηp^2 = .83) and higher levels of satisfaction with life F(1, 303) = 10.61, p = .001 (ηp^2 = .91) than unemployed adults.

Differences in results between the two samples. The results of the two samples differed in two ways. First, in the full sample, adults with ASD reported lower levels of satisfaction with life after controlling for anxiety, depression and well-being F(1, 495) = 8.46, p = .004 (ηp^2 = .89). However, this finding was not significant (p = .132) in the subset sample. Second, in the full sample, employed adults reported lower levels of anxiety, F(1, 498) = 4.84, p = .028, (ηp^2 = .01). However, this finding was not significant (p = .054) in the subset sample.

Frequency of responses from unemployed or part-time employed participants. The following section includes the frequencies of responses to the open-ended question '*If you are currently unemployed, would you like to start a paid or voluntary job in the next 12 months?'* Only responses from unemployed participants or part-time employed participants are presented from the full sample.

Results. In total, 262 participants (52.2% of the total sample) responded to the question '*If you are currently unemployed, would you like to start a paid or voluntary job in the next 12 months?'* Only responses from unemployed or part-time employed participants are presented i.e. responses from 156 participants (31.1% of the total sample). The frequency of participant responses from unemployed and part-time employed adults with and without ASD are presented in Table 3.6.

Table 3.6

Frequencies of participant responses to the question 'If you are currently unemployed, would you like to start a paid or voluntary job in the next 12 months?'

Group	Unemployed											Part-time employed									
	Yes		Unsure		No		N/A		Total		Missing	Yes		Unsure		No		N/A		Total		Missing
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*
ASD	43	33.6	10	7.8	6	4.7	3	2.3	62	48.4	2	12	42.9	1	3.6	0	0.0	5	17.9	18	64.3	25
Non-ASD	55	43.0	7	5.5	4	3.1	0	0.0	66	51.6	2	3	10.7	0	0.0	1	3.6	6	21.4	10	35.7	26
Total	98	76.6	17	13.3	10	7.8	3	2.3	128	100	4	15	53.6	1	3.6	1	3.6	11	39.2	28	100	51

Of those who responded, only 33.6% of unemployed adults with ASD expressed a desire to begin a job in the following year compared to 42.9% of unemployed adults without ASD. For part-time employed participants, far more 'Yes' responses were observed in adults with ASD (42.9%) than adults without ASD (10.7%) when expressing a desire to begin a new job in the next twelve months.

Discussion

The present study investigated employment and mental health in adults with ASD. The findings revealed higher levels of anxiety, lower levels of well-being and lower levels of satisfaction with life in adults with ASD compared to adults without ASD. The findings also revealed a significant interaction between group and employment status for anxiety. The effects of being employed were not the same for adults with ASD as for adults without ASD – levels of anxiety remained high for adults with ASD whether employed or unemployed.

The findings in this chapter confirm some of the research hypotheses initially stated. The first research hypothesis predicted adults with ASD would report higher levels of depression and anxiety, and lower levels of satisfaction with life and well-being compared to adults without ASD. This was partially confirmed. Adults with ASD did report higher levels of anxiety, and lower levels of well-being and satisfaction with life in the full sample. Levels of depression were not significantly higher but this may have been due to the high shared variance between anxiety and depression in the present study. It is also worth noting the large effect size for anxiety ($\eta p^2 = .89$) placing emphasis on the role of anxiety in ASD. The second research hypothesis predicted employed adults with ASD would report higher levels of depression and anxiety, and lower levels of satisfaction with life and well-being compared to employed adults without ASD. It also predicted employed adults with ASD would report lower levels of depression and anxiety, and higher levels of satisfaction with life and well-being compared to unemployed adults with ASD. This was partially confirmed as there was a significant interaction between group and employment status but only for anxiety. Finally, the frequency of responses from unemployed participants revealed fewer unemployed adults with ASD wished to begin a job in the following year, compared to adults without ASD. However, for those adults with ASD who were employed part-time, greater numbers wished to work full-time compared to adults without ASD. Taken together, the findings suggest that employment has different effects on adults with ASD than on adults without ASD and suggests a more

complex relationship between employment and mental health in this group. The findings also highlight the role of anxiety for adults with ASD.

Key finding 1: Adults with ASD report poorer mental health, well-being and life satisfaction than adults without ASD.

> *In other words: Autistic adults may be at higher risk of anxiety than neurotypical adults. Autistic adults also report less life satisfaction and lower well-being.*

In the present study, adults with ASD were almost twice as likely to report moderate to severe levels of depression compared to adults without ASD. This was further pronounced for anxiety, as adults with ASD were two to three times more likely to report moderate to severe levels of anxiety compared to adults without ASD. These findings are consistent with more recent research showing the prevalence of anxiety disorders is significantly higher in adults with ASD compared to adults without ASD (Gillott & Standen, 2007; Russell et al., 2016; Schmidt et al., 2015). This is further reflected in a recent online survey of 255 adults with ASD which found ¾ of the sample reporting symptoms of depression and anxiety (Gotham et al., 2013). Adults with ASD have also reported significantly higher levels of perceived stress and a poorer ability to cope with everyday life stresses (Hirvikoski & Blomqvist, 2015). Overall then, adults with ASD experience a significant and broad range of mental health difficulties and the findings from the present study are consistent with this. This could help explain why there were so few differences in reported mental health for adults with ASD dependent on employment status.

The higher levels of anxiety and lower satisfaction with life and well-being in adults with ASD in the present study is worthy of further exploration. One possible explanation is suggested by Maisel et al. (2016) in a study where 151 adults (76 with ASD and 75 in a matched comparison group) completed questionnaires. The authors found that autism traits predicted less emotional acceptance and increased alexithymia and intolerance of uncertainty. They concluded that adults with ASD report more anxiety because they are more likely to react adversely to emotional experiences while struggling to identify and understand their emotions. Indeed, more than half of the sample in Berthoz, Lalanne, Crane, and Hill (2013) was categorised as alexithymic and the total ASD sample reported significantly higher levels of social and physical anhedonia when compared to their peers. However, the possibility remains that many adults with ASD

may experience anxiety differently (Hare, Gracey, & Wood, 2015) and this may be linked to sensory sensitivity or restrictive and repetitive behaviours (RRBs) in ASD.

The findings from Study One revealed high levels of anxiety in adults with ASD, whether employed or unemployed. This is particularly interesting considering the same relationship was not observed in a comparison group of adults without ASD. However, it is unclear what underlying factors could be related to this anxiety and raises the question of whether anxiety itself is an inherent part of ASD. Rich qualitative data from focus groups run with parents of children and adolescents (aged 7-18 years) with ASD and anxiety show the impact of anxiety is often greater than the impact of ASD (Ozsivadjian, Knott, & Magiati, 2012). These parents reported their children often had difficulties reporting their anxiety verbally and anxieties were more commonly expressed through changes in behaviour. Anxiety was triggered by change or disruptions to routine, sensory sensitivities and social difficulties. For instance, one mother spoke about her husband's anger when he found out she had shown their son all of their son's Christmas presents before wrapping them up, as this was one way in which the change and sensory sensitivities could be managed for their son on Christmas day.

Sensitivity to sensory stimuli is now part of the DSM-V criteria and is thought to contribute to anxiety for adults with ASD. This may be, in part, due to an intolerance of uncertainty associated with some anxiety disorders and adults with ASD being less able to tolerate uncertainty (South & Rodgers, 2017). Intolerance of uncertainty could be a critical mediator for anxiety in ASD, particularly as there is often little control over environmental sensory input. However, sensory sensitivity may also contribute to anxiety in adults with ASD due to deficits in multisensory integration within these individuals (Baum, Stevenson, & Wallace, 2015). Little is known about the sensory experiences of adults with ASD despite one study showing 94.4% of the ASD sample reporting extreme levels of sensory processing (Crane, Goddard, & Pring, 2009), although with large within-group differences. However, this does highlight the lifelong nature of unusual sensory processing in adults with ASD and the need for future research into its relationship with anxiety for these individuals.

RRBs or interests are also a key diagnostic factor in ASD. The relationship between anxiety and RRBs has been explored in a number of studies. Significant associations have been found between insistence on sameness (such as routines, rituals, dislike of change and hoarding) and anxiety in children and adolescents (aged 2-17 years) with ASD (Lidstone et al., 2014) from parent-reports. Interestingly, in that study, repetitive sensory and motor behaviours were not associated with anxiety but the relation

between insistence on sameness and anxiety was mediated by sensory avoiding and sensory sensitivity. The authors noted that RRBs can be seen as a marker of anxiety. This insistence on sameness could therefore exist so that sensory input can be narrowed or filtered. The association found between anxiety and rigidity suggests anxiety may indirectly be a core diagnostic feature of ASD because of its relationship with RRBs. However, insistence on sameness could also be a reaction to anxiety or co-occur alongside anxiety for individuals with ASD.

Further support for anxiety indirectly being a core diagnostic feature of ASD has also been suggested. Stratis and Lecavalier (2013) used parent-reports to show RRBs predicted anxiety, depression and oppositional defiant disorder in children (aged 5-17 years) with ASD. However, restricted interests negatively predicted depression suggesting restricted interests may help protect against symptoms of depression. This also provides support for anxiety inherently being part of ASD although the authors stated Type 1 errors were not corrected in that study, due to small sample sizes.

However, the findings from some studies dispute the suggestion that anxiety could indirectly be a core diagnostic feature of ASD. Hartley and Sikora (2009) used the parent-reports of children (aged 6-15 years) referred to an ASD clinic. These included 55 children with ASD, 27 with attention deficit hyperactivity disorder (ADHD) and 23 with anxiety disorder. They found the DSM-IV criteria within communication and social relatedness could distinguish the ASD group from the ADHD and anxiety disorder groups but criteria within the domain of RRBs could not. However, the new DSM-V criteria includes sensory sensitivity and, if insistence on sameness and anxiety is mediated by sensory sensitivity as Lidstone et al. (2014) suggest, then the findings from Hartley and Sikora (2009) may not be relevant to the current diagnostic criteria. Despite this, if RRBs are seen across more than one neurodevelopmental disorder then they cannot be a unique feature of ASD and anxiety may, therefore, not indirectly be a core diagnostic feature of ASD alone.

Indeed, individuals with eating disorders may exhibit RRBs before their diagnosis and these RRBs may persist even after the eating disorder is treated. Different terminology is used across different diagnoses but behavioural rigidity in ASD could be an insistence on sameness, in anorexia could be concerns for symmetry or low novelty-seeking and in obsessive compulsive personality disorder could be preoccupation with details or stubbornness (Zucker & Losh, 2008). It would be interesting for future research to see if sensory sensitivity is problematic for individuals who display RRBs but who do

not have ASD, in order to uncover if the relationship between sensory sensitivity, RRBs and anxiety is unique to individuals with ASD.

Two possible explanations do arise when considering if anxiety is indirectly a core diagnostic feature of ASD. The first explanation is that there may be a sub-group of individuals with ASD who display both high levels of RRBs and sensory sensitivity. Gabriels et al. (2008) used informant-reports of 70 children and adolescents with ASD (aged 3-19 years) to show there was a sub-group of individuals with ASD who displayed high rates of RRBs and sensory processing (and RRBs and sensory sensitivity significantly correlated) in their sample. This sub-group also had high co-occurring psychiatric diagnoses and psychoactive medications which could further support the findings of Zucker and Losh (2008) – that RRBs may not be unique to ASD alone.

The second explanation is that different findings may emerge depending on whether self- or informant-reports are used. One study which used self- and parent-evaluations of the development of adolescents and young adults with ASD (aged 14-24 years) from their pre-school years to their middle teens found no significant differences in reported anxiety between the parents and the children but significant differences on the self- and parent-evaluations of RRBs. Parents reported significantly more problems than their children (Dewrang & Sandberg, 2011). This could suggest the children were not aware they had previously displayed RRBs and, therefore, may be impaired in providing self-reports. However, it also raises the question of whether the children were experiencing distress at the time they were displaying RRBs.

A more effective way to investigate this into adulthood may be to look at how RRBs change over time. Chowdhury, Benson, and Hillier (2010) used informant-reports from 33 mothers and one father of 34 individuals with ASD (at their present age and at age 4-5 years). Significant changes in RRBs over time were found with the highest proportion (75%) of individuals with ASD showing improvements in compulsive behaviours and the lowest (44%) of individuals with ASD showing improvements in restricted behaviours. However, the oldest individual with ASD was only 28 years old and the sample was recruited from the community. Also, considering parents of children with ASD might be reporting more RRBs than the individuals with ASD means it is unclear whether RRBs change over time or whether it is the perception of RRBs that changes.

These differences in self- and informant-reports raise the possibility that ASD involves a deficit of the psychological self but not the physical self. Individuals with ASD

may be impaired at recognising their own mental state, as well as the mental states of others (Williams, 2010). The self in ASD has previously been considered in the important context of memory. Crane, Goddard, and Pring (2010) found adults with ASD could distinguish between self-defining and everyday memories but produced fewer specific memories overall than adults with ASD. Also, adults with ASD took less meaning from their memories which means there may be a difficulty in using past experiences to update the self. In other words, the self-memory relationship might be static, rather than dynamic, in adults with ASD. This could mean the most accurate way to assess anxiety in adults with ASD would be through a mixture of self- and informant-reports, as well as independent behavioural observations, which were unfortunately outside the scope of the present study.

The presence of co-occurring disorders could further explain the higher levels of mental health problems and lower satisfaction with life and well-being in adults with ASD in the present study. A study using national data from the largest paid healthcare delivery system in the US revealed adults with ASD had significantly increased rates of depression and anxiety compared to participants without ASD matched on age and gender (Croen et al., 2015). Co-occurring disorders can often overshadow autism traits and can sometimes become the primary difficulty – so adults with ASD who have a high intelligence quotient (IQ) and good practical skills cannot seek employment because of anxiety (Farley et al., 2009). This could help further explain why employment status had little effect for adults with ASD but a greater effect for adults without ASD in the present study. Future studies could exclude participants with certain co-occurring mental health or neurodevelopmental disorders in order to gain a more accurate perspective of the influence of autism itself. A third group (comprising those with additional co-occurring disorders) could also be included as a comparison. However, it is unclear how relevant or generalisable the findings would be, given the extent of co-occurring disorders in many adults with ASD.

Key finding 2: Levels of anxiety remain high for adults with ASD, whether employed or unemployed. However, for adults without ASD, levels of anxiety were lower for those employed rather than unemployed.

> *<u>In other words:</u> Employed autistic adults may be more anxious than their neurotypical co-workers. But little funding is allocated to autism and employment services so these adults may not be getting the workplace support they need.*

The present study showed levels of anxiety remained high for adults with ASD, whether employed or unemployed. These findings may not be surprising considering the poorer mental health reported by the ASD group overall. However, as employment is considered a priority research area by autistic adults and parents (Pellicano et al., 2013), these findings must be explored further.

Difficulties in gaining and retaining fulfilling employment have been reported previously in adult ASD research. High levels of unemployment are seen amongst adults with ASD who have good educational backgrounds but who also have high levels of associated depression (Riedel et al., 2015). One study, where 75% of adults with ASD reported co-occurring depression and anxiety, showed most adults with ASD found it too difficult to hold down a job with half of the sample reporting workplace discrimination (Gotham et al., 2015). The extent of mental illness can influence the employment outcome (Hendricks, 2010) but adults with ASD may be at additional risk. There may be functional impairments involving social interaction with others, poor communication and sensory issues which can make employment a struggle (Griffith, Totsika, Nash, & Hastings, 2012; Hurlbutt & Chalmers, 2004; Schmidt et al., 2015). This can often result in unstable employment, a chequered employment history and few opportunities to work (Lawer et al., 2009). The workplace environment may be related to the mental health of employees with ASD and workplace characteristics are further explored in Chapter Five in the present thesis.

However, the present study suggests mental health difficulties continue into employment which means the type of employment must be examined further. Supported employment (meaning individualised job placements, support in applying for work instead of facing interview or assessments and support in the workplace) has been shown to improve the economy and increase social networks and well-being for adults with ASD (Mavranezouli et al., 2014). Adults with ASD have also showed improved quality of life after a period of supported employment (Garcia-Villamisar et al., 2002). However, the present study shows the vast majority of adults with ASD (76.1%) have never received any kind of employment support. This is perhaps unsurprising considering only 5% of UK research funding from 2007-2011 went towards services for autistic adults and their families (Pellicano et al., 2013). Therefore, the lack of funding towards supported employment services for adults with ASD may have consequences for the economy (Knapp et al., 2009) as well as the mental health and well-being of adults with ASD.

Levels of anxiety were higher for unemployed adults without ASD than for employed adults with ASD but this pattern was not seen in the ASD group. However, little is known about the day-to-day activities of adults with ASD who are not working. Taylor and Hodapp (2012) collected data from 796 siblings of adults with ID and developmental disabilities. They found almost 13% of adults with ID and developmental disability had no daytime activities at all and these adults had more emotional-behavioural and health problems. Although that study did not focus solely on ASD, the findings are striking considering individuals with ASD without ID are three times more likely to have no daytime activities than those with ASD and ID (Taylor & Seltzer, 2011). Greater levels of engagement and vocational independence have been associated with reduced maladaptive behaviours in adults with ASD (Taylor et al., 2014) which provides further general support for positive vocational outcomes (Nicholas et al., 2014) but does not explicitly link vocational activity (or employment) with mental health outcomes. This raises the question of whether the unemployed adults with ASD in the current study were engaging in any meaningful vocational activity at all and this is worthy of further exploration in future research.

The measures which were used in the present study must also be discussed. The questions asked by Diener et al. (1985) in the 'Satisfaction With Life Scale' relate to how close the respondent's life is to their ideal and how good the conditions of their life are. The questions do not directly relate to mental health so a change in life satisfaction can be estimated with little influence from mood. Similarly, the 'Warwick-Edinburgh Mental Well-being Scale' includes some questions related to social contact with other people and is not designed to tap into symptoms of depression and anxiety (Tennant et al., 2007). Although there were no significant differences in anxiety whether employed or not, anecdotal reports from the families and support workers of participants in Study Two (Chapter Four in the present thesis) suggest otherwise. This was observed in a previous study where no improvement in self-esteem post-employment was seen but anecdotal reports from friends and family suggested otherwise (Mawhood & Howlin, 1999). This raises further methodological questions around the measures used in ASD research (see the methodological issues discussed in Chapter Two for further details). It also questions whether the already heightened levels of anxiety in the ASD group as a whole masked any effects of employment, similar to the way that existing mental health problems may mask an autism spectrum disorder in some cases (Gould, 2009).

The present study also considered the responses of unemployed and part-time employed adults with ASD. This revealed fewer unemployed adults with ASD wished to begin a job in the following year, compared to adults without ASD. However, for those

adults with ASD who were employed part-time, greater numbers wished to work full-time compared to adults without ASD. The frequency of these responses were exploratory in nature, since the study did not set out to include a qualitative focus, and future studies would benefit from using a more thorough qualitative approach to reveal more about reasons for unemployment or part-time employment in adults with ASD.

However, higher levels of part-time employment and lower salaries have been observed in adults with ASD (Cimera & Cowan, 2009; Taylor & Seltzer, 2011) when compared to the general population, although the reasons for this remain unclear. A recent study involving 73 adults with ASD without ID looked at post-secondary education and employment outcomes over a period of twelve years. The authors found 16.4% of adults with ASD were consistently engaged in post-secondary education or employment opportunities for over ten hours per week and only 9.6% for over 30 hours per week (Taylor et al., 2015). Previous studies have also noted the high incidence of part-time employment and lower levels of earnings in adults with ASD compared to the general population. This is pertinent given an increase in the number of adults with ASD accessing vocational rehabilitation services over the last ten years but without any increase in employment levels (Burgess & Cimera, 2014). A recent systematic review revealed adults with ASD may have low expectations about employment outcomes and this may be a contributing factor to high levels of part-time employment. The authors also found education level was positively associated with social adjustment but not necessarily for job level (Holwerda, van der Klink, Groothoff, & Brouwer, 2012). The study further confirmed that many adults with ASD work in low-paid, unskilled and part-time jobs. Taken together, the low expectation around employment suggests adults with ASD may have concerns about accessing autism-specific support in the workplace.

A recent randomised controlled trial compared Project SEARCH plus ASD Supports with a control group. Project SEARCH is a US internship model which aims to place young adults with developmental disabilities in work placements embedded within a community business, such as a hospital, government department or bank. The authors found the number of hours worked per week rose significantly over time from the start of the project (M = 15.24, SD = 9.32) to the twelve month follow-up (M = 19.90, SD = 9.00) for those who received intensive autism-specific job support compared to those who continued to job-seek through their usual post-schooling route (Wehman et al., 2016). Although the reasons for the number of part-time hours increasing for adults with ASD throughout this trial are not explored, it is nonetheless a promising outcome considering 87% of the treatment group had maintained their employment at the twelve month follow-up. The authors also noted that commitment from management was critical to job

retention as managers in the trial were very open to the idea of employing adults with autism. This supports the idea that adults with ASD are willing and able to work full-time and demonstrates a positive outcome in a supportive workplace environment. The workplace environment and support from management may be a crucial factor in employment success for an adult with ASD.

Some researchers have argued for a need to use qualitative data to explore employment problems and achieve social inclusion in the workplace for adults with ASD (Vogeley et al., 2013). Also, what is defined as a 'successful' outcome in adulthood may well vary between studies and measures. In this sense, it may be more useful to look at a subjective person-environment fit and assess how well this fit is, rather than relying on measures (Henninger & Taylor, 2013). Despite the careful choice of quantitative measures used in this study, it may be more useful for future studies to approach the assessment of a person-environment fit from a qualitative perspective. Previous research has shown individuals with ASD may have low expectations about employment outcomes and a person-environment fit needs to be taken into account in assessing employment outcomes (Holwerda et al., 2012). This is further supported by qualitative research suggesting previous bad workplace experiences have stopped some adults with ASD from seeking employment (Griffith et al., 2012).

Limitations. While addressing a number of issues in previous research, the present study has a number of its own limitations which must be addressed. First, an online survey was used to reach the maximum amount of people in the most convenient way but using an online survey to collect data may have restricted the study to only the most computer literate. Furthermore, corroboration of diagnosis is uncertain/impossible in an online survey. While this has to be taken on trust, a number of approaches were taken to be as certain as possible that respondents indicating they had an ASD had indeed received a diagnosis. For instance, the AQ-10 was included as a measure of autism traits and there were significant differences between the ASD and non-ASD groups. The ASD group scored two to three times higher on autism traits compared to the non-ASD group and this met the clinical cut-off which would usually trigger a referral to autism diagnostic services. The study was also advertised on websites specific to autism services or research (such as Asperger United) and then later advertised on more general websites to recruit the non-ASD group. Also, many participants were contacted through an autism participant database previously held at Goldsmiths. Therefore, the ASD diagnosis was likely to have been the case, meaning the ASD sample were as likely as could probably be in a survey to have actually had ASD.

In addition, the AQ-10 was chosen for its efficiency and ease in administering to larger numbers of participants which is not always possible with other measures. For instance, the Social Responsiveness Scale; SRS (Constantino et al., 2003) is an alternative measure of autism traits but this is completed by parents or teachers, rather than by the participants themselves. The SRS has also primarily been designed for use in children although preliminary findings from German (Bölte, 2012) and Japanese (Takei et al., 2014) populations suggest it may be suitable for use in adults. However, the most recent research findings suggest the SRS is unable to distinguish between adults with ASD and adults with high anxiety (South & Rodgers, 2017). Although this further raises the possibility of anxiety being integral to autism, not all highly anxious adults are autistic. The present study aimed to capture a measure of anxiety separately from a measure of autism.

Other measures, such as the Pervasive Developmental Disorder Behaviour Inventory; PDDBI (Cohen, Schmidt-Lackner, Romanczyk, & Sudhalter, 2003) or the Autism Diagnostic Interview-Revised; ADI-R (Lord et al., 1994) are also based on informant-reports, designed for children or generally not suitable for online use. However, despite the fact that the AQ-10 is based on self-reports, designed for adults and suitable for online use does not mean it is without its limitations.

Perhaps the most pertinent question regarding the AQ-10 is whether it is really measuring autism traits. Murray et al. (2016) suggest caution be exercised when interpreting responses to individual items. For instance, question two: 'I usually concentrate more on the whole picture, rather than the small details' does not seem to refer to either domain of the DSM-V diagnostic criteria but could refer more to central coherence theory (Frith, 1989). Likewise, question four: 'If there is an interruption, I can switch back to what I was doing very quickly' could refer more to executive functioning than the DSM-V diagnostic criteria.

In addition, the AQ-10 does not measure the coping strategies that many adults with ASD may have gained throughout their lives which would change their responses on this measure. For instance, one coping strategy might be to respond to online measures in a certain way – answering the questions in a way which is known to please or displease the researcher. Also, many autistic adults take part in so many research studies that they may be overfamiliar with the AQ-10 and learn how to answer the questions, knowing what the cut-off score is and what the questions are referring to. However, overall, ASD must be remembered as a spectrum. In other words, there are huge variations between individuals (autistic traits vary between different individuals with

ASD) and within individuals (autistic traits vary within one person with ASD depending on the environment or context). Therefore, it remains questionable whether one measure can ever successfully quantify or confirm the presence of autism. The focus for this study was to collect as many data points as possible through an online questionnaire, and using the AQ-10 was considered the most efficient and reliable way possible.

Second, the study used self-reports, rather than informant-reports, to collect the maximum amount of data but there are inconsistencies between self- and informant-reports in ASD research (Moss et al., 2015). The use of informant-reports in future studies could lead to greater data reliability and a different perspective on responses. However, due to a lack of reliability between self- and informant-reports, and that previous research has shown adults with ASD are able to use self-report measures (Berthoz & Hill, 2005), it was considered appropriate to use self-reports for the purpose of the present study (see Chapter Two for a more detailed discussion around methodological issues).

Third, it is also worth noting the vast majority of the sample identified as White ethnicities, so it is unclear how much the findings can be generalised to the wider population. For instance, the measure of anxiety used in the present study has been shown to be culturally biased in Black-African American participants (Parkerson et al., 2015) and this could affect the generalisability of the findings. The lack of generalisability of findings has been identified in other studies with ASD research being concentrated in high-income countries (Khan et al., 2012).

Finally, while using an online quantitative survey means that a larger sample could be obtained, it must be remembered that the complexities of autism and employment experiences are more difficult to encapsulate. For example, while the present study could investigate mental health and employment in adults with ASD, it could not assess how well each employed person was matched to their job or how well the person-environment fit could be. However, the present study has revealed some important findings about the employment experiences of adults with ASD through assessing mental health, well-being and satisfaction with life which are worth following up within future research.

Conclusions

Chapter Three investigated the relationships between mental health and employment in adults with ASD using an online survey. The findings revealed

higher levels of anxiety, lower levels of well-being and lower levels of satisfaction with life in adults with ASD compared to adults without ASD. The findings also revealed a significant interaction between group and employment status for anxiety. The effects of being employed were not the same for adults with ASD as for adults without ASD – levels of anxiety remained high for adults with ASD whether employed or unemployed. These mixed findings highlight poorer mental health in adults with ASD, the importance of workplace support for these individuals and the role of anxiety in autism. Chapter Four will further investigate the effects of employment on mental health and extend its reach by focusing on another area that has been shown to improve in those with ASD in employment, specifically executive functions. This will be achieved by using a small group of adults with ASD, providing a highly rich dataset provided both before and after a period of employment. This longitudinal approach allows for a more detailed level of analysis providing data over multiple time points and using different methods, specifically both self-reports and cognitive behavioural data.

Chapter Four (Study Two): Mental Health, Executive Functions and Employment in Adults with Autism Spectrum Disorder (ASD)

Overview of Chapter Four

This chapter presents Study Two. In this study, 14 adults with autism spectrum disorder (ASD) completed a series of mental health measures and a mixture of self-report and cognitive-behavioural tasks assessing executive functions pre- and post-employment. The findings revealed: no significant differences in group performance on executive function tasks post-employment compared to pre-employment; no adult with ASD demonstrated consistent meaningful improvement on executive function tasks post-employment compared to pre-employment; no significant differences in self-reported executive function skills post-employment compared to pre-employment; and similar depression, anxiety, satisfaction with life and well-being scores pre- and post-employment. These mixed findings are discussed with reference to: whether group or individual differences are looked at; the heterogeneity within autism profiles; and the profile of adults with ASD who are currently enrolled in autism and employment services.

Introduction

As previously discussed in Chapter Three, autism spectrum disorder (ASD) often co-occurs alongside many other mental health conditions. Estimates of the prevalence and type of mental health difficulties experienced by adults with ASD vary and the underlying reasons for why these individuals may be particularly at risk have been difficult to define. However, one area of research which has received little attention is the executive functions of adults (rather than children) with ASD. This is of interest in relation to mental health because daily life behaviours, such as time-keeping or planning journeys, may also be influenced by executive functions. The following introduction will outline recent research concerning executive functions in adults with ASD; potential reasons for discrepancies between studies; and the role of employment in the executive functions of adults with ASD. The relationships between mental health and employment are covered in Chapter Three.

The term ‘executive functions’ is often considered an umbrella term for higher-order cognitive functions such as working memory, inhibition, set-shifting or cognitive

flexibility, initiating responses, planning, impulse control and action monitoring (Stuss & Knight, 2002). Usually, executive function impairments are seen in patients with acquired neurological injury to the frontal lobes but impairments may also be seen in a range of neurodevelopmental disorders. These include attention deficit hyperactivity disorder (ADHD), obsessive compulsive disorder (OCD), schizophrenia, phenylketonuria and Tourette syndrome (Hill, 2004). However, adults with ASD may also display difficulties in completing tasks designed to assess executive functions. Importantly, the extent to which executive function difficulties affect adults with ASD has implications for outcomes including diagnosis and interventions (Hill & Bird, 2006), as well as daily living activities.

Executive functions are usually assessed through the use of cognitive-behavioural tasks assigned to participants and then through timing performance and/or errors in these tasks. Typically, certain tasks have been repeatedly used in research to assess certain executive functions. These include: the Hayling test (Burgess & Shallice, 1997) and the Stroop test (Trenerry et al., 1989) to assess response initiation/suppression or inhibition; a spatial span task (Wechsler, 2002) or the Corsi blocks task (Corsi, 1972) to assess working memory; the Wisconsin Card Sorting Test; WCST (Heaton et al., 1993) or the Trail Making Task; TMT (Reitan & Wolfson, 1985) to assess cognitive flexibility; the Tower of London task (Shallice, 1982) to assess planning; and a Verbal Fluency test (Strauss et al., 2006) to assess initiation/generativity.

However, mixed findings have emerged regarding executive function performance in adults with ASD. These are summarised in Chapter One, Table 1.1 and also summarised here. When assessing response initiation/suppression or inhibition, Zimmerman et al. (2016) and Hill and Bird (2006) found adults with ASD performed worse on the Hayling test. However, when using either the Stroop test or California Stroop test (Delis et al., 1996), adults with ASD showed fewer difficulties with this task (Ambery et al., 2006; Hill & Bird, 2006) or performed at the same level as non-ASD participants (Lopez et al., 2005). When assessing working memory, adults with ASD performed worse on a letter number sequencing (Wechsler, 2008) test (Zimmerman et al., 2016) and on a Spatial Span (Wechsler, 2002) test (Geurts & Vissers, 2012). When assessing cognitive flexibility, Lopez et al. (2005) found adults with ASD performed worse on the California TMT (Delis et al., 1996) and WCST. However, Hill and Bird (2006) found adults with ASD were impaired on the TMT but only in terms of psychomotor processing and visual search skills rather than in terms of executive functions. Geurts and Vissers (2012) also found adults with ASD did not perform worse on either the TMT or the Modified Card Sorting Test; MCST (Nelson, 1976) whereas Bogte et al. (2008) found adults with ASD did not perform worse on a response bias paradigm (Sternberg,

1969) but were slower on this computerised assessment of cognitive flexibility. When assessing planning, one study showed adults with ASD have performed worse on the Tower of California (Delis et al., 1996) task (Lopez et al., 2005) whereas a more recent study showed adults with ASD did not perform worse on the Tower of London task (Geurts & Vissers, 2012). However, similar to some studies looking at cognitive flexibility, this could be because adults with ASD did not perform worse in terms of executive functions but were considerably slower when completing the Tower tasks (Davids et al., 2016). Whereas Hill and Bird (2006) found adults with ASD were impaired on the Zoo map and Six Elements test of the Behavioural Assessment of Dysexecutive Syndrome; BADS (Wilson et al., 1996), Bramham et al. (2009) found adults with ASD displayed difficulties with planning as they were slower, rather than less accurate, on the Zoo map of the BADS. Finally, when considering initiation/generativity, Bramham et al. (2009) found adults with ASD displayed difficulties on a verbal fluency test. Hill and Bird (2006) also found adults with ASD were slower and showed difficulties with initiation when using a verbal fluency test with instructions based on Lezak (1995). Adults with ASD have further demonstrated difficulties with generativity (Ambery et al., 2006) when using the Controlled Oral Word Association Test; COWAT (Benton & Hamsher, 1989).

To summarise, adults with ASD show good performance in response suppression/inhibition tasks but they may show difficulties in tasks assessing response initiation, working memory and initiation/generativity. For studies assessing cognitive flexibility or planning, adults with ASD may show difficulties but this could be because they are slower, rather than less accurate, on these tasks. Overall, then, these studies suggest an uneven profile of executive function strengths and limitations within adults with ASD. This uneven profile is likely for a variety of reasons including: the influence of associated intellectual disability (ID) or co-occurring disorders; task complexity and range of executive function tasks; and the focus on group, rather than individual, differences. Possible reasons for the varied outcomes of the studies outlined above and how these influenced the design of the present study are considered below.

i) The influence of associated ID or co-occurring disorders. ID is broadly defined as an individual having an intelligence quotient (IQ) score of below 70. However, estimates of adults with ASD and co-occurring ID vary between studies. In England, around 20-33% of adults with ID also have ASD (Emerson & Baines, 2010) whereas in the United States (US), around 19-20% of adults with ASD have an associated ID (Croen et al., 2015). In the present study, participants with ASD were required to complete a series of computerised cognitive-behavioural tasks which meant a minimum general ability was required. Therefore, only participants with an IQ score of above 70 (i.e. two

standard deviations below the mean) were included. This was assessed through the Wechsler Abbreviated Scale of Intelligence; WASI (Wechsler, 1999).

Other clinical disorders regularly co-occur with ASD (see Chapter Two for a more detailed discussion around methodological issues), such as depression (26-70%), anxiety (12-36%), bipolar disorder (1-13%), OCD (6-18%) and schizophrenia (1-10%) in adults with ASD (Chandrasekhar & Sikich, 2015; Croen et al., 2015; Moss et al., 2015; Russell et al., 2016). The presence of a co-occurring disorder means research findings may be a consequence of a known or previously unknown co-occurring condition which could affect the conclusions drawn from the data. Co-occurring disorders could also mean participants are taking medication which could further affect the findings. This is particularly relevant in autism research and requires further attention. In the present study, participants with ASD were asked about any co-occurring disorders and the approximate dates these were diagnosed, as well as details of any currently prescribed medication. In addition, participants with dyslexia, ADHD or developmental coordination disorder (DCD) were excluded as executive function impairments have been noted in these populations (Rosenblum, 2013; Tiffin-Richards et al., 2008). Therefore, participants with additional co-occurring conditions were included but those with dyslexia, ADHD or DCD were excluded.

ii) Task complexity and range of executive function tasks. Task complexity must be considered since executive function tasks, such as the WCST (Heaton et al., 1993) are likely to tap into multiple complex processes and not just cognitive flexibility alone (Hill, 2004). Many executive function tasks often produce one outcome measure which actually comprises a number of different measures e.g. the Tower of London task is often used as a measure of planning but each move involves working memory and inhibition of inefficient but more automatic sub-goal moves (Hill & Bird, 2006). Furthermore, differences may exist between 'classic' (or traditional) executive function tasks and 'newer' tasks. Traditional executive function tasks might be insensitive to developmental impaired executive function performance rather than acquired impaired executive function performance (Hill & Bird, 2006). In the present study, participants with ASD completed a mixture of pen and paper executive function tasks and a series of computerised cognitive-behavioural tasks from the Cambridge Neuropsychological Test Automated Battery; CANTAB® (Cambridge Cognition, 1996) in order to assess a broad range of executive function abilities. These tasks were also a mixture of 'classic' tasks e.g. TMT and 'newer' tasks e.g. the Hayling and Brixton Tasks. This allowed for the profile of executive function strengths and limitations to be more fully assessed in adults

with ASD. The choice of tasks are fully outlined here in Table 4.3 and are also discussed in Chapter Two.

iii) The focus on group, rather than individual, differences. The nature of autism itself means individual differences can be large in ASD but research often focuses on group, rather than individual, differences (Pellicano, 2012). This means more subtle differences within participants are at risk of being overlooked. However, group differences, as well as individual differences, have been considered in previous research involving adults with ASD (Hill & Bird, 2006). In the present study, group differences and individual differences were both considered in order to allow a fully comprehensive view of any individual differences which may not have been picked up through group analyses alone.

After reviewing studies which look at the executive functions of adults with ASD, it is clear that this is an area of importance and is in need of careful consideration. This is because executive function impairments can have an impact on the daily living activities of adults with ASD e.g. difficulties with working memory or initiation/generativity means adults with ASD may struggle to process or begin everyday tasks. This is particularly relevant when examining factors that could improve the lives of adults with ASD.

In 2007, a study was run which assessed 44 adults with ASD at the beginning and end of an employment programme (Garcia-Villamisar & Hughes, 2007). Two groups of participants were included: a supported employment group; and an unemployed group (these were individuals on a waiting list who only participated in non-competitive vocational activities). The two groups did not differ on any executive function measures at the start of the programme. However, after an average length of 30 months in community employment, the supported employment group showed improvements on a variety of executive function measures. These were assessed using CANTAB® and included: the Spatial Span Task (span length recalled); the Spatial Working Memory Task (strategy); and the Planning task 'Stockings of Cambridge' (problems solved in minimum moves and mean planning time). Improvements were also seen on other tasks such as the TMT (time on part B) and the Matching Familiar Figures (Kagan, 1966) Test; MFFT (first answer and errors). The unemployed group showed no change in cognitive performance over time.

Another study found that supported employment improved quality of life for adults with ASD whereas no improvement in quality of life was observed for those in sheltered

employment (Garcia-Villamisar et al., 2002). This raises the question of what the effects of employment are on adults with ASD, particularly considering the positive outcomes associated with supported employment, and whether these are seen both in executive functions and mental health. Therefore, the research hypotheses for the current study were:

1. Adults with ASD will perform better on executive function tasks after a period of employment (post-employment) compared to being unemployed (pre-employment).

2. Adults with ASD will report lower levels of depression and anxiety, and higher levels of satisfaction with life and well-being after a period of employment (post-employment) compared to being unemployed (pre-employment).

Method

Participants. Participants with ASD aged 18 years or above were recruited from the National Autistic Society (NAS), Care Trade, AS Mentoring and Adjust Services. This intensive period of recruitment lasted 18 months. A detailed recruitment journal was kept during this time to ensure every possible contact was followed up and to advertise the study widely across the United Kingdom. In total, 19 participants completed the pre-employment session but three were excluded for scoring under 70 on the WASI and, therefore, the session was stopped and they were thanked for their time.

This left a total of 16 participants. Of these, 14 went on to complete the post-employment session: one participant did not find employment and one participant could not be contacted at the point of follow-up. ASD diagnosis was confirmed by the autism service from which the participant was recruited although an ASD diagnosis could not be confirmed for one participant. This participant was seeking an ASD diagnosis but had not yet received it e.g. they had visited their GP but could not be referred on for an ASD diagnosis as the services did not exist in their part of the country. However, they had been recruited into an adjacent county's autism and employment service as they were a recent graduate looking for work and seeking a diagnosis of ASD, which the service deemed appropriate.

Out of 14 participants, 28.6% met the autism referral criteria on the AQ-10. The AQ-10 is a screening aid rather than a diagnostic tool and self-report scores do not necessarily predict receipt of an ASD diagnosis (Ashwood et al., 2016). These authors also noted nearly two-thirds of individuals with a diagnosis of ASD did not meet the autism referral criteria on the AQ-10. In the present study, participants' ASD diagnoses were checked by the autism and employment services in which they were enrolled. Therefore, all participants were kept in the sample and the AQ-10 scores were not considered further.

All 14 participants had a full-scale IQ of 70 or above. Participants with dyslexia, ADHD or DCD were excluded as executive function difficulties have been noted in these populations (Rosenblum, 2013; Tiffin-Richards et al., 2008). Participant characteristics are shown in Table 4.1.

Table 4.1

Participant characteristics of the total sample.

		ASD (Σn = 14)	
		n	%
Gender	Male	11	78.6
	Female	3	21.4
Ethnicities (self-defined)	White	9	64.3
	Black	2	14.3
	Mixed	2	14.3
	Asian	1	7.1
Age (years)	Mean (*SD*; range)	14	27.7 (7.1; 20-48)
Age of ASD diagnosis (years)	Under 18	3	21.4
	18 or above	7	50.0
	Unsure	3	21.4
	Seeking diagnosis	1	7.2
Full-scale IQ	Mean (*SD*; range)	14	100.4 (17.1; 71-126)
Additional diagnoses (self-defined)*	Depressive disorders	1	6.2
	Anxiety disorders	1	6.2
	Obsessive compulsive disorders	1	6.2
	Trauma-related disorders	1	6.2
	None	12	75.2

		ASD (Σn = 14)	
		n	%
Highest qualification	Left school before GCSEs	1	7.1
	GCSEs, O-Levels or equivalent	2	14.4
	Vocational qualifications	3	21.4
	A-Levels or equivalent	3	21.4
	Undergraduate degree	4	28.6
	Postgraduate degree	1	7.1
	Doctorate/PhD	0	0.0
Employment status at pre-employment session	Unemployed for less than a year	5	35.7
	Unemployed for a year or longer	8	57.1
	Student	1	7.2
Length of unemployment at pre-employment session (months)	Mean (*SD*; range)	12	27.3 (27.1; 1-72)
	Missing	2	
Employment status at post-employment session	Full-time paid employment	4	28.6
	Part-time paid employment	2	14.3
	Part-time voluntary work	4	28.6
	Student	1	7.1
	Unemployed for less than a year	3	21.4

* These additional diagnoses total more than the total number of participants as some participants reported more than one additional diagnoses. The categories are taken from the DSM-V (American Psychiatric Association, 2013).

Materials. Table 4.3 summarises all materials used and further details of executive function and mental health measures will now be discussed.

Executive function (cognitive-behavioural) measures. Participants completed various pen and paper, and computerised cognitive-behavioural tasks. These are shown in the 'Cognitive tasks' column of Table 4.3. These tasks were carefully chosen to evaluate a range of executive functions (see Chapter Two for further discussion of methodological issues) and were based on the previous work of Garcia-Villamisar and Hughes (2007). However, it should be noted that the present study differed from that of Garcia-Villamisar and Hughes (2007) in the following ways: the range of computerised tasks were extended to include an attention switching task (the

Attention Switching Task or AST) and two decision-making and response control tasks (the Affective Go/No-go or AGN and the Stop Signal Task or SST); the pen and paper tasks were extended to include the Hayling sentence completion test and the Brixton spatial anticipation test; a self-report measure of real-world executive functioning problems was included (the Behaviour Rating Inventory of Executive Function-Adult version or BRIEF-A); individual, as well as group, differences were analysed; voluntary, as well as paid, employment was included and a British sample, instead of a Spanish sample, was used.

Trail Making Task; TMT (Reitan & Wolfson, 1985). The TMT consists of two parts in which the participant must connect a series of 25 consecutive circles on a piece of paper as quickly as possible without lifting the pen or pencil from the paper. Part A is designed to assess psychomotor processing and visual search skills while part B gives a measure of cognitive flexibility. In part A, the circles are numbered 1-25 and the participant is instructed to connect the numbers in ascending order. In part B, the circles include both numbers (1-13) and letters (A-L) and the participant connects the circles in an ascending pattern but with the added task of alternating between the numbers and letters (i.e. 1-A-2-B-3-C). Normative data for varying ages and education levels are available (Tombaugh, 2004) and the TMT has good construct validity (Sanchez-Cubillo et al., 2009) and reliability (Wagner, Helmreich, Dahmen, Lieb, & Tadic, 2011).

Word Fluency test (Thurstone, 1938). The Word Fluency test is designed to give a measure of generativity. Participants are asked to write as many words as possible beginning with the letter 'S' within five minutes and then as many words as possible beginning with the letter 'C' within four minutes. This formed part of the Primary Mental Abilities Test (Thurstone, 1938) although normative data are available only for the verbal counterpart of this test rather than the written version used in the present study. The Word Fluency test has good test-retest and inter-rater reliability as well as good construct validity (Cohen & Stanczak, 2000).

Hayling and Brixton Tasks (Burgess & Shallice, 1997). The Hayling sentence completion test is a measure of response initiation/suppression. The Brixton spatial anticipation test is designed to assess visuospatial sequencing and the ability to detect rule-change in sequences of stimuli. The Hayling test is made up of two parts, with each part containing 15 sentences with the last word missing. In the first part, the researcher reads the sentence aloud and the participant has to complete the sentence which gives a measure of response initiation. In the second part, the participant is asked to complete the sentence with a word which does not fit, giving a measure of response suppression.

The Brixton test is a visuospatial sequencing task which does not require a verbal response. Participants are presented with a booklet containing a pattern with a blue dot on each page and, as the page is turned, are asked to where they think the blue dot will be on the next page. Therefore, participants are asked to detect rules in sequences of stimuli. Normative data and age-related cut-off scores are available for both the Hayling and Brixton Tasks. Both the Hayling and Brixton Tasks have moderate test-retest reliability and inter-rater reliability (Burgess & Shallice, 1997).

Cambridge Neuropsychological Test Automated Battery; CANTAB® (Cambridge Cognition, 1996). The Cambridge Neuropsychological Test Automated Battery (CANTAB®) has been widely used in research to assess cognitive performance in participants. It has established a large normative database which can be used to calculate standardised scores although, as new tests and new modes for existing tests are continually being incorporated, normative data do not exist for every test. Over 1,800 peer-reviewed journal articles advocate the use of CANTAB® in clinical research (Cambridge Cognition Ltd, 2016). The CANTAB® tests have high construct validity (Lenehan, Summers, Saunders, Summers, & Vickers, 2016) and are considered particularly suitable for use as the tests have been selected based on thorough and extensive documentation of existing research paradigms (Lowe & Rabbitt, 1998). For the present study, participants responded through the use of a touch-screen laptop, meaning the tests were practical and efficient to transport.

The CANTAB® tests can be broadly divided into seven main areas: screening/familiarisation; visual memory; executive function, working memory and planning; attention; semantic/verbal memory; decision-making and response control; and social cognition. The following tests were included in the present study:

Motor Screening Task; MOT (screening/familiarisation test). This task requires participants to touch a series of crosses which appear in different locations on the screen. This is a training task designed to familiarise the participant with CANTAB®.

Big/Little Circle; BLC (screening/familiarisation test). Participants are presented with a series of pairs of circles, one large and one small. The participant is instructed first to touch the small circle and then, after a number of trials, to touch the larger circle. This is a training task designed to prepare the participant for the Intra-Extra Dimensional Set Shift (IED).

Intra-Extra Dimensional Set Shift; IED (executive function, working memory and planning test). In this task, participants are presented with shapes and must learn which shape is correct by touching it. This continues until the rule changes and the previously incorrect stimulus is correct. Further shapes are presented and participants are required to shift their attention to correct and, then, previously incorrect shapes in order to progress through the task. This is a rule acquisition and reversal task which assesses attentional set-shifting or cognitive flexibility. Lower scores indicate better performance on this measure.

Attention Switching Task; AST (executive function, working memory and planning test). On each trial of this task, participants are presented with an arrow which appears on the right or on the left hand side of the screen. A cue appears asking participants to respond according to the direction of the arrow or the side of the screen on which the arrow appears. For some trials, side and arrow direction are incongruent. This is a cued attentional set-shifting task designed to assess cognitive flexibility. Lower scores indicate better performance on this measure.

Stockings of Cambridge; SOC (executive function, working memory and planning test). This is a computerised version of the Tower of London task. Participants are presented with two displays containing three coloured balls and must use the balls in the lower display to copy the pattern shown in the upper display. The balls must be moved one at a time. This is a spatial planning task assessing planning ability. Lower scores indicate better performance on this measure.

Spatial Span; SSP (executive function, working memory and planning test). This is a computerised version of the Corsi blocks task. A pattern of white boxes is shown on the screen and some of the boxes change colour one by one. After a brief pause, participants are asked to touch each of the coloured boxes one by one in the same order they were originally presented. This is designed to assess working memory capacity. Higher scores indicate better performance on this measure.

Spatial Working Memory; SWM (executive function, working memory and planning test). In this task, a series of boxes are presented on the screen. Participants are asked to find one blue 'token', by process of elimination, in each of a number of boxes and eventually fill up an empty column on the right hand side of the screen. This is a spatial information task which is designed to assess heuristic strategy use. Lower scores indicate better performance on this measure.

Affective Go/No-go; AGN (decision-making and response control test). In this task, a series of positive or negative words is presented rapidly on the screen. Participants are asked to touch a button when they see a target (defined before each trial as either a 'positive' or 'negative' target) word. This assesses inhibitory control for positive and negative stimuli. Lower scores indicate better performance on this measure.

Stop Signal Task; SST (decision-making and response control test). This is a classic stop signal response inhibition task which uses staircase functions to estimate stop signal reaction time. Participants are shown an arrow pointing to the left or right and asked to touch a left button when they see the left arrow and a right button when they see the right arrow. However, when a tone sounds participants must inhibit their response and not press either button. This is designed to assess response inhibition. Lower scores indicate better performance on this measure.

Mental health and executive function (self-report) measures. Data were collected through an online survey which could be accessed via Unipark. This survey was identical to that used in Chapter Three with the addition of the Behaviour Rating Inventory of Executive Function-Adult version; BRIEF-A (Roth et al., 2005). Thus the survey contained open-ended and closed questions regarding background information and included a variety of other published measures which are shown in Table 4.3. These measures were carefully chosen to ensure questions were clear and to try and distinguish depression, anxiety, satisfaction with life and well-being as separate domains (see Chapter Two for a more detailed discussion around methodological issues). Permission was sought for the published measures to be used in an online survey and these are listed in the 'Self-report measures' column of Table 4.3. Two examples of items from each measure are shown in Table 4.2. More information about the mental health self-report measures is provided in Chapter Two and further details of the executive function self-report measure will now be discussed.

Table 4.2

Examples of items from the self-report measures.

Measure	Domain	Item examples
Patient Health Questionnaire; PHQ-9 (Kroenke et al., 2001)	Depression	'Little interest or pleasure in doing things'? 'Feeling down, depressed, or hopeless'?
Generalised Anxiety Disorder; GAD-7 (Spitzer et al., 2006)	Anxiety	'Feeling nervous, anxious or on edge'? 'Not being able to stop or control worrying'?
Satisfaction With Life Scale; SWLS (Diener et al., 1985)	Satisfaction with life	'In most ways my life is close to my ideal'. 'The conditions of my life are excellent'.
Warwick-Edinburgh Mental Well-being Scale; WEMWBS (Tennant et al., 2007)	Well-being	'I've been feeling optimistic about the future'. 'I've been feeling useful'.
Autism Spectrum Quotient-10; AQ-10 (Allison et al., 2012)	Autism traits	'I often notice small sounds when others do not'. 'I usually concentrate more on the whole picture, rather than the small details'.
Behaviour Rating Inventory of Executive Function-Adult version; BRIEF-A (Roth et al., 2005)	Executive function	'I lie around the house a lot' (Initiate subscale)' 'I have trouble organising work' (Plan/Organise subscale).

Behaviour Rating Inventory of Executive Function-Adult version; BRIEF-A (Roth et al., 2005). The BRIEF-A is a 75-item questionnaire designed to assess the frequency of real-world executive functioning problems which have occurred within the last month. The self-report version of the BRIEF-A was used in the present study. Respondents are presented with three response categories: 'never'; 'sometimes'; and 'often'. There is a Global Executive composite (GEC) score which is broken down into two index scores: the Behavioural Regulation Index (BRI), which consists of four clinical subscales (Inhibit, Shift, Emotional Control, Self-Monitor); and the Metacognition Index (MI) which consists of five clinical subscales (Initiate, Working Memory, Plan/Organise, Task Monitor,

Organisation of Materials). The BRI represents the individual's ability to maintain appropriate regulatory control of their behaviour and emotional responses. The MI represents the individual's ability to systematically solve problems using planning and organisational skills while sustaining these skills in active working memory. A scoring sheet is used to calculate the scale raw score for each of the nine clinical subscales, the BRI and MI, and the GEC. All of these ratings are expressed as *T*-scores (*M* = 50, *SD* = 10) which are taken from comparisons with normative age expectations. A *T*-score of 65 represents 1.5 standard deviations above the mean and a score of 65 or above is characterised as being clinically significant and an area of clinical concern. A review of the BRI and MI, and the nine clinical subscales is strongly recommended when interpreting the BRIEF-A findings with the GEC used as a useful summary measure.

Table 4.3

Details of materials used.

Demographic information and diagnoses *(open-ended questions)*	Developmental history *(open-ended questions)*	Employment history *(open-ended questions)*	Self-report measures *(closed questions)*	Cognitive tasks *(cognitive-behavioural tasks)*
- Age	- Childhood speech, motor or social difficulties	- Highest level of qualification(s)	- Patient Health Questionnaire-9; PHQ-9 (Kroenke et al., 2001)	- Wechsler Abbreviated Scale of Intelligence; WASI (Wechsler, 1999)
- Gender	- Notable childhood illnesses	- Current occupation status	- Generalised Anxiety Disorder; GAD-7 (Spitzer et al., 2006)	- Executive functioning (pen and paper) tasks: TMT (Reitan & Wolfson, 1985); Word Fluency test (Thurstone, 1938); Hayling and Brixton Tasks (Burgess & Shallice, 1997).
- Ethnicity	- Notable schooling problems	- Whether any past or present employers have received ASD awareness training	- Satisfaction with Life Scale; SWLS (Diener et al., 1985)	- Executive functioning (computerised) tasks: CANTAB® (Cambridge Cognition, 1996) tasks: BLC (Big/Little Circle); MOT (Motor Screening Task); AST (Attention Switching Task); SSP (Spatial Span); SWM (Spatial Working Memory); IED (Intra-Extra Dimensional Set Shift); SOC (Stockings of

Demographic information and diagnoses *(open-ended questions)*	Developmental history *(open-ended questions)*	Employment history *(open-ended questions)*	Self-report measures *(closed questions)*	Cognitive tasks *(cognitive-behavioural tasks)*
				Cambridge); SST (Stop Signal Task); AGN (Affective Go/No-go).
- Postcode		- Whether participant has ever received employment support training	- Warwick-Edinburgh Mental Well-being Scale; WEMWBS (Tennant et al., 2007)	
- ASD diagnosis (age received)		- Current duration of employment or unemployment	- Autism Spectrum Quotient-10; AQ-10 (Allison et al., 2012)	
- Any other diagnosed physical, mental or neurological health disorders (age received)		- Details of any recent study, voluntary work or travel during period of unemployment	- Behaviour Rating Inventory of Executive Function-Adult version; BRIEF-A (Roth et al., 2005)	

Demographic information and diagnoses *(open-ended questions)*	Developmental history *(open-ended questions)*	Employment history *(open-ended questions)*	Self-report measures *(closed questions)*	Cognitive tasks *(cognitive-behavioural tasks)*
- Family members diagnosed with physical, mental or neurological health disorders - Details of any prescribed medication		- Whether would like to start any paid or voluntary employment in the following twelve months - Details of current or last main paid job - Estimate of average annual household income		

Note. CANTAB® = Cambridge Neuropsychological Test Automated Battery; TMT = Trail Making Task.

Procedure. Ethical approval was granted from the Research Ethics Committee at the Department of Psychology, Goldsmiths, University of London.

The mental health and executive functions of participants were assessed at two time points – pre-employment (baseline) and post-employment (follow-up). Prior to the pre-employment session taking place, participants were emailed a password protected web link to the online survey which contained questions relating to the demographic information, developmental history, employment history and measures listed in Table 4.3. The information sheet and consent form were embedded in the first page of the survey. Consent was taken when participants confirmed they had read the consent page by clicking their agreement. This meant participants understood their contribution was voluntary, anonymous and they could leave the study at any time without giving a reason. Participants were given full researcher contact details at the beginning and end of the survey, in case there were any questions relating to this. A paper version of the survey was also printed out and some participants completed the survey in this format.

The pre-employment session involved a face-to-face meeting so participants could complete the pen and paper, and computerised cognitive-behavioural tasks. A session timetable was issued to show participants the sequence and timings of the various executive function tasks and this is included in Appendix Three. This timetable acted as a visual aid to reduce uncertainty and anxiety around what was happening in the session. It also included the timings of regular breaks. The post-employment session was held after a period of employment (see Table 4.6 for further employment details of individual participants including length of time between pre- and post-employment sessions). Participants repeated the procedure of the pre-employment session (except for completing the WASI) for the post-employment session. Table 4.4 also provides more detail of the sequence of tasks.

Table 4.4

Sequence of cognitive tasks used in pre- and post-employment sessions.

Task	Overview	Detail	Pre-employment	Post-employment
Pen and paper tasks				
WASI	IQ	Four subtests including vocabulary, similarities, block design and matrix reasoning. Estimate of general cognitive ability.	Y	N
TMT	Executive function	Visual attention and task switching/cognitive flexibility.	Y	Y
Word Fluency test	Verbal fluency	Verbal generativity and initiation.	Y	Y
Hayling and Brixton Tasks	Executive function	Response initiation and inhibition. Visuospatial sequencing task.	Y	Y
CANTAB® (computerised) tasks			Y	Y
MOT (Motor Screening Task)	Screening/familiarisation tasks	Training test; familiarising with CANTAB®.	Y	Y
BLC (Big/Little Circle)	Screening/familiarisation tasks	Training test; preparing for IED.	Y	Y
IED (Intra-Extra Dimensional Set Shift)	Executive function, working memory and planning	Rule acquisition and reversal. Attentional set-shifting or flexibility. Sensitive to changes in fronto-striatal areas of the brain.	Y	Y
AST (Attention Switching Task)	Executive function, working memory and planning	Cued attentional set-shifting. Cognitive flexibility.	Y	Y

Task	Overview	Detail	Pre-employment	Post-employment
SOC (Stockings of Cambridge)	Executive function, working memory and planning	Spatial planning and spatial working memory. Frontal lobe function.	Y	Y
SSP (Spatial Span)	Executive function, working memory and planning	Version of Corsi blocks task. Working memory capacity. Frontal lobe function.	Y	Y
SWM (Spatial Working Memory)	Executive function, working memory and planning	Ability to retain spatial information and to manipulate remembered items in working memory. Assesses heuristic strategy use. Frontal lobe and executive dysfunction.	Y	Y
AGN (Affective Go/No-go)	Decision making and response control	Assesses information processing biases and inhibitory control for positive and negative stimuli.	Y	Y
SST (Stop Signal Task)	Decision making and response control	Ability to inhibit a prepotent response. Classic stop signal response inhibition test.	Y	Y

Note. CANTAB® = Cambridge Neuropsychological Test Automated Battery; IQ = intelligence quotient; N = no; TMT = Trail Making Task; WASI = Wechsler Abbreviated Scale of Intelligence; Y = yes.

All participants were engaged in community-based employment. Table 4.5 outlines further details of the type of employment which participants undertook during Study Two. Table 4.6 also outlines individual participants' details of employment (as reported by the participants).

Table 4.5

Details of employment undertaken by participants.

		ASD (Σn = 14)	
		n	%
Type of employment	Voluntary	8	57.1
	Paid	6	42.9
Hours per day employed	Mean (*SD*; range)	14	6.2 (1.4; 4-8)
Hours per week employed	Mean (*SD*; range)	14	23.1 (11.9; 4-40)
Total days in employment	Mean (*SD*; range)	14	33.5 (19.7; 6-73)
Total hours in employment	Mean (*SD*; range)	14	216 (123; 24-384)
Number of days between pre- and post-employment sessions	Mean (*SD*; range)	14	88.5 (46.4; 45-232)

Table 4.6

Individual participants' details of employment undertaken.

Participant	Gender	Age (years)	Referral	Voluntary or paid employment	Job title	Hours worked per day	Hours worked per week	Total days employed	Total hours employed	Number of days between pre- and post-employment session
1	Male	24	Care Trade	Voluntary	Catering Assistant	4.00	20.00	73.00	292.00	120
2	Male	23	Care Trade	Voluntary	Administration Assistant	6.00	12.00	20.00	120.00	92
3	Male	25	Care Trade	Paid	Retail Assistant	6.00	18.00	35.00	210.00	105
4	Male	25	NAS	Voluntary	Plant Nursery Worker/Assistant	8.00	16.00	8.00	64.00	64
5	Male	21	NAS	Voluntary	Office Administrator	4.00	8.00	18.00	144.00	58
6	Male	36	Care Trade	Voluntary	Animator	4.00	4.00	6.00	24.00	45
7	Female	26	Care Trade	Paid	Health Records Librarian	7.50	37.50	46.00	345.00	97

Participant	Gender	Age (years)	Referral	Voluntary or paid employment	Job title	Hours worked per day	Hours worked per week	Total days employed	Total hours employed	Number of days between pre- and post-employment session
8	Male	29	NAS	Voluntary	Porter/Maintenance Operative	6.50	19.50	18.00	117.00	71
9	Male	26	NAS	Voluntary	Warehouse Assistant	5.50	16.50	15.00	82.50	61
10	Male	20	Care Trade	Paid	Gateline Assistant	7.50	37.50	50.00	375.00	70
11	Male	26	NAS	Paid	Support Worker	6.00	24.00	51.00	306.00	232
12	Male	48	ASM	Paid	Software Engineer	7.00	35.00	45.00	315.00	81
13	Female	30	ASM	Paid	Forensic Analyst	8.00	40.00	48.00	384.00	88
14	Female	29	Adjust Services	Voluntary	Hospital Assistant	7.00	35.00	35.00	245.00	55

Note. ASM = AS Mentoring; NAS = National Autistic Society.

Data analysis. The independent variable (employment) contained two levels (pre- and post-employment). The main dependent variables were executive function (TMT parts A and B, Word Fluency test, Hayling and Brixton Tasks, BRIEF-A scales and the IED, AST, SOC, SSP, SWM, AGN and SST from CANTAB®) and mental health (depression, anxiety, satisfaction with life and well-being) scores.

All analyses used SPSS version 22. Data for the TMT, Word Fluency test and the Hayling and Brixton Tasks were checked for distribution normality using the Shapiro-Wilk test, in order to verify that the differences between the pre- and post-employment scores were normally distributed. The differences were calculated and this revealed the TMT part A (p = .849), TMT part B (p = .640) and Word Fluency (p = .736) scores were normally distributed but the Hayling (p = .032) and Brixton (p = .045) scores were not. Therefore, paired samples t-tests were run for the normally distributed data (and the means reported) and the Wilcoxon signed-rank tests were run as the non-parametric alternatives (and the medians reported). All outliers remained in the analysis as discussed in Chapter Three.

Data for the CANTAB® (IED, AST, SOC, SSP, SWM, AGN and SST) tasks were also checked for distribution normality using the Shapiro-Wilk test, in order to verify that the differences between the pre- and post-employment scores were normally distributed. The differences were calculated and this revealed the IED (p = .723), AST (p = .962), SOC (p = .126), SSP (p = .152), SWM (p = .124), AGN (p = .498) and SST (p = .346) scores were all normally distributed. Therefore, paired samples t-tests were run.

Data for the total number of hours in employment and the least degree of difference (LDD)[4], representing a clinically meaningful degree of change, of all cognitive-behavioural data were checked for normality using the Shapiro-Wilk test. This revealed the number of total hours in employment (p = .283) and the LDD of TMT-A (p = .849), TMT-B (p = .640), WF (p = .736), IED (p = .723), AST (p = .962), SOC (p = .126), SSP (p = .152), SWM (p = .124), AGN (p = .498) and SST (p = .346) data were normally distributed. A Pearson product-moment correlation was run on these data. The LDD of the Hayling (p = .032) and Brixton (p = .045) data were not normally distributed, so a Spearman's rank-order correlation was run on these data.

Data for the BRIEF-A were then checked for distribution normality using the Shapiro-Wilk test, in order to verify that the differences between the pre- and post-employment scores were normally distributed. The differences were calculated and this

[4] LDD (1.96*√2*SEM)

revealed the Inhibit (p = .119), Shift (p = .529), Emotional Control (p = .395), Self-Monitor (p = .635), Initiate (p = .944), Working Memory (p = .372), Plan/Organise (p = .335), Task Monitor (p = .768), Organisation of Materials (p = .074), BRI (p = .833), MI (p = .518) and GEC (p = .606) scores were normally distributed. Therefore, paired samples t-tests were run.

Data for the depression, anxiety, satisfaction with life and well-being scales were pro-rated to deal with any missing values. The dataset was checked for distribution normality using the Shapiro-Wilk test, in order to verify that the differences between the pre- and post-employment scores were normally distributed. The differences were calculated and this revealed the depression (p = .640), anxiety (p = .907), satisfaction with life (p = .842) and well-being data (p = .807) were normally distributed.

First, paired samples t-tests and Wilcoxon-signed rank tests were run on all cognitive-behavioural data. These were to assess the group differences between the pre- and post-employment stages in performance on the TMT (parts A and B), Word Fluency test, Hayling and Brixton Tasks and the IED, AST, SOC, SSP, SWM, AGN and SST CANTAB® tests.

Second, calculation of the LDD[5] was applied to all cognitive-behavioural data. This was to assess the individual differences between the pre- and post-employment stages in performance on the TMT (parts A and B), Word Fluency test, Hayling and Brixton Tasks and the IED, AST, SOC, SSP, SWM, AGN and SST CANTAB® tests. Therefore, this could assess the number of participants making meaningful progress between the pre- and post-employment stages. This was based on the methodology used in Hammond, Jones, Hill, Green, and Male (2014).

Third, the total number of hours in employment was correlated with the LDD of all cognitive-behavioural data. This was to explore the relationship between length of employment and a clinically meaningful degree of change in performance on the TMT (parts A and B), Word Fluency test, Hayling and Brixton Tasks and the IED, AST, SOC, SSP, SWM, AGN and SST CANTAB® tests. .

Fourth, the BRIEF-A *T*-scores were observed to assess the level of self-reported executive function skills both pre- and post-employment. This highlighted areas of executive function impairment which were considered to be of clinical significance or which were notably different when compared with normative age expectations. Then

[5] LDD (1.96*√2*SEM)

paired samples t-tests were run to assess the differences between the pre- and post-employment stages in self-reported executive function skills.

Finally, four paired samples t-tests were run to assess the differences between the pre- and post-employment stages in levels of depression, anxiety, satisfaction with life and well-being.

Results

Group differences in executive functions. The group differences between pre- and post-employment stages in performance on the pen and paper measures, and the computerised cognitive-behavioural tasks, were assessed. Paired samples t-tests and Wilcoxon-signed rank tests were run on participant data. This was to assess the differences between the pre- and post-employment stages in performance on the TMT (parts A and B), Word Fluency test, Hayling and Brixton Tasks and the IED, AST, SOC, SSP, SWM, AGN and SST CANTAB® tests. Bonferroni corrections were applied as twelve tests were being run, in order to avoid any Type 1 errors. This yielded a corrected significance level of .004. The results are reported in Table 4.7.

For part A of the TMT, participants' scores were what would be expected given approximate normative age comparisons, both pre- and post-employment. For part B of the TMT, participants scored within the expected range but moved down an age group post-employment, from 45-54 years to 35-44 years when compared with approximate normative age expectations. For the Hayling test, participants scored within the 'low average' range pre-employment but moved to the 'average' range post-employment. For the Brixton test, participants scored within the 'average' range pre-employment and the 'high average' range post-employment. However, as a group, participants showed no significant differences in performance post-employment compared to pre-employment on the TMT (parts A and B), Word Fluency test and Hayling and Brixton Tasks.

There were also no significant differences in performance on the CANTAB® tests at the post-employment stage compared to the pre-employment stage. Normative data were only available for the SSP and SWM tests. For the SSP test, only 14.3% of participants scored in the 90-95th percentile pre-employment and this remained unchanged post-employment. For the SWM test, only 7.1% of participants scored in the 90-95th percentile pre-employment whereas this increased to 28.6% post-employment.

Table 4.7

Group performance on executive function tasks pre- and post-employment.

	Pre-employment (Σn = 14)			Post-employment (Σn = 14)					
	M	*SD*	Range	*M*	*SD*	Range	*df*	*t*	*p*
Pen and paper measures									
TMT (part A)	29.57	10.23	17-53	26.21	11.73	15-56	13	2.28	.040
TMT (part B)	63.36	22.15	30-104	55.43	17.54	32-89	13	2.68	.019
Word Fluency	73.21	26.84	39-118	78.43	25.43	45-122	13	-2.24	.044
Hayling test	3.71	2.30	1-7	4.71	2.61	1-9	13	-2.72 *(Z)*	.006
Brixton test	5.93	2.56	1-10	6.93	1.90	3-10	13	-1.45 *(Z)*	.151
CANTAB®									
IED	34.50	30.22	7-108	37.57	30.39	7-114	13	-.51	.620
AST	174.94	192.20	-165.72-555.58	215.77	139.50	54.03-554.47	13	-.73	.481
SOC	7.93	2.79	4-12	8.36	1.87	5-12	13	-.82	.426
SSP	6.29	1.44	5-9	6.50	1.45	5-9	13	-.68	.512
SWM	32.43	5.96	19-39	30.43	7.72	18-41	13	1.84	.089
AGN	5.76	36.90	-48.37-88.93	16.18	9.86	-91.41-88.03	13	-.62	.545
SST	205.03	62.02	104.53-294.00	206.46	40.00	157.35-295.33	13	-.12	.910

Note. AGN = Affective Go/No-go; AST = Attention Switching Task; CANTAB® = Cambridge Neuropsychological Test Automated Battery; IED = Intra-Extra Dimensional Set Shift; SOC = Stockings of Cambridge; SSP = Spatial Span; SST = Stop Signal Task; SWM = Spatial Working Memory; TMT = Trail Making Task.

Individual differences in executive functions. Individual differences between pre- and post-employment stages in performance on the pen and paper measures, and the computerised cognitive-behavioural tasks were assessed. Table 4.8 shows the findings from the calculation of the least degree of difference (LDD[6]) representing a clinically meaningful degree of change on the TMT (parts A and B), Word Fluency test, Hayling and Brixton Tasks and the IED, AST, SOC, SSP, SWM, AGN and SST CANTAB® tests. This assessed the number of participants making meaningful progress between the pre- and post-employment stages. Significant improvements in individual performance are highlighted in dark grey and significant declines in individual performance are highlighted in light grey for each individual.

In total, nine (64.3%) participants showed more improvements than declines across executive function tasks post-employment compared to pre-employment, four (28.6%) participants showed more declines than improvements in performance, and one (7.1%) participant showed no change.

In terms of the executive function tasks, more improvements than declines in performance were observed on the TMT (part A), Word Fluency, the Brixton test and the SSP and SWM tests from CANTAB®. However, more declines than improvements in performance were observed on the IED, AST, SOC, AGN and SST tests from CANTAB®. Although seven (50%) of participants made meaningful progress (>1 LDD change) on the TMT (part B) and nine (64.3%) participants made meaningful progress (>1 LDD change) on the Hayling test, no participant showed consistent meaningful progress across all executive function tasks.

[6] LDD (1.96*√2*SEM)

Table 4.8

Individual performance on executive function tasks pre- and post-employment.

n	Gender	Age (years)	Pen and paper measures					CANTAB®						Σ% ≥ 2 LDD: increase	Σ% ≥ 1 LDD: increase	Σ% ≥ 2 LDD: decrease	Σ% ≥ 1 LDD: decrease
			TMT-A	TMT-B	WF	H	B	IED	AST	SOC	SSP	SWM	AGN	SST				
1	M	24	-4.00*	5.00	6.00	2.00**	4.00**	12.00*	469.65**	1.00*	1.00**	2.00*	-53.95**	23.38*	33.3	8.3	8.3	33.3
2	M	23	3.00	-7.00	-9.00*	1.00*	-1.00	-17.00**	351.09**	1.00*	.00	2.00*	51.37**	1.75	8.3	8.3	16.7	25.0
3	M	25	-4.00*	-15.00*	18.00**	.00	.00	6.00	173.19**	-1.00*	-1.00**	-6.00**	-64.10**	-51.40**	33.3	25.0	16.7	0.0
4	M	25	-2.00	5.00	7.00*	.00	.00	-4.00	-186.93**	-2.00**	1.00**	-1.00	44.36**	14.00	25.0	8.3	8.3	0.0
5	M	21	-4.00*	-4.00	16.00**	.00	-1.00	-2.00	-95.58*	.00	.00	-1.00	93.86**	-52.95**	16.7	16.7	8.3	0.0
6	M	36	-5.00*	-11.00*	12.00*	.00	.00	45.00*	-155.86**	1.00*	.00	1.00	61.80**	49.03**	8.3	25.0	16.7	16.7
7	F	26	2.00	-27.00**	2.00	1.00*	3.00*	15.00*	59.14*	-2.00**	1.00**	-1.00	-19.82**	23.25*	33.3	16.7	0.0	25.0
8	M	29	6.00*	-24.00**	.00	1.00*	7.00**	13.00*	74.73*	-2.00**	.00	2.00*	87.77**	82.57**	25.0	8.3	16.7	33.3
9	M	26	-9.00**	8.00	8.00*	1.00*	-2.00*	4.00	-46.91	4.00**	1.00**	-1.00	-112.13**	23.42*	25.0	16.7	8.3	16.7
10	M	20	-8.00*	-14.00*	19.00**	3.00**	2.00*	38.00**	-7.70	2.00**	-1.00**	-5.00**	41.83**	-7.32	25.0	25.0	33.3	0.0
11	M	26	-2.00	4.00	-4.00	1.00*	1.00	1.00	206.28**	.00	-2.00**	-6.00**	1.74	-1.18	8.3	8.3	16.7	0.0
12	M	48	-10.00**	-3.00	-2.00	2.00**	.00	-22.00**	76.95*	.00	3.00**	-7.00**	-19.49*	-105.15**	50.0	8.3	0.0	8.3
13	F	30	-13.00**	-10.00*	-4.00	.00	1.00	-44.00**	-312.31**	.00	.00	3.00*	-34.23**	25.68*	33.3	8.3	0.0	16.7
14	F	29	3.00	-18.00**	4.00	2.00**	.00	-2.00	-34.13	4.00**	.00	-10.00**	66.90**	-5.03	25.0	0.0	16.7	0.0
Σ% ≥ 2 LDD: increase			21.4	21.4	21.4	28.6	14.3	21.4	21.4	21.4	35.7	35.7	35.7	21.4				
Σ% ≥ 1 LDD: increase			35.7	28.6	21.4	35.7	14.3	0.0	7.1	7.1	0.0	0.0	7.1	0.0				
Σ% ≥ 2 LDD: decrease			0.0	0.0	0.0	0.0	0.0	7.1	28.6	21.4	21.4	0.0	50.0	14.3				
Σ% ≥ 1 LDD: decrease			7.1	0.0	7.1	0.0	7.1	28.6	21.4	21.4	0.0	28.6	0.0	28.6				

Note. AGN = Affective Go/No-go; AST = Attention Switching Task; B = Brixton test; CANTAB® = Cambridge Neuropsychological Test Automated Battery; H = Hayling test; IED = Intra-Extra Dimensional Set Shift; LDD = Least Degree of Difference; SOC = Stockings of Cambridge; SSP = Spatial Span; SST = Stop Signal Task; SWM = Spatial Working Memory; TMT-A = Trail Making Task (part A); TMT-B = Trail Making Task (part B); WF = Word Fluency.

** = ≥ 2 Least Degree of Difference; * = ≥ 1 Least Degree of Difference.

Associations between length of employment and LDD. A series of correlations were run to explore the relationship between the number of total hours in employment and LDD of performance on the pen and paper measures, and the computerised cognitive-behavioural tasks. Bonferroni corrections were applied as twelve tests were being run, in order to avoid any Type 1 errors. This yielded a corrected significance level of .004.

Table 4.9 shows there were no significant correlations between the total number of hours in employment and LDD of the TMT (parts A and B), Word Fluency test, Hayling and Brixton Tasks and the IED, AST, SOC, SSP, SWM, AGN and SST CANTAB® tests.

Table 4.9

Correlations between total number of hours in employment and LDD of all tasks.

	Number of total hours in employment (*N* = 14)		
	r	r_s	*p*
TMT-A_LDD	-.305		.289
TMT-B_LDD	-.212		.466
WF_LDD	-.158		.589
H_LDD		.428	.127
B_LDD		.473	.088
IED_LDD	-.242		.404
AST_LDD	.131		.655
SOC_LDD	-.020		.946
SSP_LDD	-.061		.835
SWM_LDD	-.304		.291
AGN_LDD	-.291		.312
SST_LDD	-.290		.315

Note. AGN = Affective Go/No-go; AST = Attention Switching Task; B = Brixton test; H = Hayling test; IED = Intra-Extra Dimensional Set Shift; LDD = Least Degree of Difference; SOC = Stockings of Cambridge; SSP = Spatial Span; SST = Stop Signal Task; SWM = Spatial Working Memory; TMT-A = Trail Making Task (part A); TMT-B = Trail Making Task (part B); WF = Word Fluency.

Differences in self-reported executive function skills pre- and post-employment. Figure 4.1 shows the BRIEF-A *T*-scores for the group pre- and post-employment. The level of executive function impairment did not reach the clinical

significance threshold on any of the clinical subscales either pre- or post-employment. However, the Shift and Working Memory subscales had a *T*-score of more than one standard deviation above the mean, indicating that this group of adults with ASD self-reported higher levels of impairment in cognitive flexibility and working memory when compared with normative age expectations.

The differences between pre- and post-employment stages in self-reported BRIEF-A scores were also assessed. Paired samples t-tests were run on participant data. This was to assess the differences between the pre- and post-employment stages in self-reported Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory, Plan/Organise, Task Monitor, Organisation of Materials, BRI, MI or GEC scores. Bonferroni corrections were applied as twelve tests were being run, in order to avoid any Type 1 errors. This yielded a corrected significance level of .004. Table 4.10 shows there were no significant differences on the Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory, Plan/Organise, Task Monitor, Organisation of Materials, BRI, MI or GEC scores post-employment compared to pre-employment.

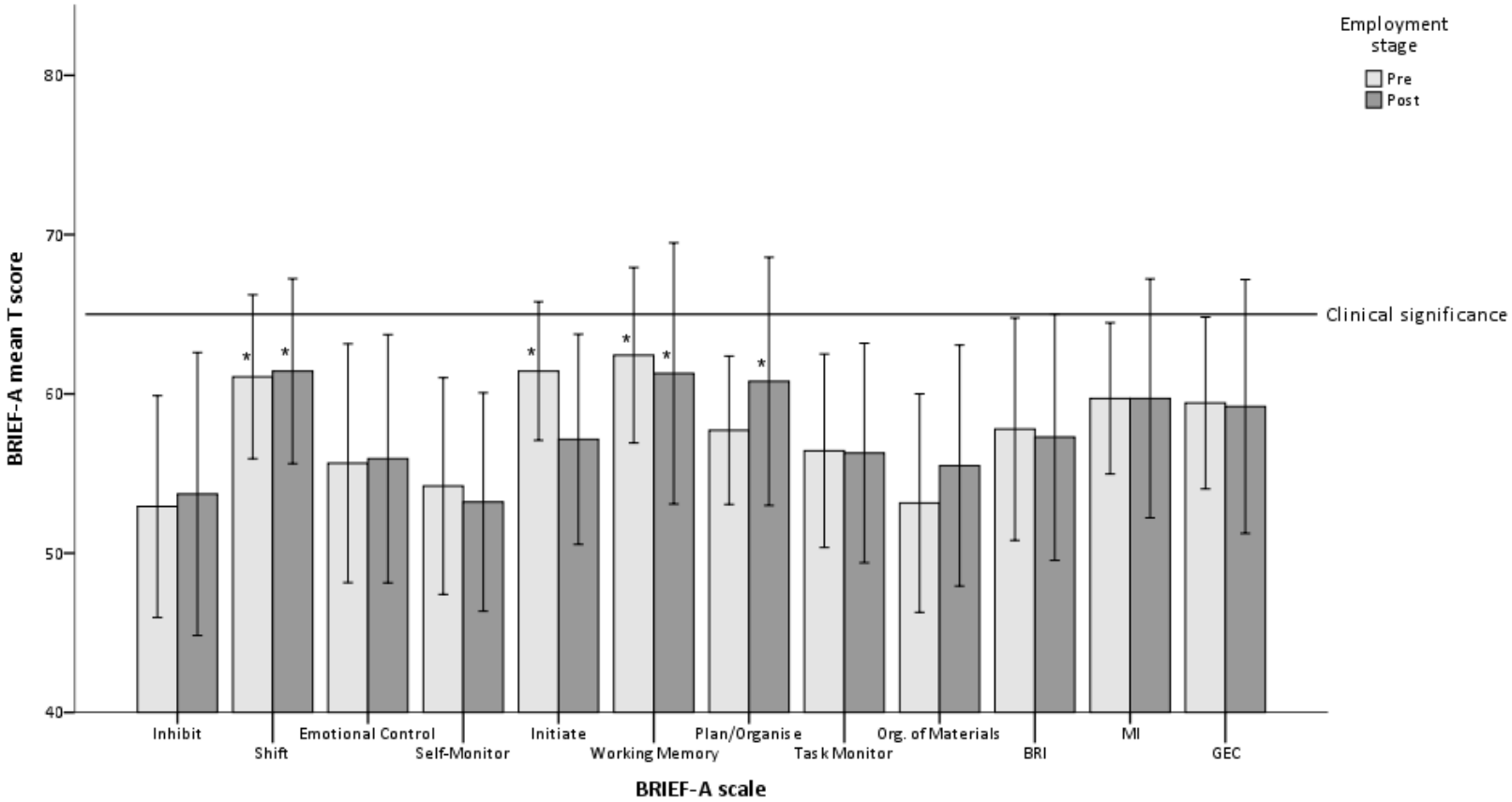

Figure 4.1. BRIEF-A self-report T-scores pre- and post-employment. Error bars represent standard error of the mean, with 95% confidence interval.
Note. BRI = Behavioural Regulation Index; MI = Metacognition Index; GEC = Global Executive composite.
*T-score is more than one standard deviation above the mean

Table 4.10

BRIEF-A self-report scores pre- and post-employment.

	Pre-employment (Σn = 14)			Post-employment (Σn = 14)					
	M	*SD*	Range	*M*	*SD*	Range	*df*	*t*	*p*
Inhibit	12.86	3.53	8-21	13.07	4.55	8-23	13	-.33	.749
Shift	11.21	2.08	8-15	11.29	2.37	7-14	13	-.15	.883
Emotional Control	17.71	5.69	10-28	17.93	5.98	10-28	13	-.29	.780
Self-Monitor	9.93	2.73	6-16	9.71	2.79	6-16	13	.32	.758
Initiate	15.43	2.21	11-19	14.14	3.48	8-19	13	1.82	.092
Working Memory	14.86	2.85	11-19	14.43	4.29	8-23	13	.55	.590
Plan/Organise	17.14	3.04	13-21	18.29	5.05	10-27	13	-1.45	.172
Task Monitor	10.43	2.28	6-14	10.43	2.62	7-14	13	.00	1.00
Org. of Materials	13.93	4.20	8-22	14.79	4.68	8-22	13	-1.08	.298
BRI	52.43	12.08	35-77	52.00	13.31	33-78	13	.24	.811
MI	71.79	10.71	49-90	72.07	17.66	44-100	13	-.09	.930
GEC	124.21	20.20	92-167	124.07	29.75	77-167	13	.03	.976

Note. Org. = Organisation; BRI = Behavioural Regulation Index; MI = Metacognition Index; GEC = Global Executive composite.

Differences in self-reported mental health pre- and post-employment. The differences between pre- and post-employment stages in self-reported mental health were assessed. Paired samples t-tests were run on participant data. This was to assess the differences between the pre- and post-employment stages in self-reported depression, anxiety, satisfaction with life and well-being. Table 4.11 shows there were no significant differences in depression, anxiety, satisfaction with life or well-being post-employment compared to pre-employment.

Table 4.11

Self-reported mental health of the group pre- and post-employment.

	Pre-employment (Σn = 14)			Post-employment (Σn = 14)					
	M	*SD*	Range	*M*	*SD*	Range	*df*	*t*	*p*
Depression	8.14	7.03	0-23	6.88	6.57	0-22	13	1.18	.260
Anxiety	4.93	4.41	0-16	4.79	3.40	0-12	13	.17	.867
Satisfaction with life	15.64	8.19	5-35	15.48	8.17	5-35	13	.16	.874
Well-being	42.97	7.91	28-57	44.78	11.77	29-70	13	-.73	.477

Cut-off scores for the depression, anxiety, satisfaction with life and well-being measures are presented in Table 4.12, as well as the number of participants who fell within each sub-category. The cut-off scores are the published norms for each measure. Pre-employment, 64.3% of participants reported some level of depression compared to 50.0% post-employment. In relation to anxiety, pre-employment, 42.8% of participants reported some level of anxiety compared to 50.0% post-employment. Only 21.3% of participants reported satisfaction with their life pre-employment and this figure remained unchanged at post-employment (21.3%). In addition, pre-employment, 7.1% of participants reported at or above levels of well-being compared to 35.7% post-employment.

Table 4.12

Cut-off scores for depression, anxiety, satisfaction with life and well-being by employment stage.

			Pre-employment (Σ*n* = 14)		Post-employment (Σ*n* = 14)	
	range	*cut-off*	*n*	%	*n*	%
Depression	0-27					
No depression		0-4	5	35.7	7	50.0
Mild depression		5-9	4	28.6	6	42.9
Moderate depression		10-14	2	14.3	1	7.1
Moderately severe depression		15-19	2	14.3	0	0.0
Severe depression		20+	1	7.1	0	0.0
Anxiety	0-21					
No anxiety		0-4	8	57.2	7	50.0
Mild anxiety		5-9	4	28.6	6	42.9
Moderate anxiety		10-14	1	7.1	1	7.1
Severe anxiety		15+	1	7.1	0	0.0
Satisfaction with life	5-35					
Extremely dissatisfied		5-9	3	21.5	4	28.6
Dissatisfied		10-14	3	21.5	3	21.5
Slightly dissatisfied		15-19	4	28.6	4	28.6
Neutral		20	1	7.1	0	0.0
Slightly satisfied		21-25	1	7.1	1	7.1
Satisfied		26-30	1	7.1	1	7.1
Extremely satisfied		31-35	1	7.1	1	7.1
Well-being	14-70	51 (mean)				
Below population mean		-	13	92.9	9	64.3
At or above population mean		-	1	7.1	5	35.7

Discussion

The study presented in this chapter assessed the mental health and executive functions of a group of adults with ASD at two time points: pre- and post-employment. The findings revealed: no significant differences in group performance on executive function tasks post-employment compared to pre-employment; no adult with ASD

demonstrated consistent meaningful improvement on executive function tasks post-employment compared to pre-employment; no significant differences in self-reported executive function skills post-employment compared to pre-employment; and similar depression, anxiety, satisfaction with life and well-being scores pre- and post-employment. The findings in this chapter confirm some of the research hypotheses initially stated and these will now be discussed.

The first research hypothesis predicted adults with ASD would perform better on executive function tasks after a period of employment (post-employment) compared to being unemployed (pre-employment). This is partially confirmed. Group differences showed adults with ASD performed no better on tasks post-employment compared to pre-employment. Individual differences showed the majority of participants demonstrated more improvements than declines across executive function tasks post-employment but no participant showed consistent meaningful progress across all executive function tasks. Whilst more improvements than declines in performance were observed on the TMT (part A), Word Fluency, the Brixton test and the SSP and SWM tests from CANTAB®, more declines than improvements in performance were observed on the IED, AST, SOC, AGN and SST tests from CANTAB®.

The second research hypothesis stated that adults with ASD would report lower levels of depression and anxiety, and higher levels of satisfaction with life and well-being after a period of employment (post-employment) compared to being unemployed (pre-employment). This was not confirmed as there were no significant differences in mental health post-employment compared to pre-employment. However, the majority of participants fell within the ‘no’ or ‘mild’ cut-offs for both depression and anxiety at both the pre- and post-employment stages, despite scoring low on satisfaction with life and well-being. Taken together, this suggests mixed findings exist depending on: whether group or individual differences are looked at; the heterogeneity within autism profiles; and the profile of adults with ASD who are currently enrolled in autism and employment services. These findings will now be further discussed in the context of each key finding.

Key finding 3: Individual differences show most participants demonstrated more improvements than declines across executive function tasks post-employment compared to pre-employment but no adult with ASD demonstrated consistent meaningful progress on executive function tasks after a period of employment.

<u>In other words:</u> Autistic adults show a varied profile of performance on executive function tasks. This highlights the heterogeneity of autism profiles and raises questions about how to apply this to employment practice.

The majority of participants showed more improvements than declines across all executive function tasks post- compared to pre-employment. However, when differences within each individual were assessed, no participant demonstrated consistent meaningful progress across executive function tasks post-employment. Also, as a group, there were no meaningful differences post- compared to pre-employment.

These findings highlight the uneven and varied cognitive profile of adults with ASD. In the present study, more improvements than declines in performance were observed on the TMT (part A), Word Fluency, the Brixton test and the SSP and SWM tests from CANTAB®. This suggests general improved performance on tasks assessing visual attention, verbal generativity, visuospatial sequencing and working memory post-employment but this could also reflect improvements via practice effects for some participants. Not all adults with ASD improved on these tasks and a minority showed more impaired performance post-employment. This lack of consistency means it cannot be reliably concluded that these executive function skills improve after a period of employment. Furthermore, more declines than improvements in performance were observed on the IED, AST, SOC, AGN and SST tests from CANTAB®. This suggests general impaired performance on tasks assessing cognitive flexibility, planning and response inhibition post-employment. Likewise, not all adults with ASD were impaired on these tasks and a minority showed improved performance post-employment. Moreover, no significant differences were found when assessing group performance. This lack of consistency also means it cannot be reliably concluded that these executive function skills decline after a period of employment.

The contrast within and between individuals, as well as between the individual and group levels highlight the heterogeneity frequently observed in autism. Heterogeneity means it is often difficult to predict outcomes, particularly when based on early presentation of ASD (Uljarevic et al., 2017). However, there now exists a growing awareness of the difficulty of behaviourally defined diagnoses, such as ASD, in understanding neurobiological or cognitive differences. For example, the current diagnostic criteria mean very different individuals can attain an autism diagnosis while not sharing many specific features. This is further complicated by the wide ranges of co-occurring psychiatric disorders, such as depression (26-70%), anxiety (12-36%), bipolar disorder (1-13%), OCD (6-18%) and schizophrenia (1-10%) in adults with ASD

(Chandrasekhar & Sikich, 2015; Croen et al., 2015; Moss et al., 2015; Russell et al., 2016) and these can contribute to the heterogeneity observed in autism. It could be that inconsistency across studies is to be expected and this is the norm rather than the exception (Lenroot & Yeung, 2013). Furthermore, the influence of cognitive ability and the qualitatively different coping strategies that adults with ASD may have developed over a lifetime can also mitigate the effects of ASD traits (Happé et al., 2016).

Previous researchers have attempted to identify whether the heterogeneity in autism can be classified as a gradient in severity or whether there are separate autism subgroups. This has also revealed mixed findings and a lack of distinct profiling has resulted in heterogeneity being associated with a gradient in the overall severity of ASD (Ring, Woodbury-Smith, Watson, Wheelwright, & Baron-Cohen, 2008). More recently, researchers have encouraged future studies to focus on individual differences, particularly in sensory features of autism, by using multidimensional, cross-disciplinary and longitudinal methods in order to increase our understanding of the individual variability observed in autism (Uljarevic et al., 2017). Interestingly, when a recent study suggested autism research is hindered by outcome measures being statistically modelled as separate dependent variables, a network analysis multivariate approach revealed social satisfaction and societal contribution were the strongest direct paths to subjective well-being (Deserno, Borsboom, Begeer, & Geurts, 2016). This style of research is perhaps most useful, not only for adults with ASD and the services they could access, but for a fundamental shift in autism research towards acceptance of difference. This shift is also reflected in the current social movement 'neurodiversity' where there is an understanding that individuals who are different bring a different perspective to existing and seemingly unsolvable problems. Baron-Cohen (2017) highlights how one feature of autism (such as good attention to detail) can either be seen as a social-cognitive deficit or a social-cognitive strength and encourages researchers to remain open-minded because of the heterogeneity within the diagnostic category of autism.

Essentially, the difficulties in mapping behavioural traits onto a biological trajectory means the complexities of autism may evade being captured using traditional methods. It could also be argued that this search is ultimately fruitless and that it is more effective to promote the positives of difference, as encouraged by the neurodiversity movement. This would impact the implementation of employment programmes for adults with ASD in a number of ways. For instance, the focus on acceptance could increase confidence and subjective well-being in adults with ASD. The focus on strengths, rather than deficits, at an individual level could increase our understanding of ASD. This is reflected in the present study where the findings showed no difference post- compared

to pre-employment at a group level but more detailed differences were revealed at an individual level. Although it may be time-intensive, it may be very worthwhile for an individual profile to be created of a potential employee with ASD. This profile could include tasks, similar to the ones used in the present study, but the findings could illustrate the 'spikes' in cognitive performance for each individual with ASD. This would help employers understand their employee's abilities in a much more personalised way. Also, promoting neurodiversity would draw attention to the co-occurring diagnoses that may exist in autism without necessarily trying to measure them. Finally, heterogeneity in autism means individual employment coaching is often necessary to mediate the relationships between the employee with ASD and the employer. This is to ensure the employer receives person-specific training and that the individual with ASD has necessary adjustments implemented. A key understanding of autism may be that the term 'spectrum' is highly apt – to describe the differences between individuals as well as within.

Key finding 4: Adults with ASD self-report similar depression, anxiety, satisfaction with life and well-being scores post-employment compared to pre-employment.

> *<u>In other words:</u> Autistic adults say their mental health changes little when they have just been through a period of employment. However, this could be because they already report few or no mental health problems pre-employment.*

The majority of adults with ASD in this study fell within the 'no' or 'mild' cut-offs for both depression and anxiety at both the pre- and post-employment stages, despite scoring low on satisfaction with life and well-being. This may help explain why there were so few differences in self-reported mental health post-employment compared to pre-employment. Previous research suggests prevalence of anxiety disorders is significantly higher in adults with ASD compared to adults without ASD (Russell et al., 2016; Schmidt et al., 2015), with 75% of respondents with ASD to an online survey reporting symptoms of depression and anxiety (Gotham et al., 2013). However, the present study shows the adults with ASD in this sample report few or no mental health problems both post- and pre-employment.

Adults with ASD in the present study were already enrolled in autism and employment services. This suggests a certain level of ability in initiating contact, and maintaining regular engagement, with a supported autism and employment programme. Previous research suggests adults with ASD have reported significantly higher levels of

perceived stress and a poorer ability to cope with everyday life stresses (Hirvikoski & Blomqvist, 2015). However, this may not have been the case for adults with ASD in the present study. The autism and employment programmes in the present study offer pre-employment support, through a mixture of workshops and individual mentoring support. For instance, Care Trade and NAS provide pre-employment workshops focusing on anxiety, confidence and social interaction in the workplace. AS Mentoring and Adjust Services provide personalised individual mentoring support and autism-specific employer training. Although the day-to-day activities of unemployed adults with ASD are unknown, it is known here that these participants were already engaged in some meaningful activity while technically unemployed. Also, the autism and employment services in which they were enrolled would have provided practical support around job applications and interviewing techniques. This could have further helped eliminate concerns around starting new employment. However, the fact that adults with ASD in the present study were already enrolled in autism and employment services suggests they were less hindered by concerns around starting new employment, perhaps than other unemployed adults with ASD might be.

Furthermore, the employers with which these participants were engaged would also have received support. This could either have been through specific autism and employment training or more informal mentoring support from a job coach. Either way, the underpinning support from autism and employment services suggests these employers knew they could access professional guidance quite easily. Previous research has shown many adults with ASD found it too difficult to hold down a job with half of the sample reporting workplace discrimination (Gotham et al., 2015). However, the support from autism and employment services in the present study means workplace discrimination may not have been a problem for the adults with ASD in the current study. This support means line managers and colleagues would have a better understanding of how to work with an employee with ASD and this could have also positively affected the self-reported mental health scores.

The lack of presence of co-occurring disorders could further explain the lower than expected levels of mental health problems in adults with ASD in the present study. The majority of adults with ASD reported no co-occurring diagnoses and this may have influenced the findings. Co-occurring disorders can often overshadow autism traits and can sometimes become the primary difficulty, meaning adults with ASD who are capable of working cannot effectively seek employment (Farley et al., 2009). However, if adults with ASD in the present study were already enrolled in autism and employment services then this suggests they were already effectively seeking employment. Whether this is a

cause or a consequence of few co-occurring diagnoses remains unclear but it does raise the possibility of a certain profile of a person with ASD enrolled in autism and employment services. This also means the generalisability of the findings may be somewhat limited.

Limitations. While addressing a number of issues in previous research, the present study has a number of its own limitations which must be addressed. First, the present study provided a relatively small sample of adults with ASD. It is also worth noting that the efforts involved in gaining this small sample meant it was unlikely a well-matched non-ASD group could also have been recruited within a suitable timeframe. A matched non-ASD group could have provided a useful comparison to establish the extent to which executive function and mental health difficulties impair everyday activities for adults with ASD and to also compare how scores would have been affected by repeated testing on these particular measures at the time scale used in the study. Also, the length of time in employment was very short for some participants. For example, one participant spent only eight days in employment and, together with the small sample size, meant it was unlikely that differences were found at the group analysis level post- compared to pre-employment. However, the study has provided a highly rich dataset for both before and after employment and the longitudinal approach allowed for a more detailed level of analysis over multiple time points. The sample size also reflects the low numbers of adults with ASD who are offered employment (Rosenblatt, 2008). Adults with ASD may need additional support to gain and maintain employment and relatively few autism and employment services exist. This meant the number of participants was low in this study in spite of the intense and extensive recruitment approach.

Second, as few autism and employment services exist, this meant each participant was less likely to have a choice regarding their preferred type of employment. For instance, some services were relying on their existing employment contacts where they could repeatedly place adults with ASD into work each year. This meant some participants were working in roles in which they had little experience or interest. This also meant it was difficult to account for the employment history for each individual in the study other than to ensure they were unemployed at the pre-employment stage, despite being enrolled in an autism and employment programme. Arguably, it may be more useful to look at a subjective person-environment fit (Henninger & Taylor, 2013) in future research but it is unclear how easily this approach could be mapped onto the reality of adults with ASD accepting employment roles which might not be entirely suitable.

Third, it is worth noting that only 28.6% of participants in the study met the autism referral criteria on the AQ-10. In the present study, participants' ASD diagnoses were

checked by the autism and employment services in which they were enrolled. However, this does raise questions around the reliability of the AQ-10. One possibility is that adults with ASD who have developed good coping strategies are able to manage traits of ASD more effectively and, therefore, are less inclined to give responses that indicate autistic characteristics. Another possibility relates to anxiety being an integral part of autism – the majority of participants in the present study fell within the 'no' or 'mild' cut-offs for anxiety at both the pre- and post-employment stages. This could reflect that some adults with ASD only demonstrate autistic behaviours when particularly stressed or anxious and, therefore, the AQ-10 would have been unlikely to pick up on autistic characteristics from participants in the present study. This could also help explain why a measure such as the Social Responsiveness Scale; SRS (Constantino et al., 2003) may be unable to distinguish between adults with ASD and adults with high anxiety (South & Rodgers, 2017). However, the present study does highlight the importance of future studies using the 'gold standard' Autism Diagnostic Observation Schedule-Generic; ADOS-G (Lord et al., 1999) and Autism Diagnostic Interview-Revised; ADI-R (Lord et al., 1994) wherever possible.

Finally, the ecological validity of the executive function tasks must be considered. It has been argued that there is a need for tasks which assess the interaction between the individual and the situation context far more (Burgess et al., 2006) and this could be a good approach in future research. For instance, a virtual reality assessment of executive functions (Jansari et al., 2014) could provide a more ecologically valid assessment, particularly when used in autism and employment research.

Conclusions

Chapter Four further investigated the effects of employment on mental health and extended its reach by focusing on executive functions. A small sample consisting of 14 adults with ASD completed a series of mental health measures and a mixture of self-report and cognitive-behavioural tasks assessing executive functions pre- and post-employment. The findings revealed: no significant differences in group performance on executive function tasks post-employment compared to pre-employment; no adult with ASD demonstrated consistent meaningful improvement on executive function tasks post-employment compared to pre-employment; no significant differences in self-reported executive function skills post-employment compared to pre-employment; and similar depression, anxiety, satisfaction with life and well-being scores pre- and post-employment. The findings

highlight the importance of: whether group or individual differences are looked at; the heterogeneity within autism profiles; and the profile of adults with ASD who are currently enrolled in autism and employment services. A certain profile of an adult with ASD may exist in autism and employment services e.g. fewer self-reported mental health problems than for some adults with ASD and this contrasts with the findings from Study One where adults with ASD reported higher levels of anxiety than adults with ASD in Study Two. Chapter Five will further investigate the relationship between employment and mental health (specifically anxiety) through Study Three. This will look at whether certain types of work characteristics relate to job satisfaction and anxiety for adults with ASD. This will be achieved by using a larger sample of adults with ASD and a non-ASD group matched closely on age and gender.

Chapter Five (Study Three): Work Characteristics, Job Satisfaction and Anxiety in Employed Adults with Autism Spectrum Disorder (ASD)

Overview of Chapter Five

In this study, participants completed an online survey which included measures assessing work characteristics, job satisfaction and anxiety. In total, 98 employed adults with ASD were matched across age and gender to a non-ASD group of 98 employed adults without ASD. Adults with ASD reported both lower levels of job satisfaction and higher levels of anxiety than their peers without ASD. Adults without ASD reported higher levels of job satisfaction the longer they stayed employed in their job but this was not seen in the ASD group. Importantly, social support predicted an increase in job satisfaction and a decrease in anxiety for adults with ASD. However, for adults without ASD, feedback from others predicted an increase in job satisfaction and a decrease in anxiety. Furthermore, work methods autonomy predicted an increase in job satisfaction and a decrease in trait anxiety, and work conditions predicted an increase in job satisfaction only for adults with ASD. Ergonomics predicted a decrease in trait anxiety only for adults without ASD. These findings are discussed with reference to: disparities in funding for employment support; the role of responsibility in accessing employment support; and uncertainty around outcomes with employment being a potential measure of social inclusion for adults with ASD.

Introduction

As discussed in Chapter One, employment for adults with autism spectrum disorder (ASD) is of legislative, clinical and financial concern. Few adults with ASD are in employment and the underlying reasons for this have been discussed to some extent although there exists a surprisingly low amount of academic literature on autism and employment. Chapter Three considered the mental health of adults with ASD who were employed or unemployed, whereas Chapter Four focused on the mental health and executive functions of adults with ASD pre- and post-employment. However, little is known about the relationship between the workplace environment and the mental health of adults with ASD who are presently employed. The following introduction will outline recent research concerning legislative changes in autism and employment; the impact

of these changes on workplace difficulties reported by adults with ASD; and the influence of social support as a workplace characteristic on the mental health of employed adults with ASD.

Recent legislative changes have drawn increasing attention to employment issues for adults with ASD over the last few years. The 'I Exist' campaign highlighted the lack of support for adults with ASD, with a third experiencing severe mental health problems as a result. It also found only 15% of adults with ASD were in full-time employment, despite many more being able and willing to work (Rosenblatt, 2008). As a result of this campaign, the Autism Act was passed as the first disability-specific law in England. The introduction of the Adult Autism Strategy in 2010 now means the National Health Service (NHS) and councils are obliged to provide relevant services for adults with ASD – including employment services. New statutory guidance also means the NHS and local authorities must include employment in needs assessments for adults with ASD.

These recent legislative changes around autism and employment have been brought to the attention of academics, policymakers and employers alike. These changes are important to consider because it is unclear to what extent they have helped adults with ASD gain and maintain employment. Possible reasons for this may include:

i) Disparities in funding. In 2007-2011, around 56% of United Kingdom autism research funding went towards projects in the areas of brain, biology and cognition while only 5% of funding went towards services for adults with ASD and their families (Pellicano et al., 2013). However, qualitative interviews and focus groups with adults with ASD and their parents have highlighted employment as a priority area for research (Pellicano et al., 2014b). Furthermore, of the 42 projects funded in 2014 from the £1.2 million government funded Innovation Fund, only ten (24%) were linked to employment. Considering the government's Access to Work scheme only provides support for individuals already in work (rather than pre-employment support), this means it may be more difficult to implement any legislative guidance, or support, until an adult with ASD is already in work and begins to struggle in the workplace.

ii) The role of responsibility. The Autism Act means the NHS and local authorities must now include employment in needs assessments for adults with ASD but it is unclear how this can be implemented. Presently, for an adult with ASD to access funded workplace support, they must contact Access to Work themselves and then support is arranged by a provider. However, this is problematic if adults with ASD

struggle with initiation and could mean many employees with ASD who face difficulties at work do not arrange for workplace support. This support is only provided for six months at a time with the support needing justifying at each point of renewal. This means it is unclear where responsibility lies for accessing employment support – whether at the point of funding allocation, needs assessments or with the individual with ASD themselves.

iii) Uncertainty around outcomes. An independent report showed the progress of the Adult Autism Strategy in helping adults with ASD into work was unclear (National Audit Office, 2012). However, it may be difficult to measure outcomes as few service evaluations have been published and the non-financial benefits to employment may be difficult to quantify (Howlin et al., 2005). If few adults with ASD are seen to be in employment, this may make it harder to justify funding applications for pre-employment support which, in turn, may be what is missing from successful employment outcomes.

Therefore, legislative guidance may be difficult for the NHS, local authorities and councils to implement as funded workplace support only exists for adults with ASD who are already employed and struggling in work. The lack of funded pre-employment support also means adults with ASD seeking employment may be even more vulnerable to negative workplace experiences because of social communication difficulties and this will now be discussed further.

Previous research has explored some of the underlying reasons for workplace difficulties experienced by adults with ASD. In a detailed qualitative study, Müller et al. (2003) identified four main themes as obstacles to successful employment. These included: the job application process itself, in terms of understanding how much detail to provide on application forms or difficulty initiating a job search; learning new job routines; communicating in the workplace including difficulties reading 'between the lines'; and social interactions such as knowing when to end a conversation or understanding small talk in the workplace. Some adults with ASD reported tolerating feeling different whereas other adults with ASD felt isolated and stigmatised. However, all participants knew the difficulties with social interaction were hindering them from succeeding at work even when they fulfilled their job description, although it is unknown to what extent this affected their mental health.

Difficulties around social interaction in the workplace have also been reported in other studies (Mawhood & Howlin, 1999). These include problems such as inappropriate dress, talking too much or too little, associated anxiety and demonstrating rigidity rather

than adjusting to the demands of the job itself. However, the extent to which these are linked to poorer employment outcomes for adults with ASD is not fully understood. Previous research from the United States has shown that many adults with ASD who are employed earn less and work fewer hours than those in the general population (Burgess & Cimera, 2014; Cimera & Cowan, 2009). Poor outcomes for employed adults with ASD were also found within a study run in Australia which showed over twice as many employed adults with ASD were overqualified for their jobs when compared to the typical population. Employed adults with ASD were also found to be underrepresented in senior or managerial positions within companies (Baldwin et al., 2014). Interestingly, the authors found that earning money did not make a difference to adults with ASDs' perceptions of job satisfaction. This suggests employment does offer adults with ASD the opportunity to apply their knowledge, skills and interests within a workplace environment where the job itself has intrinsic value and the rewards are not only financial.

Further positive findings have also emerged from studies and some employers have rated their employees with ASD highly on punctuality, knowing the job, starting a task when asked, reliability and following directions (Hillier et al., 2007). However, the same employers noted employees with ASD struggled with asking for help, checking over work for mistakes and moving independently onto a new task. In the same study, participants with ASD reported slightly different difficulties in the workplace such as problems socialising outside of work with colleagues and struggling to make friends in the workplace. High levels of job satisfaction and happiness were also reported by participants with ASD although these decreased over time, possibly due to the job becoming less challenging. However, co-workers spoke positively of employees with ASDs' adherence to rules, attention to detail, honesty and reliability. This enhanced perceptual capacity (Remington, Swettenham, Campbell, & Coleman, 2009) resulting in excellent attention to detail has also been promoted by some autism and employment services (e.g. Auticon) as a unique trait to encourage employers to offer employment to adults with ASD.

Previous research shows adults with ASD report both positive and negative workplace experiences. Funded workplace support is time-limited and, for those who do struggle in the workplace, unlikely to be a long-term solution. This means more attention must be placed on the characteristics of the workplace environment in order to uncover why some employed adults with ASD report positive experiences and others negative experiences. Higher levels of employment success have been observed in autism and employment services such as Project SEARCH plus ASD Supports (Wehman et al., 2014). Project SEARCH is a North American internship model where young adults with

developmental disabilities are placed in work embedded within the community e.g. within a business in the community. Possible reasons for its success include close collaboration between the administration team, classroom and the business with highly trained staff specific to the needs of individuals with ASD. High levels of job retention have also been confirmed when there have been high levels of commitment from management to employing the individual with ASD (Wehman et al., 2016).

Therefore, different workplaces have differing effects for adults with ASD and, more specifically, workplace characteristics (such as social support, given the difficulties adults with ASD report around workplace social interaction) could be linked to mental health more for adults with ASD than for adults without ASD. The findings from Chapter Three revealed employed adults with ASD simultaneously reported higher levels of depression and anxiety than their work colleagues without ASD but also higher levels of satisfaction with life (and well-being in Study 1a in the more 'pure' group) than their unemployed peers with ASD. Since many adults with ASD may have found employment with little or no pre-employment support, these findings suggest it is crucial to consider mental health in the workplace for employed adults with ASD. This is because employed adults with ASD may face a double disadvantage. First, a lack of pre-employment support which may hinder adults with ASD from seeking suitable employment and, second, social communication difficulties which could make accessing funded workplace support particularly difficult. This means workplace characteristics must be considered in the context of mental health for adults with ASD, as these may influence positive or negative employment outcomes. Therefore, the research hypotheses for the current study were:

1. Employed adults with ASD will report lower levels of job satisfaction and higher levels of anxiety than employed adults without ASD.

2. Social support and workplace conditions will be associated with higher levels of job satisfaction and lower levels of anxiety for employed adults with ASD and this effect will be greater than for employed adults without ASD.

Method

This study was undertaken in two identical parts. First, data were collected between September 2012 and October 2013 as part of an MSc study based in the

Institute of Management Studies (IMS) at Goldsmiths, University of London[7]. Second, data were collected between August 2014 and July 2016 as part of the present PhD, to significantly expand the dataset and also to include a well-matched non-ASD group[8].

Participants. In the first wave of data collection, participants with ASD were recruited from the National Autistic Society. In the second wave of data collection, participants with ASD were recruited from the National Autistic Society, an autism participant database previously held at Goldsmiths, Network Autism, Asperger United and regional autism social groups, Research Autism, Care Trade, AS Mentoring, Genius Within, Autism West Midlands, Auticon and Resources for Autism.

Participants without ASD were recruited in the second wave of data collection. Various websites were used to advertise the study including Twitter, Reddit, Facebook, Craigslist, LinkedIn and Call for Participants. Various universities also helped distribute the study including Birmingham City University, University of Bradford, University of Bristol, University of Cambridge, Goldsmiths, University of Kent, School of Oriental and African Studies, University of Edinburgh, University of Oxford, University of Portsmouth and University of Warwick.

A total of 275 participants (age 18 years and above) took part in the online survey. In the second wave of data collection (i.e., during the time course of the current thesis) 87.8% of the sample was collected. Specifically, 78 (35.5% of the total sample) adults with ASD and 115 (52.3% of the total sample) adults without ASD completed the online survey.

Matching procedure. A non-ASD group matched on age and gender was considered essential to provide a comparison for the employment experiences of adults with ASD. From the total sample, 24 participants (8.7%) were removed for failing to answer if they had an ASD diagnosis; 20 (7.3%) for duplicating previously completed responses; ten (3.6%) due to large amounts of missing data; and one (0.4%) for not being in employment. This left a total of 220 participants. Of these, 196 were included in the study as 98 participants with ASD could be matched across age and gender to 98 participants without ASD. This left seven participants with ASD who could not be matched and, therefore, were left out of the dataset. When matching across age, all participants were matched within two years of their age. When matching across gender,

[7] This was supervised by Professor Elisabeth Hill.
[8] However, all work submitted in this thesis (including in the present study) has been analysed, written and expressed as new research, rather than replicating any previous or existing material.

male or female participants were matched exactly to either males or females. There were no significant differences in groups between age, ($t(194) = -.16$, $p = .874$) and gender ($\chi^2(1) = .00$, $p = 1.000$). Participant characteristics for the sample are shown in Table 5.1.

Table 5.1

Participant characteristics of the sample.

		ASD group (Σn = 98)		Matched non-ASD group (Σn = 98)	
		n	%	*n*	%
Gender	Male	55	56.1	55	56.1
	Female	43	43.9	43	43.9
Age (years)	Mean (*SD*; range)	98	39.5 (13.3; 19-69)	98	39.8 (12.8; 19-67)
Additional diagnoses (self-defined)*	Sch.spectrum disorders			0	0.0
	Bipolar and related disorders			1	1.0
	Depressive disorders			5	5.0
	Anxiety disorders			4	4.0
	Obs. compulsive disorders			0	0.0
	Trauma-related disorders			1	1.0
	Feeding and eating disorders			1	1.0
	Neurocognitive disorders			0	0.0
	Neurodevelopmental disorders			0	0.0
	None			79	78.2
	Missing	98	100.0	10	9.8

		ASD group (Σn = 98)		Matched non-ASD group (Σn = 98)	
		n	%	*n*	%
Length of employment in current job (months)	Mean (*SD*; range)	95	75.2 (93.7; 1-420)	95	81.7 (90.7; 1-420)
	Missing	3		3	
Number of unplanned absences from job in last month (days)	0 days	66	67.3	52	53.1
	1 day	5	5.1	14	14.3
	2 days	6	6.1	7	7.1
	3 to 4 days	2	2.0	14	14.3
	5 to 10 days	4	4.1	6	6.1
	10 or more days	8	8.2	0	0.0
	Missing	7	7.2	5	5.1

Note. Obs. = obsessive; Sch. = schizophrenia.

* These additional diagnoses total more than the total number of participants as some participants reported more than one additional diagnoses. This information was only collected for the non-ASD group and the categories are taken from the DSM-V (American Psychiatric Association, 2013).

Materials. Data were collected through an online survey accessed via Bristol Online Surveys. The survey contained open-ended and closed questions regarding background information and included a variety of other published measures which are shown in Table 5.2. These measures were carefully chosen to ensure questions were clear and to try and fully explore job satisfaction and the role of anxiety in the workplace (see Chapter Two for a more detailed discussion around methodological issues). Permission was sought for the published measures to be used in an online survey and are listed in the 'Measures' column of Table 5.2.

Table 5.2

Details of materials used in the online survey.

Demographic information and diagnoses *(open-ended questions)*	Measures *(closed questions)*
Age	WDQ (Morgeson & Humphrey, 2006)
Gender	JSS (Warr, Cook, & Wall, 1979)
ASD diagnosis	STAI (Spielberger, 1983)
Any other diagnosed physical, mental, developmental, neurological or medical disorders	
Duration of time in current job in months	
Number of days absent from job in the last month	

Note. JSS = Job Satisfaction Scale; STAI = State Trait Anxiety Inventory for Adults; WDQ = Work Design Questionnaire.

Further details of the measures are provided below:

The Work Design Questionnaire; WDQ (Morgeson & Humphrey, 2006). This is a 77-item questionnaire developed to provide a comprehensive assessment of work characteristics. The WDQ has been validated with 540 incumbents holding 243 distinct jobs and shows excellent reliability and validity. Respondents are presented with items relating to four types of work characteristics: Task Characteristics (24 items), Knowledge Characteristics (20 items), Social Characteristics (19 items) and Work Context (14 items). Each work characteristic has been divided into separate work characteristic

scales. Task Characteristics contains Work Scheduling Autonomy, Decision-Making Autonomy, Work Methods Autonomy, Task Variety, Task Significance, Task Identity and Feedback From Job. Knowledge Characteristics contains Job Complexity, Information Processing, Problem Solving, Skill Variety and Specialisation. Social Characteristics contains Social Support, Interdependence, Interaction From Outside Organisation and Feedback From Others. Work Context contains Ergonomics, Physical Demands, Work Conditions and Equipment Use. Each separate scale has between three and six related statements. There were five response categories: 'strongly disagree'; 'somewhat disagree'; 'neither agree or disagree'; 'agree'; and 'strongly agree'. All three of the Job Complexity items, one of the Work Context items and one of the Ergonomics items were reverse scored. The pro-rated means of each separate work characteristic scale could then be compared, with higher scores indicating higher agreement with that particular work characteristic. Table 5.3 gives two examples of items from each work characteristic.

Table 5.3

Examples of items from the Work Design Questionnaire (Morgeson & Humphrey, 2006).

Work characteristic	Work characteristic scale	Item examples
Task Characteristics	Work Scheduling Autonomy	'The job allows me to make my own decisions about how to schedule my work'.
		'The job allows me to decide on the order in which things are done on the job'.
	Decision Making Autonomy	'The job gives me a chance to use my personal initiative or judgment in carrying out the work'.
		'The job allows me to make a lot of decisions on my own'.
	Work Methods Autonomy	'The job allows me to make decisions about what methods I use to complete my work'.
		'The job gives me considerable opportunity for independence and freedom in how I do the work'.
	Task Variety	'The job involves a great deal of task variety'.
		'The job involves doing a number of different things'.
	Task Significance	'The results of my work are likely to significantly affect the lives of other people'.
		'The job itself is very significant and important in the broader scheme of things'.
	Task Identity	'The job involves completing a piece of work that has an obvious beginning and end'.

Work characteristic	Work characteristic scale	Item examples
		‘The job is arranged so that I can do an entire piece of work from beginning to end’.
	Feedback From Job	‘The work activities themselves provide direct and clear information about the effectiveness (e.g., quality and quantity) of my job performance’.
		‘The job itself provides feedback on my performance’.
Knowledge Characteristics	Job Complexity	‘The job requires that I only do one task or activity at a time’.
		‘The tasks on the job are simple and uncomplicated’.
	Information Processing	‘The job requires me to monitor a great deal of information’.
		‘The job requires that I engage in a large amount of thinking’.
	Problem Solving	‘The job involves solving problems that have no obvious correct answer’.
		‘The job requires me to be creative’.
	Skill Variety	‘The job requires a variety of skills’.
		‘The job requires me to utilise a variety of different skills in order to complete the work’.
	Specialisation	‘The job is highly specialised in terms of purpose, tasks, or activities’.
		‘The tools, procedures, materials, and so forth used on this job are highly specialised in terms of purpose’.

Work characteristic	Work characteristic scale	Item examples
Social Characteristics	Social Support	‘I have the opportunity to develop close friendships in my job’.
		‘I have the chance in my job to get to know other people’.
	Initiated Interdependence	‘The job requires me to accomplish my job before others complete their job’.
		‘Other jobs depend directly on my job’.
	Received Interdependence	‘The job activities are greatly affected by the work of other people’.
		‘The job depends on the work of many different people for its completion’.
	Interaction Outside Organisation	‘The job requires spending a great deal of time with people outside my organisation’.
		‘The job involves interaction with people who are not members of my organisation’.
	Feedback From Others	‘I receive a great deal of information from my manager and co-workers about my job performance’.
		‘Other people in the organisation, such as managers and co-workers, provide information about the effectiveness (e.g. quality and quantity) of my job performance’.
Work Context	Ergonomics	‘The seating arrangements on the job are adequate (e.g. ample opportunities to sit, comfortable chairs, good postural support)’.

Work characteristic	Work characteristic scale	Item examples
		'The work place allows for all size differences between people in terms of clearance, reach, eye height, leg room, etc.'
	Physical Demands	'The job requires a great deal of muscular endurance'.
		'The job requires a great deal of muscular strength'.
	Work Conditions	'The work place is free from excessive noise'.
		'The climate at the work place is comfortable in terms of temperature and humidity'.
	Equipment Use	'The job involves the use of a variety of different equipment'.
		'The job involves the use of complex equipment or technology'.

The Job Satisfaction Scale; JSS (Warr et al., 1979). This is a 16-item questionnaire designed to assess job satisfaction levels in employees. The scale is a sub-scale of the Work and Life Attitudes Survey (Warr et al., 1979) and was deemed more comprehensive than the one used in Morgeson and Humphrey (2006). This is because using the same source of data for both work characteristics and job satisfaction might inflate the relationships between them (Morgeson & Humphrey, 2006). The scale has been shown to be factorially separate with good internal reliability. Respondents are presented with items relating to job satisfaction including work conditions, fellow workers, recognition, hours of work, rate of pay and job security. There were seven response categories: 'extremely dissatisfied'; 'very dissatisfied'; 'moderately dissatisfied'; 'not sure'; 'moderately satisfied'; 'very satisfied'; and 'extremely satisfied'. None of the items were negatively scored. The items were summated to form a job satisfaction score with higher scores indicating higher levels of job satisfaction. Table 5.4 gives examples of items from this measure.

Table 5.4

Examples of items from the Job Satisfaction Scale (Warr et al., 1979).

Measure	Item examples
Job Satisfaction Scale; JSS	'The physical work conditions'.
	'Your fellow workers'.
	'The recognition you get for good work'.
	'The amount of responsibility you are given'.

The State Trait Anxiety Inventory for Adults; STAI (Spielberger, 1983). This is a 40-item questionnaire designed to assess anxiety levels in adults. The STAI has high levels of reliability and has been used to assess present (state) feelings of anxiety and general (trait) feelings of anxiety (see Chapter Two for a more detailed discussion around this measure). Responses for the state and trait scales are summated separately, ranging from a minimum of 20 to a maximum of 80, with higher scores indicating higher levels of anxiety. Ten items on the state scale and eleven items on the trait scale are reverse scored. Table 5.5 gives examples of items from this measure.

Table 5.5

Examples of items from the State Trait Anxiety Inventory for Adults (Spielberger, 1983)

STAI scale	Item examples
State	'I feel calm'.
	'I feel secure'.
Trait	'I feel pleasant'.
	'I feel satisfied with myself'.

Procedure. The study received ethical approval from the Research Ethics Committee of the IMS in the first wave of data collection. In the second wave, ethics approval was given by the Research Ethics Committee at the Department of Psychology, Goldsmiths.

In both waves of data collection the online survey link for the study could be accessed openly. This was distributed via email amongst potential participants and displayed on various websites assisting with the research study and listed in the 'Participants' section. The information sheet and consent form were embedded in the first page of the survey. Consent was taken when participants confirmed they had read the consent page by clicking their agreement. This meant participants understood their contribution was voluntary, anonymous and they could leave the study at any time without giving a reason. Participants were given full researcher contact details at the beginning and end of the survey and there was the option to leave an email address if the participant believed they had completed the questionnaire before. A paper version of the survey was also printed out and some participants (for instance, some individuals through Asperger United or the social groups) completed the survey in this format.

Data analysis. The first independent variable was group (ASD or matched non-ASD). The second independent variable was work characteristics (WDQ subscales) which were used as predictor variables in the multiple regressions. The three dependent variables were job satisfaction, state anxiety and trait anxiety.

All analyses used SPSS version 22. Data for the work characteristics, job satisfaction and anxiety scales were pro-rated to deal with any missing values. The dataset was checked for distribution normality across both levels of the independent variable (group) using the Shapiro-Wilk test. This revealed the job satisfaction ($p < .050$) and trait anxiety ($p < .050$) data were not normally distributed (so the medians are reported) but the state anxiety ($p > .050$) data were (so the means are reported).

Homogeneity of variance was also checked across the group level using a non-parametric Levene's Test for Equality of Variances for the job satisfaction (p = .383), trait anxiety (p = .605) and a parametric Levene's Test for the state anxiety (p = .685) data. This showed the assumption of equality of variances could be met for the dataset. All outliers remained in the analysis as discussed in Chapter Three.

First, Mann-Whitney U tests and an independent samples t-test were run on all participant data. This was to assess the differences between the ASD group and the matched non-ASD group in levels of job satisfaction, state anxiety and trait anxiety.

Second, a series of Spearman's rank-order correlations were run on the ASD data and matched non-ASD data separately to explore the relationships between length of employment in current job, job satisfaction, state anxiety and trait anxiety. This was to explore any differences between the ASD group and the matched non-ASD group in the potential influence of length of employment on job satisfaction, state anxiety and trait anxiety.

Third, a series of multiple linear regressions were calculated for the ASD group and matched non-ASD group to assess job satisfaction, state anxiety and trait anxiety based on work characteristics from the WDQ. This was to assess differences between the ASD group and the matched non-ASD group in work characteristics which increase job satisfaction and reduce state anxiety and trait anxiety.

Results

Differences in job satisfaction, state anxiety and trait anxiety between the ASD and matched non-ASD group. Two Mann-Whitney U tests and one independent samples t-test were run on all participant data. This was to assess the differences between the ASD group and the matched non-ASD group in levels of job satisfaction, state anxiety and trait anxiety. Bonferroni corrections were applied as three tests were being run, in order to avoid any Type 1 errors. This yielded a corrected significance level of .02. The results are reported in Table 5.6 with significant findings highlighted in dark grey.

The second independent variable (WDQ subscales) was only considered as a predictor variable to assess job satisfaction, state anxiety and trait anxiety in the multiple linear regressions. There are 21 subscales on the WDQ and multiple linear regression was chosen as a method of modelling the relationship between the dependent variables

(job satisfaction, state anxiety and trait anxiety) and work characteristics. This was considered exploratory in nature as all relationships were to be explored between work characteristics and job satisfaction, state anxiety and trait anxiety. These are reported further in Tables 5.9 to 5.14.

Table 5.6

Differences in job satisfaction, state anxiety and trait anxiety between the ASD and matched non-ASD group.

	ASD group (Σn = 98)			Matched non-ASD group (Σn = 98)					
	M	*SD*	Range	*M*	*SD*	Range	*df*	*t*	*p*
JSS	67.45	17.63	30-99	81.23	15.66	31-101	194	2525.50 (*U)*	< .001
STAI-s	46.35	14.48	20-80	36.12	9.76	20-67	194	5.80	< .001
STAI-t	52.58	14.48	25-76	40.95	10.21	22-78	194	2523.00 (*U)*	< .001

Note. JSS = job satisfaction; STAI-s = state anxiety; STAI-t = trait anxiety.

Analyses were run on the total scores for each measure. Job satisfaction was greater for participants without ASD (*Mdn* = 85) than for participants with ASD (*Mdn* = 71), *U* = 2525.50, $p < .001$, $r = .41$. State anxiety was greater for participants with ASD (*M* = 46.35, *SD* = 14.48) than participants without ASD (*M* = 36.12, *SD* = 9.76), $t(194) = 5.80$, $p < .001$, $d = 0.83$. Trait anxiety was also greater for participants with ASD (*Mdn* = 52) than participants without ASD (*Mdn* = 40), *U* = 2523.00, $p < .001$, $r = .41$. The influence of the second independent variable (WDQ subscales) was only considered as a predictor variable in the multiple linear regressions, as reported in Tables 5.9 to 5.14.

Associations between length of employment in current job, job satisfaction, state anxiety and trait anxiety between the ASD and matched non-ASD group. A series of Spearman's rank-order correlations were run on the ASD data and matched non-ASD data separately to explore the relationships between length of employment in current job, job satisfaction, state anxiety and trait anxiety. Correlations between the WDQ, job satisfaction, state anxiety and trait anxiety were used only to establish predictors for the multiple linear regressions and these are reported further in Table 5.8. As many correlations were run in this exploratory analysis, an alpha level of .01 was set as an attempt to avoid any Type 1 errors. All significant correlation results are also interpreted with caution.

Relationships between length of employment in current job, job satisfaction, state anxiety and trait anxiety in the ASD and matched non-ASD group. For the ASD participants, there were significant correlations between job satisfaction and state anxiety (r_s = -.51, p < .001) and job satisfaction and trait anxiety, (r_s = -.52, p < .001). The higher the job satisfaction reported by ASD participants, the lower their state and trait anxiety. There was also a significant correlation between state anxiety and trait anxiety (r_s = .82, p < .001). The more state anxiety reported by ASD participants, the more trait anxiety reported. For the matched non-ASD participants, there were significant correlations between length of employment in current job and job satisfaction (r_s = .31, p = .002). The longer matched non-ASD participants had been employed, the higher their job satisfaction. There was also a significant correlation between job satisfaction and trait anxiety (r_s = -.29, p = .004). The higher the job satisfaction reported by matched non-ASD participants, the lower their trait anxiety. Finally, there was a significant correlation between state anxiety and trait anxiety (r_s = .71, p < .001). The more state anxiety reported by matched non-ASD participants, the more trait anxiety reported. These findings are summarised in Table 5.7 and shown in Figure 5.1.

Table 5.7

ASD and matched non-ASD participants: Correlations of length of employment in current job, job satisfaction, state anxiety and trait anxiety

	State anxiety		Job satisfaction		Length of employment in current job (months)	
	ASD	Matched non-ASD	ASD	Matched non-ASD	ASD	Matched non-ASD
Trait anxiety	.82*	.71*	-.52*	-.29*	-.06	-.02
State anxiety			-.51*	-.23	-.10	.03
Job satisfaction					-.04	.31*

* p < .01

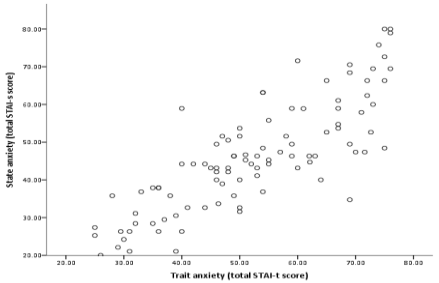

Figure 5.1a. ASD: Scatterplot showing trait anxiety correlated with state anxiety (r_s = .82, p < .001)

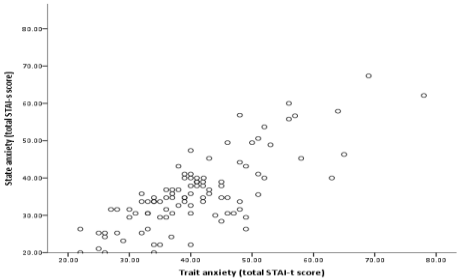

Figure 5.1b. Non-ASD: Scatterplot showing trait anxiety correlated with state anxiety (r_s = .71, p < .001)

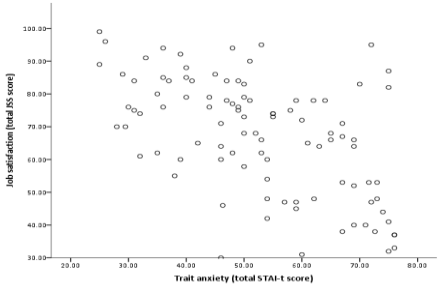

Figure 5.1c. ASD: Scatterplot showing trait anxiety correlated with job satisfaction (r_s = -.52, p < .001)

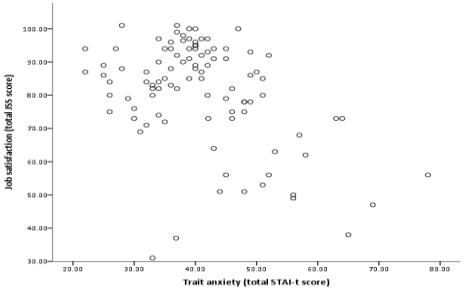

Figure 5.1d. Non-ASD: Scatterplot showing trait anxiety correlated with job satisfaction (r_s = -.29, p = .004)

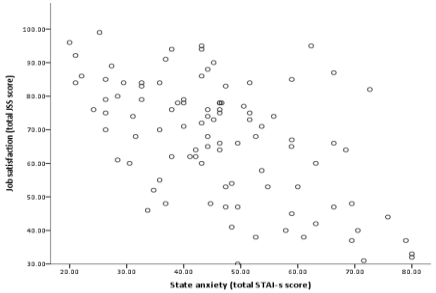

Figure 5.1e. ASD: Scatterplot showing state anxiety correlated with job satisfaction (r_s = -.51, p < .001)

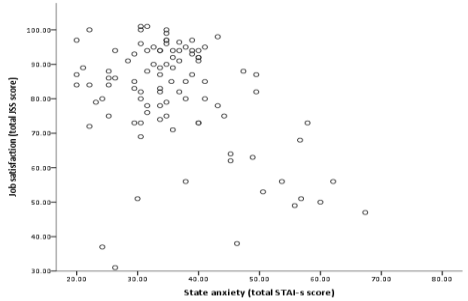

Figure 5.1f. Non-ASD: Scatterplot showing state anxiety correlated with job satisfaction (r_s = -.23, p = .026)

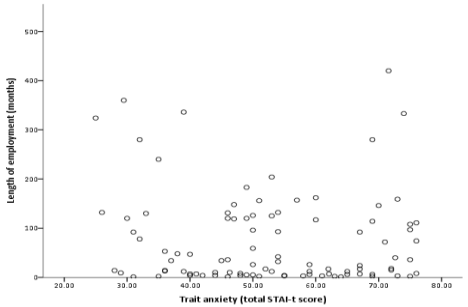

Figure 5.1g. ASD: Scatterplot showing trait anxiety correlated with length of employment (r_s = -.06, p = .567)

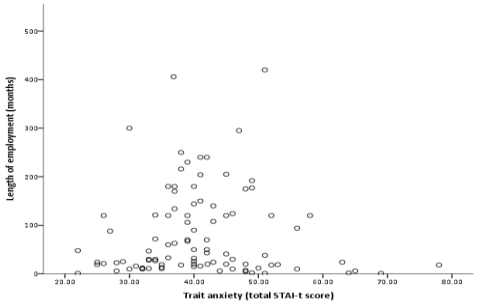

Figure 5.1h. Non-ASD: Scatterplot showing trait anxiety correlated with length of employment (r_s = -.02, p = .872)

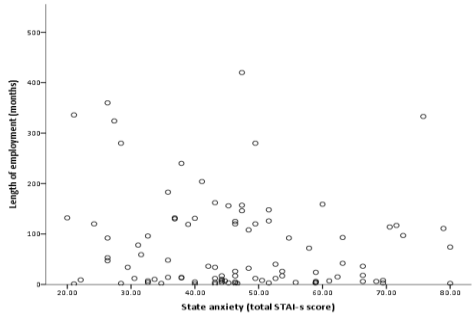

Figure 5.1i. ASD: Scatterplot showing state anxiety correlated with length of employment (r_s = -.10, p = .345)

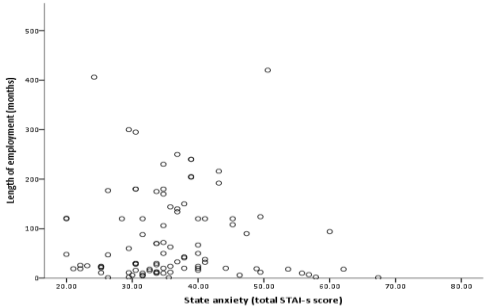

Figure 5.1j. Non-ASD: Scatterplot showing state anxiety correlated with length of employment (r_s = .03, p = .795)

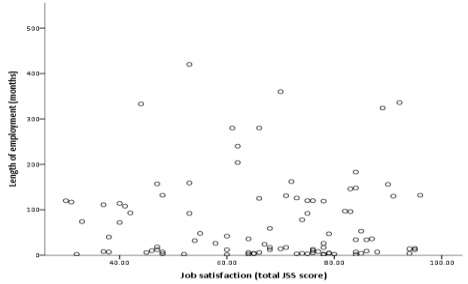

Figure 5.1k. ASD: Scatterplot showing job satisfaction correlated with length of employment (r_s = -.04, p = .672)

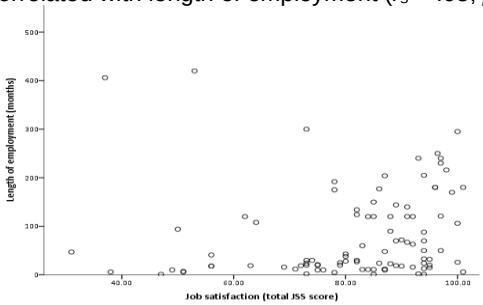

Figure 5.1l. Non-ASD: Scatterplot showing job satisfaction correlated with length of employment (r_s = .31, p = .002)

Figure 5.1. Scatterplots showing Spearman's rank-order correlations of length of employment, job satisfaction, state anxiety and trait anxiety in ASD and matched non-ASD participants.

Predictors of job satisfaction, state anxiety and trait anxiety for the ASD and matched non-ASD group. A series of multiple linear regressions, using the 'enter' regression method for all analyses, were calculated for the ASD and matched non-ASD groups to assess job satisfaction, state anxiety and trait anxiety based on work characteristics. The data were checked for linearity (using scatterplots), multicollinearity (using the variance inflation factors), homoscedasticity and normality of residuals (using scatterplots and histograms) to ensure any assumptions were not violated.

In order to decide which work characteristics were to be included as predictor variables in the multiple regression, a series of correlations was run to identify any significant associations between each work characteristic, job satisfaction, state anxiety and trait anxiety. Where significant correlations were seen with job satisfaction, state anxiety and trait anxiety, the relevant work characteristics were then included as predictors in the multiple regressions. These were uncorrected as the correlations were not stand-alone analyses to be reported but only used as an indication of which predictor variables should be included in the regression models:

1. Up to six significant predictor variables were included in each regression, with the most highly significant variables taking priority.

2. If there were more than six significant variables then up to four of the most highly significant variables from Task Characteristics and Social Characteristics and up to one of the most highly significant variables from Work Context and Knowledge Characteristics were chosen. More emphasis was placed on the importance of Task Characteristics and Social Characteristics in these analyses. This was deduced from clinical knowledge based on previous observations in supporting adults with ASD into employment as adults with ASD are often highly sensitive to the social environment of the workplace and also the clarity with which tasks are designated and completed. These were hypothesised in line with clinical knowledge being constructed from communication, opinions and experience (Malterud, 2001).

3. If there were more than four significant variables from Task Characteristics and Social Characteristics, then the predictor variables with the greatest coefficients across both of these areas took priority to be included. However, both Task Characteristics and Social Characteristics were looked at in relation to the sub-areas within them. For instance, the area Task Characteristics has three sub-areas relating to Autonomy, Task elements and Feedback From Job. Therefore,

up to two of the most highly significant variables were included from each sub-area with variables with the greatest coefficients taking priority to be included. This was to ensure predictor variables did not overlap and that a full range of work characteristics was considered in the analysis.

The final work characteristics chosen as predictor variables are highlighted in dark grey in Table 5.8. It is worth noting that the predictor variables for the ASD group and matched non-ASD group were different.

Table 5.8

ASD and matched non-ASD participants: Correlations of work characteristics, job satisfaction, state anxiety and trait anxiety.

		Job satisfaction		State anxiety		Trait anxiety	
		ASD	Matched non-ASD	ASD	Matched non-ASD	ASD	Matched non-ASD
Task Characteristics	Work Scheduling Autonomy	r_s = .38, p < .001	r_s = .16, p = .120	r_s = -.22, p = .032	r_s = -.27, p = .006	r_s = -.37, p < .001	r_s = -.26, p = .011
	Decision Making Autonomy	r_s = .49, p < .001	r_s = .17, p = .090	r_s = -.24, p = .017	r_s = -.30, p = .003	r_s = -.39, p < .001	r_s = -.23, p = .023
	Work Methods Autonomy	r_s = .54, p < .001	r_s = .17, p = .105	r_s = -.28, p = .005	r_s = -.23, p = .024	r_s = -.46, p < .001	r_s = -.20, p = .052
	Task Variety	r_s = .36, p < .001	r_s = .20, p = .046	r_s = -.08, p = .454	r_s = -.29, p = .003	r_s = -.26, p = .017	r_s = -.21, p = .036
	Task Significance	r_s = .34, p = .001	r_s = .04, p = .671	r_s = -.12, p = .235	r_s = -.24, p = .018	r_s = -.20, p = .044	r_s = -.30, p = .003
	Task Identity	r_s = .33, p = .001	r_s = -.18, p = .072	r_s = -.19, p = .066	r_s = -.11, p = .289	r_s = -.20, p = .054	r_s = -.11, p = .299
	Feedback From Job	r_s = .44, p < .001	r_s = .18, p = .072	r_s = -.08, p = .429	r_s = -.17, p = .087	r_s = -.24, p = .011	r_s = -.25, p = .013
Knowledge Characteristics	Job Complexity	r_s = -.06, p = .566	r_s = .18, p = .076	r_s = .00, p = .978	r_s = -.16, p = .109	r_s = -.08, p = .445	r_s = -.11, p = .300

		Job satisfaction		State anxiety		Trait anxiety	
		ASD	Matched non-ASD	ASD	Matched non-ASD	ASD	Matched non-ASD
	Information Processing	r_s = .09, p = .370	r_s = .12, p = .235	r_s = .03, p = .786	r_s = -.30, p = .003	r_s = -.11, p = .288	r_s = -.17, p = .091
	Problem Solving	r_s = .12, p = .234	r_s = .14, p = .157	r_s = .05, p = .620	r_s = -.30, p = .002	r_s = -.08, p = .444	r_s = -.24, p = .020
	Skill Variety	r_s = .19, p = .060	r_s = .04, p = .690	r_s = -.02, p = .854	r_s = -.29, p = .004	r_s = -.21, p = .035	r_s = -.19, p = .063
	Specialisation	r_s = .14, p = .170	r_s = -.09, p = .357	r_s = -.08, p = .437	r_s = -.36, p < .001	r_s = -.26, p = .010	r_s = -.27, p = .008
Social Characteristics	Social Support	r = .61, p < .001	r = .22, p = .026	r = -.37, p < .001	r = -.36, p < .001	r = -.38, p < .001	r = -.33, p = .001
	Initiated Interdependence	r_s = .08, p = .412	r_s = .01, p = .924	r_s = -.06, p = .573	r_s = -.18, p = .075	r_s = -.13, p = .195	r_s = -.29, p = .004
	Received Interdependence	r_s = -.10, p = .350	r_s = -.14, p = .164	r_s = .00, p = .979	r_s = -.22, p = .028	r_s = -.06, p = .592	r_s = -.16, p = .107
	Interaction Outside Organisation	r_s = .12, p = .261	r_s = -.04, p = .710	r_s = -.03, p = .758	r_s = -.18, p = .073	r_s = -.12, p = .246	r_s = -.22, p = .031
	Feedback From Others	r_s = .32, p < .001	r_s = .30, p = .003	r_s = -.12, p = .247	r_s = -.40, p < .001	r_s = -.17, p = .088	r_s = -.52, p < .001

		Job satisfaction		State anxiety		Trait anxiety	
		ASD	Matched non-ASD	ASD	Matched non-ASD	ASD	Matched non-ASD
Work Context	Ergonomics	r_s = .31, p = .002	r_s = .04, p = .718	r_s = -.18, p = .080	r_s = -.38, p < .001	r_s = -.10, p = .307	r_s = -.33, p = .001
	Physical Demands	r_s = -.03, p = .743	r_s = .09, p = .378	r_s = -.06, p = .589	r_s = .28, p = .005	r_s = -.12, p = .259	r_s = .20, p = .045
	Work Conditions	r_s = .36, p < .001	r_s = .19, p = .069	r_s = -.30, p = .003	r_s = -.22, p = .003	r_s = -.29, p = .004	r_s = -.23, p = .023
	Equipment Use	r_s = .07, p = .475	r_s = .27, p = .007	r_s = -.01, p = .891	r_s = .00, p = .982	r_s = -.09, p = .375	r_s = -.08, p = .454

ASD participants: Job satisfaction. A multiple linear regression was calculated to assess job satisfaction based on Decision Making Autonomy, Work Methods Autonomy, Task Variety, Feedback From Job, Social Support and Work Conditions. A significant regression equation was found ($F(6, 91) = 19.50$, $p < .001$), with an R^2 of .56. Job satisfaction increased 6.17 units for each unit of Work Methods Autonomy, 10.02 units for each unit of Social Support and 3.59 units for each unit of Work Conditions. Work Methods Autonomy ($\beta = .36$, $p = .007$), Social Support ($\beta = .39$, $p < .001$) and Work Conditions ($\beta = .17$, $p = .028$) were significant predictor variables of job satisfaction for participants with ASD. This is summarised in Table 5.9.

Table 5.9

ASD participants: Summary of multiple regression results for job satisfaction.

Predictor variable	B	SE B	B	*t*	*p*
Decision Making Autonomy	-.24	2.25	-.01	-.11	.916
Work Methods Autonomy	6.17	2.23	.36	2.76	.007
Task Variety	.30	1.72	.02	.18	.861
Feedback From Job	1.94	1.42	.11	1.37	.175
Social Support	10.02	2.08	.39	4.83	< .001
Work Conditions	3.58	1.61	.17	2.23	.028

B = unstandardised beta coefficient; SE B = standard error; B = standardised beta coefficient.

ASD participants: State anxiety. A multiple linear regression was calculated to assess state anxiety based on Work Scheduling Autonomy, Decision Making Autonomy, Work Methods Autonomy, Task Identity, Social Support and Work Conditions. A significant regression equation was found ($F(5, 92) = 3.98$, $p = .003$), with an R^2 of .18. State anxiety decreased -.30 units for each unit of Social Support and Social Support ($\beta = -.29$, $p = .008$) was a significant predictor of reduction in state anxiety for participants with ASD. This is summarised in Table 5.10.

Table 5.10

ASD participants: Summary of multiple regression results for state anxiety.

Predictor variable	B	SE B	B	*t*	*p*
Work Scheduling Autonomy	.02	.11	.03	.20	.839
Decision Making Autonomy	.05	.12	.07	.38	.702
Work Methods Autonomy	-.13	.15	-.19	-.87	.389
Social Support	-.30	.11	-.29	-2.70	.008
Work Conditions	-.145	.09	-.17	-1.64	.104

B = unstandardised beta coefficient; SE B = standard error; B = standardised beta coefficient.

ASD participants: Trait anxiety. A multiple linear regression was calculated to assess trait anxiety based on Decision Making Autonomy, Work Methods Autonomy, Feedback From Job, Specialisation, Social Support and Work Conditions. A significant regression equation was found ($F(6, 91) = 6.20$ $p < .001$), with an R^2 of .29. Trait anxiety decreased -5.02 units for each unit of Social Support and -5.06 units for each unit of Work Methods Autonomy. Social Support (β = -.24, p = .024) and Work Methods Autonomy (β = -.36, p = .026) were significant predictors of a reduction in trait anxiety for participants with ASD. This is summarised in Table 5.11.

Table 5.11

ASD participants: Summary of multiple regression results for trait anxiety.

Predictor variable	B	SE B	B	*t*	*p*
Decision Making Autonomy	1.23	2.35	.08	.52	.602
Work Methods Autonomy	-5.06	2.24	-.36	-2.26	.026
Feedback From Job	-.22	1.49	-.02	-.15	.884
Specialisation	-1.52	1.41	-.11	-1.08	.285
Social Support	-5.02	2.18	-.24	-2.30	.024
Work Conditions	-1.96	1.62	-.11	-1.22	.228

B = unstandardised beta coefficient; SE B = standard error; B = standardised beta coefficient.

Matched non-ASD participants: Job satisfaction. A multiple linear regression was calculated to assess job satisfaction based on Task Variety, Social Support, Feedback From Others and Equipment Use. A significant regression equation was found ($F(4, 93) = 6.17$, $p < .001$), with an R^2 of .21. Job satisfaction increased 5.72 units for each unit of Feedback From Others and Feedback From Others ($\beta = .34$, $p = .001$) was a significant predictor of job satisfaction for participants without ASD. This is summarised in Table 5.12.

Table 5.12

Matched non-ASD participants: Summary of multiple regression results for job satisfaction.

Predictor variable	B	SE B	B	*t*	*p*
Task Variety	3.45	1.90	.20	1.82	.072
Social Support	.07	2.39	.00	.03	.978
Feedback From Others	5.72	1.71	.34	3.35	.001
Equipment Use	2.19	1.60	.14	1.37	.174

B = unstandardised beta coefficient; SE B = standard error; B = standardised beta coefficient.

Matched non-ASD participants: State anxiety. A multiple linear regression was calculated to assess state anxiety based on Decision Making Autonomy, Task Variety, Specialisation, Social Support, Feedback From Others and Ergonomics. A significant regression equation was found ($F(6, 91) = 7.68$, $p < .001$), with an R^2 of .34. State anxiety decreased -4.09 units for each unit of Feedback From Others and Feedback From Others ($\beta = -.40$, $p < .001$) was a significant predictor of reduction in state anxiety for participants without ASD. This is summarised in Table 5.13.

Table 5.13

Matched non-ASD participants: Summary of multiple regression results for state anxiety.

Predictor variable	B	SE B	B	t	p
Decision Making Autonomy	.21	1.23	.02	.17	.866
Task Variety	-1.83	1.24	-.17	-1.48	.143
Specialisation	-1.60	1.36	-.13	-1.17	.244
Social Support	.43	1.57	.03	.27	.785
Feedback From Others	-4.09	.993	-.40	-4.11	< .001
Ergonomics	-2.58	1.35	-.21	-1.91	.060

B = unstandardised beta coefficient; SE B = standard error; B = standardised beta coefficient.

Matched non-ASD participants: Trait anxiety. A multiple linear regression was calculated to assess trait anxiety based on Specialisation, Task Significance, Social Support, Initiated Interdependence, Feedback From Others and Ergonomics. A significant regression equation was found ($F(6, 91) = 8.96$, $p < .001$), with an R^2 of .37. Trait anxiety decreased -5.53 units for each unit of Feedback From Others and -2.79 units for each unit of Ergonomics. Both Feedback From Others ($\beta = -.51$, $p < .001$) and Ergonomics ($\beta = -.21$, $p = .045$) were significant predictors of a reduction in trait anxiety for participants without ASD. This is summarised in Table 5.14.

Table 5.14

Matched non-ASD participants: Summary of multiple regression results for trait anxiety.

Predictor variable	B	SE B	B	*t*	*p*
Specialisation	-1.20	1.32	-.10	-.91	.364
Task Significance	-1.40	1.02	-.14	-1.37	.173
Social Support	1.30	1.60	.09	.81	.419
Initiated Interdependence	.18	1.10	.02	.16	.874
Feedback From Others	-5.53	1.02	-.51	-5.44	< .001
Ergonomics	-2.79	1.37	-.21	-2.03	.045

B = unstandardised beta coefficient; SE B = standard error; B = standardised beta coefficient.

Discussion

The study presented in this chapter assessed the mental health (anxiety) and job satisfaction of employed adults with ASD compared to a non-ASD group closely matched on age and gender of employed adults without ASD. The findings revealed: employed adults with ASD self-reported lower levels of job satisfaction and higher levels of state anxiety and trait anxiety than employed adults without ASD; employed adults without ASD self-reported higher levels of job satisfaction the longer they stayed in their job, whereas employed adults with ASD did not report this; social support at work predicted an increase in job satisfaction and a decrease in state anxiety and trait anxiety for employed adults with ASD whereas for employed adults without ASD, feedback from others predicted an increase in job satisfaction and a decrease in state anxiety and trait anxiety; work methods autonomy and work conditions also predicted an increase in job satisfaction for employed adults with ASD; and work methods autonomy predicted a decrease in trait anxiety for employed adults with ASD whereas ergonomics predicted a decrease in trait anxiety for employed adults without ASD. The findings in this chapter confirm some of the research hypotheses initially stated and these will now be discussed.

The first research hypothesis predicted employed adults with ASD would report higher levels of anxiety and lower levels of job satisfaction than employed adults without

ASD. This is confirmed through the findings from the present study. Employed adults with ASD self-reported higher levels of state anxiety and trait anxiety and lower levels of job satisfaction than employed adults without ASD.

The second research hypothesis stated social support and workplace conditions would be associated with lower levels of anxiety and higher levels of job satisfaction for employed adults with ASD and this effect would be greater than for employed adults without ASD. This was partially confirmed. Social support at work did predict a decrease in state anxiety and trait anxiety and an increase in job satisfaction for employed adults with ASD. Social support was not as important for employed adults without ASD. For these individuals, feedback from others predicted an increase in job satisfaction and a decrease in state anxiety and trait anxiety. However, work conditions predicted an increase in job satisfaction only for employed adults with ASD and ergonomics predicted a decrease in trait anxiety for employed adults without ASD. Considering these findings overall, this suggests social inclusion in the workplace is more important for adults with ASD than for adults without ASD, particularly as adults with ASD reported higher levels of anxiety and lower levels of job satisfaction at work. These findings will now be further discussed in the context of each key finding.

Key finding 5: Employed adults with ASD self-report lower levels of job satisfaction and higher levels of state anxiety and trait anxiety than employed adults without ASD.

> *In other words: Autistic adults at work say they have less job satisfaction and more anxiety than their neurotypical colleagues. But this might depend on how much support they receive presently at work and how much they received before they got their current job.*

In the present study, employed adults with ASD reported lower levels of job satisfaction and higher levels of anxiety than employed adults without ASD. Previous research suggests securing employment for adults with ASD is particularly difficult due to social communication impairments characterised by autism. This means the job application process itself, in terms of understanding how much detail to provide on application forms, or difficulty initiating a job search can be particularly difficult for adults with ASD (Müller et al., 2003). This could also mean adults with ASD are less successful in securing the type of employment they wish to work in and have fewer opportunities to work. This can result in an uneven job profile where many different or unsuitable jobs are seen within one individual's employment history (Lawer et al., 2009). Therefore,

employed adults with ASD in the present study may have been more likely to be working in unsuitable jobs and this could have affected the self-reported levels of job satisfaction and anxiety.

Furthermore, it is unclear how much pre-employment or workplace support the employed adults with ASD in the present study would have received. Research funding is rarely allocated to adult autism services (Pellicano et al., 2013) despite employment being seen as a priority area for research by adults with ASD and their parents (Pellicano et al., 2014b). This is reflected in the current state of support as only employed adults with ASD can access funded workplace support through the Access to Work scheme. Furthermore, only those who can initiate the request for Access to Work support (and are willing to justify the support every six months when it needs renewing) can receive this help. This means it is unlikely that funded long-term support can be given to employed adults with ASD and this is now discussed further within the context of each following key finding.

Key finding 6: Employed adults without ASD self-report higher levels of job satisfaction the longer they stay in their job, whereas employed adults with ASD did not report this.

> *In other words: Autistic adults at work do not report any differences in job satisfaction the longer they stay in the job but their neurotypical colleagues do.*

In the present study, employed adults without ASD reported higher levels of job satisfaction the longer they stayed in their job, whereas this pattern was not seen in employed adults with ASD. Previous research suggests adults with ASD report declining levels of job satisfaction over time, possibly due to the job becoming less challenging (Hillier et al., 2007). Although declining job satisfaction levels were not reported by adults with ASD in the present study, the findings from the present study do suggest differences in the workplace experiences of employed adults with and without ASD.

Increasing levels of job satisfaction over time suggest changes occur in the workplace which enable employees without ASD to become more satisfied with their work. The job satisfaction measure used in the present study assessed work aspects such as the physical work conditions, recognition received for good work, amount of responsibility given, rate of pay and opportunities to use abilities. This suggests employed adults without ASD gain, or perceive that they gain, more of these

opportunities the longer they stay in their job. Previous research involving adults with ASD has shown employed adults with ASD were underrepresented in senior or managerial positions within companies. In addition, almost half of the adults with ASD in that study were overqualified for their jobs, which was estimated to be more than double that within the typical population (Baldwin et al., 2014). This suggests adults without ASD in the present study probably were gaining more opportunities at work than adults with ASD and this increased their job satisfaction over time.

An additional explanation could be that some of the workplace problems previously reported by adults with ASD, such as social communication difficulties (Mawhood & Howlin, 1999; Müller et al., 2003) are ongoing and are unlikely to diminish over time. Considering the participants with ASD in the study run by Müller et al. (2003) knew their social interaction difficulties were hindering them from succeeding at work suggests adults with ASD know they are different from their work colleagues. This could also explain why anxiety levels were higher and job satisfaction levels lower for employed adults with ASD compared to employed adults without ASD.

The absence of an increase in job satisfaction over time seen in the ASD group also raises questions around how effective workplace support, such as Access to Work, is. Many employed adults with ASD may not initiate receiving funded support if they are struggling in the workplace. However, for those who do, the support is allocated for six months at a time with each renewal needing justifying. It is, therefore, unlikely employed adults with ASD would receive ongoing support at work which places more emphasis on the importance of beneficial workplace characteristics.

Key finding 7: Social support at work predicts an increase in job satisfaction and a decrease in state anxiety and trait anxiety for employed adults with ASD. However, for employed adults without ASD, feedback from others predicts an increase in job satisfaction and a decrease in state anxiety and trait anxiety.

> *<u>In other words:</u> Social support increases job satisfaction and decreases anxiety in autistic employees whereas feedback from others increases job satisfaction and decreases anxiety in neurotypical employees.*

In the present study, social support predicted an increase in job satisfaction and a decrease in state anxiety and trait anxiety for employed adults with ASD. Items assessing social support included: '*I have the opportunity to develop close friendships in my job'* and '*People I work with take a personal interest in me'*. Previous research

suggests securing employment for adults with ASD is particularly difficult due to social communication impairments characterised by autism. However, these difficulties can extend into employment with many adults with ASD reporting struggles with reading 'between the lines' or understanding small talk at work (Müller et al., 2003). Other difficulties in the workplace for adults with ASD have included inappropriate dress, talking too much or too little and demonstrating rigidity rather than adjusting to the demands of the job itself (Mawhood & Howlin, 1999). Employed adults with ASD have also reported difficulties such as problems socialising outside of work with colleagues and struggling to make friends in the workplace despite positive feedback from colleagues around honesty and reliability (Hillier et al., 2007). Therefore, it may be unsurprising that social support predicted an increase in job satisfaction and a decrease in state anxiety and trait anxiety for employed adults with ASD.

These findings are particularly poignant given the matched non-ASD group differed in their self-reported responses. For employed adults without ASD, feedback from others predicted an increase in job satisfaction and a decrease in state anxiety and trait anxiety. Items assessing feedback from others included: '*I receive a great deal of information from my manager and co-workers about my job performance'* and '*Other people in the organisation, such as managers and co-workers, provide information about the effectiveness (e.g. quality and quantity) of my job performance'*. This is also interesting considering employed adults without ASD reported higher levels of job satisfaction the longer they remained employed in their current job. This suggests employed adults without ASD respond to feedback from managers and co-workers about their performance, and adapt accordingly, to improve their workplace performance which would increase their job satisfaction.

Furthermore, the differences between employed adults with ASD and employed adults without ASD highlight the importance of the workplace as an environment of social inclusion for adults with ASD. Unemployed adults with ASD may not be engaging in any meaningful vocational activity at all. Therefore, the day-to-day activities of an employed adult with ASD could be very different to an unemployed adult with ASD and this is worthy of further exploration in future research. Employment, therefore, can be a means of social inclusion for individuals who are often excluded and it is this social support which predicts a decrease in anxiety.

Key finding 8: Work methods autonomy and work conditions predict an increase in job satisfaction for employed adults with ASD. Work methods autonomy also predicts a decrease in trait anxiety for employed adults with ASD.

<u>In other words:</u> Freedom to complete their work in the ways they want to predicts more job satisfaction and less anxiety for employed adults with ASD. Also, better workplace conditions predict more job satisfaction for these individuals.

The present study also showed work methods autonomy predicted an increase in job satisfaction and a decrease in trait anxiety for employed adults with ASD. Items assessing work methods autonomy included: '*The job allows me to make decisions about what methods I use to complete my work'* and '*The job gives me considerable opportunity for independence and freedom in how I do the work'*. This suggests a great deal of job satisfaction and less anxiety is reported when employed adults with ASD can complete their work using their preferred methods. Although previous research suggests employed adults with ASD demonstrate rigidity, rather than adjust to the demands of the job itself, the findings from the present study indicate this could increase job satisfaction and decrease anxiety for these individuals. Furthermore, this could also link into employed adults with ASD being underrepresented in senior or managerial positions within companies, particularly as earning money did not make a difference to adults with ASDs' perceptions of job satisfaction (Baldwin et al., 2014). There may be greater job satisfaction and less anxiety when employed adults with ASD can choose their work methods, rather than from pursuing promotions into more socially complex senior or managerial positions.

Work conditions also predicted an increase in job satisfaction for employed adults with ASD. Items assessing work conditions included: *'The work place is free from excessive noise'* and *'The climate at the work place is comfortable in terms of temperature and humidity'.* This suggests a good deal of job satisfaction is gained when employed adults with ASD are in a comfortable environment which does not exacerbate any sensory issues. Interestingly, work conditions did not predict any significant changes in anxiety in the present study. Sensitivity to sensory stimuli is now part of the diagnostic criteria for ASD and is thought to link to anxiety – possibility due to adults with ASD being less able to tolerate uncertainty (South & Rodgers, 2017). Perhaps the employed adults with ASD already had a certain level of control over their workplace environment which meant work conditions predicted an increase in job satisfaction only, rather than a decrease in anxiety, or perhaps the work conditions items were not specifically assessing sensory sensitivity. The present study showed close correlations between job satisfaction and anxiety, so it would be interesting for future studies to investigate the relationship between sensory sensitivity and anxiety for adults with ASD at work.

Key finding 9: Ergonomics predicts a decrease in trait anxiety for employed adults without ASD.

> *In other words: Ergonomics, such as suitable seating arrangements predicts less anxiety for neurotypical employees.*

The present study also showed ergonomics predicted a decrease in trait anxiety for employed adults without ASD. Items assessing ergonomics included: '*The seating arrangements on the job are adequate (e.g. ample opportunities to sit, comfortable chairs, good postural support)'* and '*The workplace allows for all size differences between people in terms of clearance, reach, eye height, leg room etc.'*. This suggests a physically comfortable workplace environment is important for employed adults without ASD, although this pattern was not replicated in employed adults with ASD.

Limitations. While addressing a number of issues in previous research, the present study has a number of its own limitations which must be addressed. First, an online survey was used to reach the maximum amount of people in the most convenient way and also to allow for a well-matched control group to be included. However, corroboration of diagnosis is uncertain/impossible in an online survey. While this has to be taken on trust, a number of approaches were taken to be as certain as possible that respondents indicating they had an ASD had indeed received a diagnosis. The study was advertised on websites specific to autism services or research and then later advertised on more general websites to recruit the matched non-ASD group. Many participants were contacted through an autism participant database previously held at Goldsmiths. Also, in the first wave of data collection, participants with ASD were emailed individually as they were personally known to the author at this time, who was working in an autism and employment service. The study was also advertised through Asperger United where telephone and postal surveys are commonly used and a small number of individuals requested a paper copy be posted to them. However, confirming an ASD diagnosis through a survey means this is completely reliant on self-reported diagnoses. Therefore, the ASD diagnosis was likely to have been the case, meaning the ASD sample were as likely as could probably be in a survey to have actually had autism.

Second, the type of employment was not considered and this could have affected how participants with ASD responded. This was, in part, deliberate as the aim of the study was not to suggest certain types of employment were more appropriate for adults with ASD than others but whether, once in employment, adults with ASD differed

in levels of job satisfaction and anxiety than adults without ASD. It may also have been difficult to determine from an online survey how well the subjective person-environment fit was or how well matched each individual was to their job. It may also have been helpful to know whether participants with ASD had received any pre-employment support previously or were receiving workplace support presently, although there may have been few participants who had accessed these types of support.

Third, there were some missing data around co-occurring diagnoses for participants with ASD. Co-occurring diagnoses were only recorded for participants without ASD as data collection for the matched non-ASD group began later and questions around co-occurring diagnoses had not been previously included for participants with ASD. Co-occurring disorders would be important to consider because these can often overshadow autism traits and can sometimes become the primary difficulty – meaning adults with ASD cannot seek employment because of anxiety (Farley et al., 2009). However, given the extent to which adults with ASD self-report co-occurring diagnoses means it is likely the sample is representative of the employment experiences of many adults with ASD.

Conclusions

The approach in this chapter was to further investigate employment and mental health and to extend the reach of previous research by focusing on workplace characteristics and job satisfaction for employed adults with ASD. In this study, the online survey responses of 98 employed adults with ASD were compared to a matched non-ASD group of 98 employed adults without ASD. Adults with ASD reported lower levels of job satisfaction and higher levels of anxiety. Only adults without ASD reported higher levels of job satisfaction the longer they stayed employed. Social support predicted an increase in job satisfaction and a decrease in anxiety for adults with ASD. However, for adults without ASD, feedback from others predicted an increase in job satisfaction and a decrease in anxiety. Furthermore, work methods autonomy predicted an increase in job satisfaction and a decrease in trait anxiety, and work conditions predicted an increase in job satisfaction only for adults with ASD. Ergonomics predicted a decrease in trait anxiety only for employed adults without ASD. The findings highlight the importance of workplace support for adults with ASD but also the difficulties in accessing this employment support. However, they also reveal the role of employment as being a potential measure of social inclusion for adults with ASD. This is

consistent with the findings from Study One where unemployed adults without ASD reported poorer mental health than employed adults without ASD but this pattern was not seen in the ASD group. This suggests the day-to-day activities of an employed adult with ASD could be very different to an unemployed adult with ASD. In Chapter Six, the findings from all three studies will be discussed in relation to each other with suggestions for practical implications and future research in autism and employment.

Chapter Six: General Discussion

Overview of Chapter Six

The present thesis considered the effects of employment on the mental health and executive functions of adults with autism spectrum disorder (ASD) through three studies. The findings of these studies are summarised and then the thesis aims outlined in Chapter One are addressed. The methodological challenges and limitations are discussed including: confirming ASD diagnosis in participants; co-occurring intellectual disability (ID) and clinical disorders in adults with ASD; matching participants; the choice of executive function tasks; and the choice of mental health measures. Recommendations for future research addressing these methodological challenges are presented. Finally, practical implications of the thesis are considered in the context of the legislative, clinical and financial impact of employment as a means of social inclusion for adults with ASD.

The present thesis considered the effects of employment on the mental health and executive functions of adults with autism spectrum disorder (ASD). Study One used an online survey to assess the relationships between mental health and employment in adults with ASD. Study Two used a series of mental health measures and a mixture of self-report and cognitive-behavioural tasks assessing mental health and executive functions pre- and post-employment. This study was a small sample of adults with ASD only. Study Three used an online survey to assess the relationships between work characteristics, job satisfaction and anxiety in employed adults with ASD. This study used a well-matched sample. Table 6.1 provides a summary of the key findings from these three studies. These findings will now be discussed in relation to the thesis aims, as outlined in Chapter One. Methodological challenges and limitations will then be discussed and, finally, practical recommendations arising from the present thesis will be considered.

Table 6.1

Summary of key findings from the present thesis.

Chapter	Study	Key finding number	Key finding
Three	1	1	Adults with ASD report poorer mental health, well-being and life satisfaction than adults without ASD.
Three	1	2	Levels of anxiety remain high for adults with ASD, whether employed or unemployed. However, for adults without ASD, levels of anxiety were lower for those employed rather than unemployed.
Four	2	3	Individual differences show most participants demonstrated more improvements than declines across executive function tasks post-employment compared to pre-employment but no adult with ASD demonstrated consistent meaningful progress on executive function tasks after a period of employment.
Four	2	4	Adults with ASD self-report similar depression, anxiety, satisfaction with life and well-being scores post-employment compared to pre-employment.
Five	3	5	Employed adults with ASD self-report lower levels of job satisfaction and higher levels of state anxiety and trait anxiety than employed adults without ASD.
Five	3	6	Employed adults without ASD self-report higher levels of job satisfaction the longer they stay in their job, whereas employed adults with ASD did not report this.
Five	3	7	Social support at work predicts an increase in job satisfaction and a decrease in state anxiety and trait anxiety for employed adults with ASD. However, for employed adults without ASD, feedback from others predicts an increase in job satisfaction and a decrease in state anxiety and trait anxiety.
Five	3	8	Work methods autonomy and work conditions predict an increase in job satisfaction for employed adults with ASD. Work methods autonomy also predicts a decrease in trait anxiety for employed adults with ASD.
Five	3	9	Ergonomics predicts a decrease in trait anxiety for employed adults without ASD.

Thesis Aim 1: What are the relationships between employment and mental health in adults with ASD (Study One)? The findings from Study One revealed adults with ASD reported higher levels of anxiety, lower levels of well-being and lower levels of satisfaction with life compared to adults without ASD. The findings also revealed a significant interaction between group and employment status for anxiety. The effects of being employed were not the same for adults with ASD as for adults without ASD – levels of anxiety remained high for adults with ASD whether employed or unemployed. Taken together, this suggests that employment has different effects on adults with ASD than on adults without ASD and suggests a more complex relationship between employment and mental health in this group.

The findings from Study One raise the question of whether anxiety itself is an inherent part of ASD in the following three ways. First, sensitivity to sensory stimuli is now part of the autism diagnostic criteria and is thought to contribute to anxiety for adults with ASD. Unusual sensory processing is likely to be lifelong for adults with ASD and this highlights the need for future research into its relationship with anxiety for these individuals. Second, restrictive and repetitive behaviours (RRBs) or interests are also a key diagnostic factor in ASD. The relationship between anxiety and RRBs has been explored in a number of studies. However, it would be interesting for future research to see if sensory sensitivity is problematic for individuals who display RRBs but who do not have ASD, in order to uncover if the relationship between sensory sensitivity, RRBs and anxiety is unique to individuals with ASD. Third, different findings may emerge depending on whether self- or informant-reports are used. A more effective way to investigate this into adulthood may be to look at how RRBs change over time as the differences in self- and informant-reports raise the possibility that ASD involves a deficit of the psychological self. For future research, this could mean that the most accurate way to assess anxiety in adults with ASD would be through a mixture of self- and informant-reports.

Thesis Aim 2: What are the relationships between employment, mental health and executive functions in adults with ASD (Study Two)? The findings from Study Two revealed that adults with ASD showed no significant differences in group performance on executive function tasks post-employment compared to pre-employment. When looking at individual differences, no adult with ASD demonstrated consistent meaningful improvement on executive function tasks post-employment compared to pre-employment. No significant differences in self-reported executive function skills post-employment compared to pre-employment were found. Also, similar depression, anxiety, satisfaction with life and well-being scores pre- and post-employment were found, with the majority of adults with ASD reporting depression and

anxiety scores in the ‘no’ and ‘mild’ cut-offs. However, the fact that adults with ASD in the present study were already enrolled in autism and employment services suggests they were less hindered by concerns around starting new employment, perhaps, than other unemployed adults with ASD might be. Essentially, the adults with ASD enrolled in autism and employment services were already effectively seeking employment. This does raise the possibility of a certain profile of a person with ASD enrolled in autism and employment services and also limits the generalisability of the findings.

The findings from Study Two highlight the uneven and varied cognitive profile of adults with ASD. The contrasts observed within and between individuals, as well as between the individual and group level, demonstrate the heterogeneity frequently observed in autism. However, there is now a growing awareness of the difficulty of behaviourally defined diagnoses, such as ASD, in understanding neurobiological or cognitive differences. For instance, the current diagnostic criteria mean very different individuals can attain an autism diagnosis while not entirely sharing many specific features. This is further complicated by the wide ranges of co-occurring psychiatric disorders often observed in adults with ASD. The influences of cognitive ability and the qualitatively different coping strategies that adults with ASD may have developed over a lifetime can also mitigate the extent to which individuals experience ASD traits. It is unclear whether heterogeneity in autism can be classified as a gradient in severity or whether there are separate autism subgroups but a lack of distinct profiling has resulted in heterogeneity being associated with a gradient in the overall severity of ASD. It has also been argued that autism research is hindered by the focus on separate dependent variables. A fundamental shift away from this style of research could be much more useful for adults with ASD and the services they could access. Acceptance of difference (through the social movement ‘neurodiversity’) would remove many of the difficulties in mapping behavioural traits onto a biological trajectory.

Essentially, any patterns in cognitive data within autism may be too complex to capture and it may be more effective to promote the positives of difference. This means it would be very worthwhile for an individual profile to be created of a potential employee with ASD. This could be used to provide neurodiversity training to employers. The heterogeneity in autism also means individual employment coaching is often necessary to mediate the relationships between the employee with ASD and the employer. Therefore, the term ‘spectrum’ is highly apt to describe individuals with autism – to describe the differences between individuals as well as within.

Thesis Aim 3: What work characteristics are related to job satisfaction and anxiety in employed adults with ASD (Study Three)? The findings from Study Three revealed that employed adults with ASD reported both lower levels of job satisfaction and higher levels of anxiety than employed adults without ASD. Also, adults without ASD reported higher levels of job satisfaction the longer they stayed employed in their job but this was not seen in the ASD group. Importantly, social support predicted an increase in job satisfaction and a decrease in anxiety for employed adults with ASD whereas, for employed adults without ASD, feedback from others predicted an increase in job satisfaction and a decrease in anxiety. Furthermore, work methods autonomy predicted an increase in job satisfaction and a decrease in trait anxiety, and work conditions predicted an increase in job satisfaction only for employed adults with ASD. Ergonomics predicted a decrease in trait anxiety only for employed adults without ASD. Considering these findings overall, this suggests social inclusion in the workplace is more important for adults with ASD than for adults without ASD, particularly as adults with ASD reported higher levels of anxiety and lower levels of job satisfaction at work. The findings highlight the importance of workplace support for adults with ASD but also the difficulties in accessing this employment support. However, they also reveal the role of employment as being a potential measure of social inclusion for adults with ASD. This further supports the promotion of neurodiversity in the workplace. For instance, if anxiety is accepted as being associated with autism, then the findings from Study Three demonstrate the positive effects employment can bring.

Methodological Challenges and Limitations in the Present Thesis

A number of methodological challenges were presented in the current thesis. These will be outlined with details confirming how the methodological approaches adopted in the present thesis affected the research findings. Suggestions for future research are also provided.

Confirming ASD diagnosis in participants. The Autism Diagnostic Observation Schedule-Generic; ADOS-G (Lord et al., 1999) is considered the 'gold standard' measure for assessing and diagnosing individuals with ASD, particularly when combined with the semi-structured clinical instrument, the Autism Diagnostic Interview-Revised; ADI-R (Lord et al., 1994). Ideally, the ADOS-G and ADI-R would both have been used to confirm participants' diagnosis of ASD in the present thesis. However, a trained assessor would have been needed to administer these instruments and this was not possible given the time and financial constraints of the present research. Also, Study One and Study Three were predominantly accessed online to reach the greatest number

of participants and it would not have been possible to confirm the presence of ASD using these measures.

The criteria for inclusion in the present thesis for those with ASD included a formal diagnosis of ASD from a psychologist or psychiatrist. However, the Autism Spectrum Quotient-10; AQ-10 (Allison et al., 2012) was selected as an appropriately short measure to characterising participants' diagnostic status in the present thesis. While there are many issues around recruitment of adults with ASD, not least to online surveys, in the current thesis reporting an ASD diagnosis was fundamental to inclusion in the ASD group. The AQ-10 was used to confirm that there was indeed a group difference in the number of self-reported autistic traits between the ASD and non-ASD groups in Study One. As participants with ASD were mainly recruited through autism-specific services, this diagnosis was confirmed by each individual service and the AQ-10 was included to confirm participants still met criteria for a diagnosis of ASD in adulthood. The findings from the AQ-10 have been interpreted with caution as recent research suggests self-reported AQ scores do not significantly predict receipt of an ASD diagnosis (Ashwood et al., 2016). However, in Study One, the ASD group scored two to three times higher on autism traits compared to the non-ASD group and this met the clinical cut-off which would usually trigger a referral to autism diagnostic services. Study One and Study Three were advertised on websites specific to autism services or research (such as Asperger United) and then later advertised on more general websites to recruit the non-ASD groups. Many participants were contacted through an autism participant database previously held at Goldsmiths. Therefore, the ASD diagnosis was likely to have been the case, meaning the ASD sample were as likely as could probably be in a survey to have actually had ASD.

For future research, it may be possible to administer the ADOS-G and ADI-R if the sample is small and if it is practical within the constraints of the research. However, a self-report measure designed to diagnose ASD in adulthood is unlikely to exist as it would be difficult to capture the complexities of autism within one measure alone. It may have been more appropriate to only distribute Study One and Study Three directly to participants whose diagnosis had been confirmed through an autism service, rather than having the surveys openly accessible online. However, this would have limited the sample size and also only reflect the experiences of those who are being supported by autism-specific services.

Co-occurring ID and clinical disorders in adults with ASD. Estimates of adults with ASD and co-occurring intellectual disability (ID) vary widely (Brugha et al.,

2016; Croen et al., 2015; Emerson & Baines, 2010), as do those of adults with ASD and co-occurring clinical disorders (Chandrasekhar & Sikich, 2015; Croen et al., 2015; Moss et al., 2015; Russell et al., 2016). The presence of a co-occurring ID or clinical disorder means research findings may be a consequence of a known or previously unknown co-occurring condition which would affect the conclusions drawn from the data. Study One and Study Three required adults with ASD to complete an online (or paper, if requested) survey and it was therefore not feasible to assess intelligence quotient (IQ) through these methods of data collection. However, it may be assumed that data provided by adults with ASD, who were computer literate and able to finish the survey(s) to completion, were acceptable to include in the overall analyses. Study Two required adults with ASD to complete a series of cognitive tasks which meant a minimum general ability was required. In Study Two, the Wechsler Abbreviated Scale of Intelligence; WASI (Wechsler, 1999) was issued to participants and only those with an IQ score of above 70 (i.e. two standard deviations below the mean) were included in the final sample.

In the present thesis, questions were included which asked participants about any co-occurring disorders and the approximate dates these were diagnosed. Questions were also asked about any currently prescribed medication. One method of accounting for all co-occurring clinical disorders is to exclude all participants with any additional diagnoses in order to provide a 'purer' sample of adults with ASD. However, if co-occurrence is as vast as previous studies suggest, then this smaller group of adults with ASD would not be representative of the wider autism community. There may also be difficulties in screening for additional diagnoses as many measures have not been validated in adults with ASD, so it may not be justified to exclude participants on this basis.

For future research, it may be beneficial to include adults with ASD with co-occurring clinical disorders. In Study Two the final sample size was relatively small and, given the low numbers of adults with ASD moving from unemployment to employment, would have benefitted from a greater number of participants. Participants in the final sample had few co-occurring clinical disorders and so the generalisability of the findings is somewhat limited. This is despite the intensive and exhaustive recruitment process adopted for Study Two, where autism services were contacted across the United Kingdom over a period of 18 months.

Matching participants. A well-matched control group is considered essential for progress in autism research (Hill, 2004) and researchers must decide whether to match participants on a group or individual basis. In the present thesis, participants were

individually matched according to age, gender and occupation status in Study One. Participants in Study Three were similarly matched according to age and gender. Participants in Study Two consisted of only adults with ASD.

For future research, it would be very relevant to recruit a well-matched non-ASD group for Study Two. The recruitment period for Study Two was intense and extensive and this left little scope for a matched non-ASD group to also be recruited in the present thesis. However, if the sample size was increased by including adults with ASD with co-occurring clinical disorders then a larger sample might have been reached earlier which could have left open the possibility of a recruitment period for a matched non-ASD group. The increase in diversity, plus the non-ASD group, could have allowed for more conclusions to have been drawn from the relationship between mental health and executive functions pre- and post-employment. However, this was limited in the present thesis as adults with ASD mostly reported levels of depression and anxiety in the 'no' or 'mild' cut-offs.

The choice of executive function tasks. Task complexity and the differences between 'classic' or 'newer' executive function tasks were considered in the present thesis. Many executive function tasks tend to be complex and often produce one outcome measure which actually comprises a number of different measures. Differences may also exist between 'classic' (or 'traditional') executive function tasks and 'newer' tasks. Traditional executive function tasks might be insensitive to developmental impaired executive function performance rather than acquired impaired executive function performance (Hill & Bird, 2006). In the present thesis, a variety of executive function tasks were chosen very carefully based on tasks which have been previously been used in adult autism research and which evaluate a range of executive functions. The TMT was chosen as a classic executive function measure and the newer Hayling and Brixton Tasks were included, particularly as the Hayling test may be a good measure of inhibition in an autism sample (Hill & Bird, 2006).

Future research may benefit from more ecologically valid executive function tasks. This is relevant for adults with ASD who struggle to communicate socially and interact day-to-day. If adults with ASD demonstrate impairments in executive function tasks then this has implications for real-world adaptive functioning including employment e.g. through difficulties in completing job interview or initiating a job search – both of which use social communication skills. A virtual reality assessment of executive functions (Jansari et al., 2014) could provide a more ecologically valid assessment, particularly when used in autism and employment research

The choice of mental health measures. Presently, there are no available measures specifically for depression (Stewart et al., 2006) or anxiety (White et al., 2012) in individuals with ASD. This general lack of validated mental health measures – validated for those with ASD can also affect the quality of autism research in adulthood (Moss et al., 2015). The measures included in the present thesis were carefully considered by choosing measures with good validity and reliability, as an attempt to reduce any existing ambiguity around items that adults with ASD may experience when participating.

Future research could also consider using informant-report measures. Only self-report measures were used in the present thesis due to a lack of reliability between self- and informant-reports, and that previous research has shown adults with ASD are able to use self-report measures (Berthoz & Hill, 2005). However, it would be beneficial to include informant-reports, as different findings often emerge depending on whether self- or informant-reports are used.

Practical Implications

Employment was highlighted in Chapter One as being of legislative, clinical and financial concern. The findings from the present thesis have impact in the following three ways.

First, employed adults with ASD might be more anxious than their colleagues without ASD (Study One). This suggests the government's Access to Work scheme is vital in supporting adults with ASD in the workplace. However, for an adult with ASD to access funded workplace support, they must contact Access to Work themselves and then support is arranged by a provider. This is problematic as adults with ASD report problems in daily living tasks involving initiation (Study Two). It would be beneficial for the support to be arranged on behalf of the employed adult with ASD. It would also be beneficial for this support to be ongoing as higher levels of job satisfaction are seen in adults without ASD the longer they remain employed, and not adults with ASD (Study Three).

Second, current legislative guidance (e.g. The Autism Act) places a legal duty on the National Health Service (NHS) and councils to provide relevant services for adults with ASD. This includes employment, and the NHS and local authorities must now include employment in needs assessments. However, this may be difficult to implement

as there is a lack of funding for individual supported employment programmes, despite this being recommended by the National Institute for Health and Care Excellence (2012) in clinical guidelines. If employment is seen as a route to social inclusion, then the finding that social support at work predicts a reduction in anxiety for adults with ASD (Study Three) is crucial. This applies to both present (state) and longer-lasting (trait) aspects of anxiety for these individuals. This gain in clinical knowledge from research findings, plus the existing NICE guidelines, can be used as an argument to attract funding for individual supported employment programmes for adults with ASD.

Third, there has been difficulty in establishing the number of adults with ASD being supported into employment (National Audit Office, 2012). Few service evaluations have been published which makes the non-financial benefits of employment more difficult to quantify (Howlin et al., 2005). However, if employment is seen as a route to social inclusion, then this gain in clinical knowledge from research findings, plus the existing NICE guidelines, can also be used as an argument to attract funding for individual supported employment programmes for adults with ASD.

These three implications, outlined above, would be strengthened through participatory research with the involvement of adults with ASD, from the beginning of the research design through to ongoing impact in future autism and employment studies (Pellicano, Dinsmore, & Charman, 2014a).

Concluding Remarks

The three studies in the present thesis considered the effects of employment on the mental health and executive functions of adults with ASD. Study One showed adults with ASD reported higher levels of anxiety, lower levels of well-being and lower levels of satisfaction with life compared to adults without ASD. Also, the effects of being employed were not the same for adults with ASD as for adults without ASD – levels of anxiety remained high for adults with ASD whether employed or unemployed. Study Two showed no significant differences in group performance on executive function tasks post-employment compared to pre-employment and no adult with ASD demonstrated consistent meaningful improvement on executive function tasks post-employment compared to pre-employment. Also, adults with ASD reported similar depression, anxiety, satisfaction with life and well-being scores pre- and post-employment. This demonstrates the heterogeneity

within autism and suggests a certain profile of an adult with ASD may exist in autism and employment services e.g. fewer self-reported mental health problems than other adults with ASD. Study Three showed social support predicted an increase in job satisfaction and a decrease in anxiety for employed adults with ASD. The findings were collectively discussed in relation to: co-occurring ID and clinical disorders; the use of measures and types of reports; task complexity and the range of executive function tasks; the focus on group rather than individual differences; whether anxiety is inherently part of autism and neurodiversity. There is legislative, clinical and financial impact of employment as a means of social inclusion for adults with ASD and this approach would be greatly strengthened by participatory research in future autism and employment studies.

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Appendices

Appendix One: Information Sheet (Study Two)

Goldsmiths
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INFORMATION SHEET

Research study title: The effects of employment on well-being and cognition in adults with and without Autism Spectrum Disorder (ASD).

What is the research study about?
The effects of employment on your well-being and cognition.

Why have I been chosen?
We wish to work with adults (age 18+) **with and without** ASD who are just about to start paid or voluntary employment. Unfortunately we cannot include anyone with dyslexia, attention deficit hyperactivity disorder (ADHD) or developmental coordination disorder (DCD).

Do I have to take part?
No. If you do decide to take part, you can leave the study at any point and without giving a reason.

What do I have to do?
Before you start your employment:

- Complete an online questionnaire (30-40 minutes).
- Meet the researcher to complete some cognitive tasks (1-3 hours).

Some individuals are asked if they would like to meet again a couple of months after starting a work placement. As a thank you, everyone has the chance to win £125 at the end of the study.

Your information will be:

- Anonymous (information is stored under a participant ID number so you cannot be identified).
- Confidential (information will only be available to researchers directly involved in the study).

Ethical clearance has been granted by the Psychology Departmental Ethics Committee (DEC), Goldsmiths, University of London.

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Appendix Two: Consent Form (Study Two)

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CONSENT FORM

Research study title: The effects of employment on well-being and cognition in adults with and without Autism Spectrum Disorder (ASD).

Please initial box

1. I confirm that I have read and understand the information sheet for the above research study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. ☐
3. I agree to take part in the above research study. ☐
4. ***(Optional)*** I am interested in the results of the research study and would like to receive an information sheet once the study is complete ***(please write your details below)***. ☐

Name: _____
Address: _____
_____
_____
_____
Email: _____

_____	_____	_____
Name of participant	Date	Signature
_____	_____	_____
Name of person taking consent (if different from researcher)	Date	Signature
_____	_____	_____
Researcher	Date	Signature

Appendix Three: Session Timetable (Study Two)

Goldsmiths
UNIVERSITY OF LONDON

My name is Lisa Dockery. I am a research student at Goldsmiths, University of London. Please ask me questions if you feel confused at any point during this session.
This is what you will be doing today:

START

	Task	Time	Done
Pen and paper	WASI	10-50 mins	
	Trail Making	6 mins	
	Word Fluency	9 mins	
	Hayling & Brixton	15 mins	
	BREAK	*2 mins*	
Computer	MOT (Motor Screening Task)	1 min	
	BLC (Big/Little Circle)	2 mins	
	IED (Intra-Extra Dimensional Set Shift)	7 mins	
	BREAK	*2 mins*	
	AST (Attention Switching Task)	8 mins	
	SOC (Stockings of Cambridge)	10 mins	
	BREAK	*2 mins*	
	SSP (Spatial Span)	5 mins	
	SWM (Spatial Working Memory)	9 mins	
	BREAK	*2 mins*	
	AGN (Affective Go/No-go)	6 mins	
	SST (Stop Signal Task)	15 mins	
	BREAK	*2 mins*	
	ERT (Emotion Recognition Task)	12 mins	

END