Anxiety and Asperger’s Syndrome: An Investigation into the Delivery of a Novel Real-Time Stress Management Approach

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ABSTRACT

INTRODUCTION: Anxiety and stress are everyday issues for a large proportion of individuals with AS. This population is considered particularly vulnerable both as children and as adults and research suggests that these experiences may be qualitatively different from the general population. Cognitive Behavioural Therapy (CBT) is considered the treatment of choice for the management of anxiety and there is extensive research discussing how it can be modified and adapted to meet the needs of individuals on the autistic spectrum. However, certain challenges remain for many attempting to work in this way (i.e. limited access, autobiographical memory difficulties, limited generalisation skills). Despite suggestions for novel and exploratory interventions for these individuals, research has rarely gone beyond conventional individual or group CBT settings in order to accommodate the characteristics of this population.

OBJECTIVES: Computerised interventions offer the opportunity to capture real-life experiences on a moment to moment basis. Using momentary assessment techniques, this pilot study aimed to further explore the phenomenology of everyday anxiety and stress in adults with AS and explore the feasibility of using a hand-held computer (Personal Digital Assistant, PDA) to deliver a stress-management intervention in real-time.

METHOD: The current study used Experience Sampling Methodology delivered via PDAs to capture everyday experiences in nine adults with AS (i.e. baseline) and to deliver directive real-time stress management techniques in situ (i.e. intervention).

RESULTS: The findings revealed high levels of anxiety in adults with AS. Anxiety was characterised by worrying, and confusing thoughts and spending time on their own, although this differed from baseline to intervention. Anxiety was not associated with internally-focused thinking, image-based thoughts, or prolonged thinking. Individuals reported improved mood, less worrying and anxious thoughts during the intervention phase. There was no significant decrease in subjective anxiety ratings from day-to-day, although there was a decrease between phases and between subjective ratings provided before and after a technique was employed.

CONCLUSIONS: The results of this study support the literature suggesting that individuals with AS may differ in their experience of anxiety. Furthermore, this study provided preliminary data for the feasibility of implementing an intervention in this way. Despite the limitations of the PDA platform, findings from this study and feedback from participants provide a basis for future modifications to be made. Mobile devices (e.g., PDAs, mobile phones) offer the possibility of a more didactic intervention for anxiety within this population. High levels of anxiety and the paucity of research into treatment for adults in particular speaks to the need for more appropriate and adaptive interventions.
DECLARATION

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1. **INTRODUCTION**

**AUTISM SPECTRUM CONDITIONS**

Autism Spectrum Conditions (ASC) refers to a range of developmental disorders including Autistic Disorder (AD), Asperger’s syndrome (AS), Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), Childhood Disintegrative Disorder and Rett’s Disorder (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR; American Psychiatric Association (APA), 2004). Although the term ASC is often used synonymously with PDD, it typically refers to AD, AS and PDD-NOS alone. ASCs are characterised by core difficulties in social interaction, social communication and restricted behaviour and interests (APA, 2004; Wing & Gould, 1979). This pattern is commonly referred to as the ‘autistic triad’ (Wing & Gould, 1979) and more specifically alludes to a) impairments of social interaction, including limited eye contact, few peer relationships, apparent disinterest, and poor socio-emotional reciprocity; b) impairments of social communication, including an unusual use of language, difficulties with non-verbal communication, idiosyncratic speech and difficulties with conversations; c) impairments of imagination, including obsessive routines and interests, narrow and restricted interests, and difficulties with imaginative play.

ASCs are considered to exist on a spectrum of severity and varying ability (Wing & Gould, 1979; Wing, 1996). Figures of those individuals who do not have a comorbid intellectual disability range from 26% up to 75% (Fombonne, 2003; Medical Research Council, 2001) and would represent the ‘higher functioning’ end of the spectrum.

**1.1 ASPERGER’S SYNDROME**

Asperger’s syndrome (AS) was first described as a distinct condition by Wing (1981), representing a subtype of individuals who shared impairments in social interaction and restricted patterns of behaviour associated with autism, but did not have an intellectual disability or history of a clinically significant language delay (APA, 2004). There is ongoing discussion regarding the differentiation of AS and ‘high functioning autism’ and there has been a recent shift away from the prevailing categorical perspective (i.e.
distinct subtypes) towards a dimensional approach (e.g. Kamp-Becker et al., 2010). Consequently, upcoming revisions in diagnostic criteria (DSM-V) have proposed that Asperger’s syndrome should be subsumed within Autistic Disorder.

Prevalence rates of ASCs, and AS more specifically, have been complicated by variations in diagnostic criteria (i.e. DSM-IV TR, International Classification of Diseases Tenth Revision (ICD-10) World Health Organisation, 1993; Gillberg, 1989; see Tables 1 and 2). Although the various diagnostic systems are similar in the view that impairments in reciprocal social interaction, communication and the existence of repetitive behaviours are at the core of autism spectrum conditions, rates can vary depending upon which criteria are employed (e.g. Mattila et al., 2007). Reported rates range from 12.9 (Williams, Higgins, & Brayne, 2006) to 71 per 10000 children (Fombonne, 2005) for ASCs and 2.6 (Fombonne, 2005; Fombonne & Tidmarsh, 2003) to 27.1 (Baird et al., 2001) per 10000 for AS. For these reasons, prevalence rates of AS have proven problematic and raise concerns regarding the appropriateness of comparisons between studies (e.g. Kopra, von Wendt, Nieminen-von Wendt, & Paavonen, 2008; Mattila et al., 2007). A recent study investigated the presence of AS in a sample of children using three different diagnostic systems and reported an average of 1 in 370 children (DSM-IV-TR: 2.5/1000; ICD-10: 2.9/1000; Gillberg: 2.7/1000). Additionally, these rates may represent an underestimate as it has been suggested that Asperger’s is more common than autism (Gillberg & Gillberg, 1989) and many individuals may in fact remain undiagnosed or misdiagnosed (Dossetor, 2007; Ehlers & Gillberg, 1993; Gillberg & Ehlers, 1998; Perlman, 2000).

Gender differences are well-documented in ASCs (see Rivet, 2011 for review), which are generally considered to be more common in males (e.g. 4.3:1; Fombonne, 2003) and it has been suggested that ratios may increase linearly with intellectual functioning (e.g. Fombonne, 2005). Although there have been no studies exploring gender ratios in AS directly, these results suggest that AS may be even more common amongst males than in AD. Additionally, these figures may also represent an underestimate as a result of underdiagnosis, particularly in females (Attwood, Grandin, & Bolick, 2006; Tantam & Girgis, 2009).
1.2 AETIOLOGY

Although the aetiological basis for Asperger’s syndrome remains unclear, there is a general consensus for the involvement of neurobiological and genetic components (Bowler, 2007). The majority of research into the genetics of ASCs has involved autism and suggests that there is a significant familial link involving multiple genes (e.g. Chakrabarti & Fombonne, 2001; Ghaziuddin, 2005; MRC, 2001; Schopler, Mesibov, & Kunce, 1998). Given the widespread opinion that both autism and AS exist on a single spectrum, an assumption can be made that a similar genetic component is involved in the expression of AS as well (Volkmar, Klin, & Pauls, 1998).

Research into the ‘causes’ of ASCs has predominantly focused on genetic (e.g. O’Roak & State, 2008) and environmental (e.g. Landrigan, 2010) factors, but this endeavour has been complicated by the phenotypically and genotypically heterogeneous nature of these conditions. As a result, the explanatory scope of research thus far has been somewhat limited and has led to the suggestion that exploration into distinct, triadic causes (‘fractionable autism triad’) at various levels (i.e. genetic, cognitive and neural) may be more productive and potentially more realistic than aiming for a unitary account (Happé & Ronald, 2008; Happé, Ronald, & Plomin, 2006).
1) **Qualitative impairment in social interaction, as manifested by at least two of the following:**

   a) marked impairment in the use of multiple non-verbal behaviours such as eye-to-eye gaze, facial expression, body postures, and gestures to regulated social interaction.
   
   b) failure to develop peer relationships appropriate to developmental level
   
   c) a lack of spontaneous seeking to share enjoyment, interests or achievements with other people (e.g. by a lack of showing, bringing, or pointing out objects of interest to other people)
   
   d) lack of social or emotional reciprocity

2) **Restricted, repetitive and stereotyped patterns of behaviour, interests, and activities, as manifested by at least one of the following:**

   a) an encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
   
   b) apparently inflexible adherence to specific, non-functional, routines or rituals
   
   c) stereotyped and repetitive motor mannerisms (e.g. hand or finger flapping or twisting, or complex body movements)
   
   d) persistent preoccupation with parts of objects

3) **The disturbance causes clinically significant impairment in social, occupational or other important areas of functioning.**

4) **There is no clinically significant general delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behaviour, and curiosity about the environment.**

5) **Criteria are not met for another specific pervasive developmental disorder or schizophrenia.**
**TABLE 2: ICD-10: Diagnostic Criteria for Asperger’s Syndrome (WHO, 1993)**

A) **There is no clinically significant general delay in spoken or receptive language or cognitive development.** Diagnosis requires that single words should have developed by 2 years of age or earlier and the communicative phrases be used by 3 years or age or earlier. Self-help skills, adaptive behaviour and curiosity about the environment during the first 3 years should be at a level consistent with normal intellectual development. However, motor milestones may be somewhat delayed and motor clumsiness is usual (although not a necessary diagnostic feature). Isolated special skills, often related to abnormal preoccupations, are common, but are not required diagnosis.

B) **Qualitative abnormalities in reciprocal social interaction are manifest in at least two of the following areas:**
   a) failure to adequately use eye-to-eye gaze, facial expression, body posture and gesture to regulate social interaction
   b) failure to develop (in a manner appropriate to mental age and despite ample opportunities) peer relationships that involve a mutual sharing of interests, activities, and emotions
   c) lack of socio-emotional reciprocity, as shown by an impaired or deviant response to other peoples’ emotions; or lack of modulation of behaviour according to social context or a weak integration of social, emotional and communicative behaviours
   d) lack of spontaneous seeking to share enjoyment, interests or achievements with other people (e.g. a lack of showing, bringing or pointing out to other people objects of interest to the individual)

C) **The individual exhibits an unusually intense circumscribed interest or restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities.**

D) **The disorder is not attributable to the other varieties of pervasive developmental disorder.**
1.3 Theoretical Underpinnings

Numerous theoretical accounts have been proposed in an attempt to explain the features that characterise ASCs. Of the most predominant and well-known are cognitive theories including Theory of Mind, Weak Central Coherence and Executive Dysfunction (see Bowler, 2007 and Rajendran & Mitchell, 2007 for reviews).

**Theory of Mind**

Theory of Mind (ToM) refers to the ability to attribute mental states to others and to oneself in order to understand and predict behaviour (Premack & Woodruff, 1978). The ToM hypothesis aims to aid the understanding of the socio-communicative impairments by suggesting that difficulties within this domain reflect the central cognitive deficit (Baron-Cohen, 2000 for review). It posits that individuals with ASC have difficulty taking other peoples’ perspectives into account, which has obvious implications for social behaviour, social reasoning, pragmatic aspects of language, as well as the overall social experience (e.g. Loth, Gomez, & Happé, 2008; Tantam, 2000).

Numerous studies have provided support for the hypothesis in individuals with AD (Klin, 2000; Phillips, Baron-Cohen, & Rutter, 1998). However evidence for the existence of such a deficit or delay (Bowler, 1992; Happé, 1995) has been questioned as research findings involving high functioning autism¹ (HFA) or AS are mixed. Research thus far has predominantly focused on ‘first order’ (i.e. relating to ones own mental state), ‘second order’ (i.e. relating to the mental states of others) and ‘advanced’ (i.e. relating to more complex social situations) tasks to examine ToM abilities. Although children with HFA or AS often demonstrate difficulties on simple first or second-order tasks, this is not always the case amongst adults (e.g. Barbaro & Dissanayake, 2007; Baron-Cohen, 2000; Bowler, 1992; Dahlgren & Trillingsgaard, 1996). Alternatively, other studies have shown that adults with HFA demonstrate difficulties in more advanced ToM tasks (Jolliffe & Baron-Cohen, 1999; Kaland et al., 2002; Spek, Scholte, & van Berckelaer-Onnes, 2010; Zalla, Sav, Stopin, Ahade, & Leboyer, 2009) and tasks that more closely reflect every day experiences (Beaumont &

¹ The terms ‘high functioning autism’ and AS are used interchangeably throughout the remainder of this paper.
Sofronoff, 2008; Heavey, Phillips, Baron-Cohen, & Rutter, 2000). These discrepancies have led to suggestions that ToM difference in AS is not a deficit per se, but a reflection of a different developmental trajectory (Bowler, 1992), that learned compensatory strategies or logical problem solving may enhance performance (Frith, Happé, & Siddons, 1994; Happé, 1994) or that the difficulty lies in the spontaneous use of ToM skills in real-life (Bowler, 1992; Klin, 2000; Senju, Southgate, White, & Frith, 2009).

Over the years, the ToM hypothesis has come under criticism as a unitary explanation of ASCs. It has focused on the social communicative aspects although is limited in its explanation of the non-social features (e.g. restricted and repetitive behaviours, preference for routine, etc.) (Joseph & Tager-Flusberg, 2004; Tager-Flusberg, 2007). Others have suggested that inconsistencies with regards to the definition of ToM have proven problematic (e.g. Rajendran & Mitchell, 2007) or that certain ToM tasks have been in fact measuring other cognitive domains (e.g. Bowler, 2007).

**Weak Central Coherence**

Central coherence refers to the natural tendency to process and integrate stimuli as a whole to derive an overall meaning. The Weak Central Coherence (WCC) hypothesis originally posited that individuals with ASCs possessed a weak drive for global coherence and an overriding tendency to process local elements at the expense of the whole (Frith, 1989; Happé & Frith, 1994). WCC may prove advantageous on tasks that require discrimination of parts (e.g. Embedded Figures Test, Block Design), but can negatively impact upon social functioning in particular, such as the integration of social cues, recognition of emotions and the interpretation and processing of social experience (i.e. schematisation) (Frith, 1989; Happé & Booth 2008; Loth et al., 2008). In contrast to the ToM hypothesis, WCC was presented as a more overarching account, aiming to explain non-social features such as attention to detail, insistence on sameness, narrow interests and poor generalisation.

The evidence in support of this account has been somewhat mixed. Numerous studies have demonstrated superior local processing in this population (see Happé & Frith, 2006 for review), some have shown that global processing may in fact be intact (e.g. Hoy, Hatton, & Hare, 2004; Mottron, Burack, Iarocci, Belleville, & Enns,
2003) and others have demonstrated difference within central coherence amongst individuals with ASCs (e.g. Loth et al., 2008). Such findings have led to the question of whether the two processing approaches are distinct and whether certain tests of central coherence are sensitive enough to reliably measure global and local processing independently (Happé & Booth, 2008; Mottron et al., 2003). As a result, the WCC account has been revised over the years to implicate a common cognitive style characterised by an increased tendency for local processing and a decreased tendency for global processing, as opposed to a deficit per se (Happé & Frith, 2006; Happé & Booth, 2008). Furthermore, it is viewed more generally, as one component of the cognitive profile, rather than a unitary theory, of the strengths and weaknesses that characterise ASCs.

EXECUTIVE FUNCTIONING

Executive functioning (EF) refers to high level cognitive abilities, including inhibiting responses, initiating and planning, disengaging from external stimuli, monitoring and modifying performance (Lezak, 1995). Welsh and Pennington (1988) claim the term refers to the ‘ability to maintain an appropriate problem solving set for attainment of a future goal’ (p. 201). The Executive Function hypothesis posits that individuals with ASCs have difficulties within a number of these domains (South, Ozonoff, & McMahon, 2007), particularly cognitive flexibility (Ozonoff & Strayer, 2001). As a result, this account offers an explanation of common features such as repetitive behaviours, everyday planning, decision making, difficulty adapting to change, rigid behaviour, attention shifting, poor impulse control and self-regulation.

Executive functioning difficulties are common amongst this population (Hill, 2004a,b) and may be more significant in adulthood (Pennington & Ozonoff, 1996; Rogers, 1999). Hill and Bird (2006) recently added support to the executive dysfunction account in a study involving adults with AS. When compared to a matched sample of neurotypical controls, group differences were only observed on ‘newer’, ecologically valid EF tasks, in terms of planning, abstract problem solving, multi-tasking and response inhibition. Similarly, a number of studies have demonstrated impairments on EF tasks requiring flexibility and the generation of novel responses (e.g. Ambery, Russell, Perry, Morris & Murphy, 2006; Flood, Wallis, & Hare, 2011; Ruble & Scott, 2002). However, research
supporting this account is mixed as although numerous studies have suggested EF difficulties (Bowler, 2007), others have not (e.g. Baron-Cohen, Wheelwright, Stone & Rutherford, 1999; Thede & Coolidge, 2007).

Despite the strength of the EF hypothesis within its explanation of restricted behaviour and repetitive interests, it has been criticised as a unitary cognitive theory of ASC. EF difficulties are not restricted to autism or AS as they are present in other developmental disorders and are not present across all individuals within the spectrum (see Rajendran & Mitchell, 2007). Individuals with EF difficulties may also differ in the pattern of performance leading to the suggestion that perhaps executive dysfunction reflects a distinct profile rather than a specific deficit (Hill, 2004a).

MOVING FORWARD

These theories were initially presented as sole explanations of the core impairments associated with autism spectrum conditions, but, given that autism and AS are complex and heterogeneous, such theoretical accounts and investigations into primary deficits have fallen short in providing unitary explanations and the usefulness and mutual exclusivity of such endeavours have been questioned as a result (e.g. Bowler, 2007; Happé & Ronald, 2008; Rajendran & Mitchell, 2007). Alternatively, Bowler (2007) suggests a shift from a deficit-focused perspective towards an adaptation perspective, which takes into account the continuous and dynamic interplay that is required from this population to adapt to and cope with their environment as a result of atypical profiles of abilities and difficulties. This perspective emphasises that aspects of various theories impact upon the sense of self and subjective experience and influence how an individual with AS may understand it and cope on a day-to-day basis.
An element of the cognitive profile that goes beyond the aforementioned cognitive theories relates to autobiographical memory. Autobiographical memory refers to the recollection of personal experiences that have taken place in an individual’s life or information related to the self. Impairments in autobiographical memory are well documented in ASCs. Numerous studies have shown that individuals with ASC have difficulty remembering personal experiences and events (i.e. personal episodic memory) (Boucher & Lewis, 1989; Millward, Powell, Messer, & Jordan, 2008). Furthermore, the quality of remembering and recall may differ in that episodic or self-referential memories may be more general (Bowler, Gardiner & Grice, 2000; Bowler, Gardiner, Grice, & Saavalaineen, 2000) and less spontaneous (Bowler, Gardiner, & Berthollier, 2004; Hare, Mellor, & Azmi, 2007). A recent study examined social problem solving in AS (Goddard, Howlin, Dritschel, & Patel, 2007), in which individuals with AS demonstrated difficulties retrieving self-referential information and provided solutions that were less detailed, more time specific and overall less effective suggesting specific deficits in autobiographical memory and problem solving. Specific impairments in autobiographical memory have likely implications for the everyday social functioning of these individuals as it may impede learning from social experiences in order to adapt to new social interactions (e.g., Flood, Wallis, & Hare, 2011; Goddard et al., 2007).
1.4 ADULTHOOD

The long-term outcome associated with AS has been widely researched (e.g. Barnhill, 2007; Howlin, 2000), as the transition to adulthood and the adult life remain challenging for the majority of individuals. Social impairments continue into adulthood (Seltzer, Shattuck, Abbeduto, & Greenberg, 2004) affecting the development and maintenance of social networks (e.g. personal and intimate relationships) (Hofvander et al., 2009; Howlin, 2000; Lawrence, Alleckson, & Bjorklund, 2010), often leading to social isolation (Cederlund, Hagberg, Billstedt, Gillberg, & Gillberg, 2008; Muller, Schuler, & Yates, 2008) and activity restricted lives (Cederlund et al., 2008; Jennes-Coussens, Magill-Evans, & Koning, 2006).

Although outcomes are often variable within this population, positive outcomes are associated with a number of factors, including high IQ score (i.e. no presence of an intellectual disability) and increased support from family, employment agencies and social services (Howlin, Goode, Hutton, & Rutter, 2004). However, despite the absence of an intellectual disability and the general consensus that AS reflects the ‘higher functioning’ end of the spectrum, adults often attain limited education and meaningful employment (Barnard, Harvard, Potter & Prior, 2001; Cederlund et al., 2008; Engstrom, Ekstrom, & Emission, 2003; Green, Gilchrist, Burton, & Cox, 2000; Howlin, Alcock & Barkin, 2005). Additionally, these individuals often struggle to live independently and require significant ongoing support from their families (Barnard et al., 2001; Engstrom et al., 2003; Hofvander et al., 2009; Howlin et al., 2004; Lawrence et al., 2010). Such factors often contribute to poorer quality of life and poorer outcomes overall than same aged peers (e.g. Eaves & Ho, 2008; Jennes-Coussens et al., 2006; Renty & Roeyers, 2006).

Given the challenges that are present for adults, there is little guidance for the support and management of AS past childhood (Berney, 2004; Department of Health, 2010). A recent study into the psycho-social functioning of a community sample of adults with AS reported poor social and health profiles, characterised by social isolation, difficulty managing day-to-day tasks (i.e. life skills), medication and experiences of mental health problems (Balfe & Tantam, 2010). Medication is a common component of intervention in children and adults with ASCs (Lynne, Sutcliffe, Tanner, & Feldman, 2011) and this may increase with age (Esbensen, Greenberg, Seltzer, & Aman, 2009), despite questions regarding efficacy and side effects (Matson
Mental health problems are common amongst adults with AS (e.g. Hofvander et al., 2009) and can be exacerbated by difficulties accessing support (Barnard et al., 2001; Barnhill, 2007; Berney, 2004; Madar, 2007). Furthermore, ASCs can be undiagnosed or even misdiagnosed (Ehlers & Gillberg, 1993; Gillberg & Ehlers, 1998) and can mean years of limited or a lack of support and services (Berney, 2004). Positive outcomes for this population have been associated with timely diagnosis and treatment of comorbidity and highlight the importance of appropriate and accessible support (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Renty & Roeyers, 2006).
1.5 Mental Health

The mental health of this adult population is further complicated by the fact that diagnosis can impact on the experience of mental health difficulties as early identification can mean more timely and appropriate access to services. Barnard and colleagues (2001) reported that individuals who received diagnoses of AS in adulthood experienced difficulties accessing services, often needed acute care and often developed mental health problems. Access to mental health services can present challenges for individuals with AS as they often fall in the gap between mainstream adult services and services for individuals with intellectual disabilities (Chaplin, 2007; Ward & Russell, 2007). Lack of support and input can exacerbate mental health to the point of crisis or even psychiatric admission in adulthood (e.g. Larsen & Mouridsen, 1997).

There is a well-established evidence base indicating that individuals with autism spectrum conditions are particularly vulnerable to comorbid mental health difficulties (i.e. mood disorders, anxiety disorders, psychosis, etc.) across the lifespan (see Carpenter, 2007; Skokauskas & Gallagher, 2010; Tantam, 2000 for reviews). Research suggests that a high proportion (i.e. 65% to 85%) of children with ASCs and Asperger’s meet criteria for the diagnosis of at least one psychiatric disorder (e.g. Ghazuiddin, Weidmer-Mikhail & Ghazuiddin, 1998; Gillott, Furniss, & Walter, 2001; Kim et al., 2000; Mattila et al., 2010; Muris, Steerneman, Merckelbach, Holdrinet, & Meesters, 1998; Simonoff et al., 2008), reflecting higher comorbidity rates than in the general population. Similarly elevated comorbidity rates have also been reported in adults with HFA or AS (e.g. Balfe & Tantam, 2010; Barnard et al., 2001; Hofvander et al., 2009; Skokauskas & Gallagher, 2010; Tantam & Girgis, 2009).

Although there have been few direct investigations into the prevalence of mental health problems in the adult AS population per se, a relationship has been suggested between the existence of comorbid psychiatric conditions and the severity of ASC. Individuals without an intellectual disability and with less severe triadic impairments may present with more symptoms of anxiety (e.g. Sterling, Dawson, Estes, & Greenson, 2008; Weisbrot, Gadow, DeVincent, & Pomeroy, 2005; White, Oswald, Ollendich, & Scahill, 2009). This may be due to a number of factors such as the ability of individuals with AS to express themselves (e.g. Tsai, 1996) or the level of social functioning and self-awareness (Klin et al., 2005; Sterling et al., 2008). This
suggests that individuals with AS may not only experience and report more symptoms of anxiety and depression, but may also be at greater risk for developing mental health difficulties.
1.6 Anxiety and Stress

1.6.1 Anxiety

Although ASCs are associated with a number of mental health problems, anxiety disorders appear to be the most common both in children (see MacNeil, Lopes & Minnes, 2009 and White et al., 2009 for reviews) and adults (e.g. Balfe & Tantam, 2010; Hofvander et al., 2009; Skokauskas & Gallagher, 2010; Tantam & Girgis, 2009). Autobiographical accounts also provide support that anxiety and stress are common everyday experiences for individuals with Asperger's syndrome (Dubin, 2009; Prince-Hughes, 2004).

A number of factors may impact upon the development and maintenance of anxiety and stress, making adults with AS particularly vulnerable. Intrinsic characteristics can contribute to these experiences and may also impede the development of coping strategies (Groden, Cautela, Prince & Berryman, 1994; Tantam, 2000). The interplay between these individuals and extrinsic factors (i.e. environment) and the adaptations that are required to effectively manage on a daily basis may further exacerbate these experiences.

Communication

Limitations in communication can contribute to the risk and experience of anxiety in people with AS (Baron, Groden, Groden, & Lipsitt, 2006). Anxiety can arise as a result of communication impairments that make it difficult for individuals to express themselves and communicate with others (e.g. White et al., 2010). Research has suggested a positive association between level of communication and anxiety, in that anxiety increases as communication deficits increase (Davis et al., 2011). Not only may individuals be less aware of emotional states, but likely also have difficulties with understanding and communicating emotions (Attwood, 2006; Tsai, 2006). Additionally, limited understanding of non-verbal gestures and the pragmatics of language may be confusing for others and themselves.

Social Interaction

Impairments in social interaction can impact upon social understanding and processing as well as the overall social experience and can influence the onset of anxiety.
Individuals may desire social relationships, but often lack the skills to develop and maintain social networks (Barnard et al., 2001; Green et al., 2000). As a result, the lifespan of an individual with AS is often characterised by negative social experiences (e.g. bullying, social failure) and social isolation (e.g. Tantam, 2000), which could mean decreased likelihood of social buffers to cope with daily stress (Groden, Levasseur, & Baron, 2002). Such experiences may lead to thoughts focused on social threat and particular social processing patterns, which have been associated with anxiety symptoms in ASCs (Blackshaw, Kinderman, Hare, & Hatton, 2001; Meyer, Mundy, van Hecke, & Durocher, 2006). There may also be a reciprocal relationship with anxiety as social isolation can lead to further anxiety (e.g. White & Roberson-Nay, 2009). Difficulties with generating appropriate responses in social situations and limited understanding of the more subtle facets of social interaction may also contribute to the experience of anxiety and stress in this population (e.g. Meyer et al., 2006).

Adults with AS may also be more prone to anxiety because of a greater awareness of their difficulties and how they differ from others (e.g. Hofvander et al., 2009; Meyer et al., 2006; Sterling et al., 2008). Social comparison and attempts to conform to social ‘norms’ and expectations can be a chronic source of stress and anxiety (e.g. Gillott et al., 2001; Groden et al., 2002). Individuals with AS can vary in levels of self-awareness and self-reflection and poorly developed sense of self may contribute to limited social functioning (Jackson, Hare, & Skirrow, 2011).

BEHAVIOUR AND INTERESTS
It has been suggested that repetitive or ritualistic behaviours and insistence on sameness may be both a source (Groden et al., 1994; Howlin, 1997) and a coping response to anxiety (Gillott et al., 2001; Tantam, 2000). Individuals with ASCs may have difficulty understanding change, which may result in a sense of constant unpredictability and the experience of anxiety (Schopler & Mesibov, 1994). Engaging in repetitive behaviour and rituals may reflect an attempt to manage feelings of anxiety.

SENSORY PROCESSING
Individuals with AS may also have sensory processing patterns that differ from the neurotypical population (e.g. Dunn, Myles, & Orr, 2002). Studies have suggested that sensory hypersensitivities (i.e. overstimulation) and hyposensitivities (i.e. understimulation) can impact upon functioning and daily living (e.g. Dunn, 1997).
Autobiographical accounts suggest that sensory hypersensitivity decreases tolerance for particular situations and can result in the experience of stress and anxiety (e.g. Dubin, 2009).

NEUROBIOLOGICAL
Numerous studies have indicated atypical responses in relation to stress and anxiety in individuals with ASCs. Structural differences in the amygdala, a structure within the brain involved in the processing of emotional states (e.g. fear, anxiety) have been reported in this population (Adolphs, Sears, & Piven, 2001; Amaral, Bauman, & Schumann, 2003; Baron-Cohen et al., 2000; Critchley et al., 2000) as well as greater stress reactivity (e.g. stress related hormones) (e.g. Tani et al., 2005).

COGNITIVE
Cognitive theories and associated cognitive profiles also highlight why individuals with AS may be particularly vulnerable to the experience of anxiety (Gaus, 2011). Deficits in identifying and understanding thoughts and feelings of oneself and of others in order to predict actions (i.e. ToM) can contribute to difficulties in social interaction. It can also be exacerbated by difficulty with identifying and describing emotions (i.e. alexithymia; Berthoz & Hill, 2005) and recognising facial expressions (e.g. Humphreys, Minshew, Leonard, & Behrmann, 2007). As a result, other people and the environment are perceived as unpredictable and misunderstandings can arise, which may lead to increased anxiety (Frith, 1992). Executive functioning impairments can lead to impulsive behaviour (e.g. Ozonoff, South, & Miller, 2000) and can impact upon the ability to regulate emotions (e.g. Laurent & Rubin, 2004). These impairments can limit planning and the cognitive flexibility necessary to adapt to the demands of the environment (e.g. Ozonoff & Jensen, 1999; Ruble & Scott, 2002). Difficulties in such self-regulatory behaviours impact upon the daily experiences of individuals with AS (Hughes, 2001; Meraj, 2004) and may make them particularly vulnerable to anxiety and stress.

Abell and Hare (2005) conducted a study investigating the phenomenology of delusional ideation in adults with AS. Findings indicated that delusional beliefs (i.e. grandiose, persecutory) were related to anxiety, high levels of self-consciousness and social anxiety. Abell and Hare (2005) suggest that cognitive impairments common to AS (i.e. ToM, EF, autobiographical memory) impact negatively on social experiences,
contributing to the development of depressogenic thoughts (regarding self, others, & world) and low self-esteem maintained by an attentional bias. This vulnerable self-esteem is protected by such delusions and act alongside the attentional bias to maintain high self-consciousness and heightened levels of anxiety.
1.6.2 STRESS

Stress is typically described as the subjective experience when the perceived demands of an individual's situation exceed the perceived available resources (Dantzer, 1991). According to Lovallo (1997), stress is processed by first, evaluating the level of threat and second, evaluating the availability of resources and effectiveness of coping. Appraisals can lead to the activation of the physiological stress response (i.e. increased respiration and heart rate, cortisol release) and the development of an action plan. If perceived threat is high however, an individual may become hyper-aroused and may conclude effective coping is unlikely, resulting in an escalation of stress.

Some generic models of stress place emphasis on minor daily experiences (i.e. hassles and uplifts) as opposed to major life events (e.g. Jones & Bright, 2001). A number of studies have reported associations between such daily events, anxiety and stress (D'Angelo & Wierzbicki, 2003; Lu, 1991). It has been argued that hassles may be more accurate reflections of stress, as they represent the demands required through daily interaction with the environment and can highlight differences between individuals (Chamberlain & Zika, 1990).

STRESS, ANXIETY AND ASCS

People with ASCs seem particularly susceptible to the experience of stress (Baron, Groden, Groden, & Lipsitt, 2006). Autobiographical accounts (e.g., Dubin, 2009; Grandin, 2006) of adults with AS describing daily lives characterised by unpredictability lend further support for the notion that anxiety and stress are regular components of everyday experiences. This is not surprising given that it is the perception of stress that determines the extent of the stress response (Lazarus & Folkman, 1984; Lovallo, 1997) and the consensus that stress results from the perceived imbalance between demands and coping resources.

The appraisal of stress and the experience of anxiety are likely to be different for individuals with ASCs as a result of intrinsic difficulties generating and modulating emotional behaviour responses in social and interpersonal contexts. Core impairments interrelate to increase the likelihood of heightened experience of stress on a day-to-day basis (Baron et al., 2006; Gaus, 2011; Groden et al., 2002). These individuals may more often perceive an imbalance with regards to their own capabilities, which may
lead to increased likelihood of stressors, hyper-arousal and ultimately the experience of even more stress (Dubin, 2009; Morgan, 2006).

Sources of stress for individuals with ASCs may also differ from the general population (Morgan, 2006). Gillott and Standen (2007) investigated the relationship between stress and anxiety in 34 adults with autism and intellectual disability and reported associations between heightened anxiety and tolerance of change, anticipation, sensory stimuli and negative events. Similarly, Soderstrom, Rastam and Gillberg (2002) explored personality characteristics in 31 adults with AS and reported anxious temperaments, characterised by high avoidance (i.e. worry, fear of uncertainty) and idiosyncratic perspectives and low on self-directedness (i.e. goal orientation), novelty seeking, and cooperativeness (i.e. tolerance). Furthermore, anxiety has also been shown to be associated with daily hassles and everyday life stress (Meraj, 2004; Sze & Wood, 2007).

Individuals with AS may not only experience more stress and anxiety, but may be further disadvantaged with regards to coping. Stress as a result of social comparison and attempts to accommodate to social expectations (Gillott et al., 2001; Groden et al., 2002) may increase, but often these individuals do not have the social buffers to help cope (Groden et al., 2002). Common cognitive deficits (i.e. ToM, WCC, EF) may exacerbate everyday stress, although increasing anxiety has been shown to compromise individuals’ ability to cope (Gillott & Standen, 2007).

Stress has also been linked to ASCs on a neurobiological level. Numerous studies have investigated the role of cortisol in the experience of stress suggesting differences in response between this population and that of the neurotypical population. Many studies have shown that children with ASCs have heightened and more variable cortisol responses to stressors (e.g., Corbett, Mendoza, Abdullah, Wegelin, & Levine; 2006; Corbett, Mendoza, Wegelin, Carmean, & Levine, 2008; Lopata, Volker, Putnam, Thomeer, & Nida, 2008), although others have not shown any differences (Jansen, Gispen-de Wied, van der Gaag, & van Engeland, 2003; Zinke, Fries, Kliegel, Kirschbaum, & Dettenborn, 2010). There is also research indicating that the pattern of response may differ. Levine and colleagues (2011) recently reported that differences in cortisol responses in children with high functioning autism were only noticeable after a social stressor. Another recent study found that adolescents with AS do not show the
expected morning rise of cortisol (‘cortisol awaking response’), which has been linked to helping prepare individuals for the activities of the day (Brosnan, Turner-Cobb, Munro-Naan, & Jessop, 2009). As a result, it has been suggested that these patterns may reflect inefficient modulation of stress that manifests as difficulties adapting to change (see Lam et al., 2006). Although it is relatively unclear whether similar cortisol responses are evident in adulthood, research thus far suggests that stress responses may be qualitatively different in individuals with Asperger’s syndrome.

Relatedly, Gaus (2011) has recently proposed a model of Asperger’s syndrome as a disorder of information processing. The model suggests that the core impairments may interrelate and contribute to increased susceptibility and experience of mental health problems in the everyday lives of people with AS. Core impairments in the processing of social (i.e. ToM, pragmatics), self-awareness (i.e. emotion regulation), and non-social information (i.e. central coherence, executive functioning) contribute to deficits in social functioning and self-management (i.e. activities of daily living). Deficits in social skills lead to negative social experiences (e.g. bullying, rejection) and limited social support, and deficits in daily living skills lead to the frequent experience of daily hassles and chronic stress. These consequences simultaneously increase the risk and thus, vulnerability of adults with AS to mental health problems. The model also proposes that these experiences are set within the context of maladaptive schemas about the self, others, world and future which are developed and reciprocally maintained through negative life experiences and core processing impairments (Gaus, 2011). In accordance with this proposition, one facet of intervention might involve facilitating the development of coping skills (e.g. time management, problem-solving, relaxation) to improve self-management.
1.6.3 INTERVENTION

There is a general consensus that psychotherapeutic treatments commonly recommended and implemented for anxiety and depression in the general population are also effective for people with ASC (e.g., Lang, Regester, Lauderdale, Asbaugh, & Haring, 2010; Tantam & Prestwood, 1999). Research has been predominantly focused on Cognitive Behavioural Therapy (CBT) based interventions for the management of anxiety in children, from single case studies (e.g., Lehmkuhl, Storch, Bodfish, & Geffken, 2008; Reaven & Hepburn, 2003; Shleismann & Gillis, 2011; Sze & Wood, 2007; 2008), groups (e.g., Chalfant, Rapee & Caroll, 2007; Ooi et al., 2008; Reaven et al., 2009; White et al., 2009), and randomized controlled trials (e.g., Sofronoff, Attwood, & Hinton, 2005; Wood et al., 2009).

In contrast, only a small number of studies have explored the use of CBT interventions in the adult HFA (high functioning autism) or Asperger’s population (Cardaciotto & Herbert, 2004; Russell, Mataix-Cols, Anson, & Murphy, 2008; Weiss & Lunsky, 2010) despite recommendations for its use (e.g., Attwood, 2004; Donoghue, Stallard, & Kuczia, 2011; Gaus, 2007; 2011). Weiss and Lunsky (2010) recently reported on a 12-week manualised CBT group for three adults with AS and anxiety or mood disorders who experienced difficulty accessing mainstream mental health services. Participants expressed particular strengths of the programme as the predictability and structure of the intervention, the focus on repetition and skill building and group support. Although there was some reported improvement in symptoms over the course, this was not maintained at follow-up and the authors suggested that an increase in behavioural strategies and greater emphasis on generalising skills with real-life practice may have been beneficial in retrospect.

Barriers and difficulties, however, may arise for individuals with AS engaged in traditional or mainstream treatments (see Gaus, 2011; Hare, 1997; Hare & Flood, 2001). The core impairment in social functioning may be problematic for the development and maintenance of the therapeutic relationship, which is often central to psychotherapeutic work. Communication impairments and difficulties with understanding and expressing emotions (c.f. ‘alexithymia’; e.g., Berthoz & Hill, 2005; Chapman, 2007; Fitzgerald & Bellgrove, 2006) could prove problematic for the ability to make links between thoughts, feelings and behaviours. Difficulties with
autobiographical memory and reliance on past experiences as well as difficulties related to the understanding of others (i.e. ToM) and executive functioning may present additional challenges to therapeutic work (e.g., Russell et al., 2008). Furthermore, numerous studies have commented on the difficulty of maintaining treatment gains once therapy has ceased as a result of limited generalisation beyond treatment sessions (e.g. Anderson & Morris, 2006; Hare, 1997; Hare & Paine, 1997; Tantam & Girgis, 2009).

As a result, research with children and adults with AS has often stressed the importance of an adaptive approach, in which modifications are made to traditional interventions to take into account the unique profile of individuals with ASCs (see Hare, 2011; Moree & Davis, 2010 for reviews). Additional components such as affective education, stress management and a greater use of behavioural strategies have been suggested as well as increased structure and visual supports, within a more directive approach (e.g. Anderson & Morris, 2006; Attwood, 1999; Hare, 1997; Hare & Flood, 2001; Hare & Paine, 1997; Schleismman & Gillis, 2011; Sze & Wood, 2008; Weiss & Lunsky, 2010). Other suggestions have placed an emphasis on incorporating parents or support staff as ‘co-therapists’ as well as on practice and skill building in situ in order to aid generalisation and maintain treatment gains (e.g. Gaus, 2011; Weiss & Lunsky, 2010; White et al., 2010). Recent discussions on modified treatments have highlighted the movement from the more introspective approaches towards the use of behavioural elements and the acquisition of skills to increase coping with everyday life, in everyday contexts (e.g. Hare, 2011; Lang et al., 2010; Tantam & Girgis, 2009).

Despite difficulties and potential challenges with more traditional therapy, few studies have explored psychotherapeutic interventions beyond CBT for adults with AS (e.g. Bliss, 2007; Hare, Jones, & Payne, 1999; Munro, 2010; Turner-Brown, Perry, Dichter, Bodfish, & Penn, 2008). Research into therapeutic approaches has involved varying adaptations and has been predominantly limited to children with ASCs. Given the lifespan nature of mental health difficulties in the adult population and the potential challenges with regards to accessing services, it is not surprising that the need for development of appropriate and timely psychotherapeutic interventions remains.
2. COMPUTERISED INTERVENTIONS

Technology based and assisted interventions for mental health difficulties have received substantial attention over the past decade in response to increasing demands and costs placed on services. Computerised packages and programmes have been developed and implemented, often within a CBT framework, for a number of psychological difficulties such as depression, anxiety, phobia, Obsessive Compulsive Disorder (OCD), and Post-Traumatic Stress Disorder (see Cough & Casey, 2011 and Kaltenthaler et al., 2006 for reviews). Desktop and palm-top (i.e. hand-held) computer programmes (e.g. Personal Digital Assistant, PDA), internet programmes, virtual reality, and mobile phone applications (i.e. ‘smartphones’) have all been used as adjuncts (Clough & Casey, 2011; Cuijpers et al., 2009; Preziosa, Grassi, Gaggioli, & Riva, 2009) or stand-alone treatments (Newman, Szkodny, Llera, & Przeworski, 2011).

In a review of computer-assisted CBT for anxiety disorders, Newman, Consil and Taylor (1999) note that CBT is particularly well suited for delivery by computer because it is structured, well described, and focused on specific behaviours. Several advantages of computer-assisted CBT are discussed, including increased mastery and control for the user as well as improved accessibility, privacy, convenience, and reproducibility. Computer-assisted CBT typically consists of presenting aspects of CBT via computer, including the rationale for treatment, instruction in various anxiety management techniques, and instruction in situ.

Newman, Szkodny, Llera, and Przeworski (2011) produced a recent review of minimal contact, self-help technology assisted interventions for anxiety and depression. Newman and colleagues (1996) conducted one such study in which a hand-held computer was utilised as an adjunct to CBT for anxiety. The programme consisted of two phases that could be initiated by an individual or initiated via a pre-programmed schedule four times a day. The ‘diary only’ phase involved individuals recording frequency of panic attacks and subjective ratings of anxiety throughout the day and the ‘treatment plus diary’, in which individuals were provided with instructions for CBT techniques, including cognitive restructuring, exposure, and breathing exercises. Other studies have reported on the use of mobile phone ‘narratives’ (e.g. Grassi, Gaggioli, & Riva, 2009; Preziosia et al., 2009) and CBT applications for stress management and anxiety (e.g. Ekberg et al., 2011; Morris et al., 2010). Reviews have predominantly
demonstrated the effectiveness of such treatments for anxiety and depression (e.g. Anderson, Jacobs, & Rothbaum, 2004; Kaltenthaler et al., 2002; Kaltenthaler, Parry, & Beverley, 2004; Kaltenthaler et al., 2006; Newman, Erickson, Przeworski, & Dzus, 2003; Proudfoot, 2004).

Computerised programmes are considered to offer a number of advantages over traditional face-to-face interventions (Newman et al., 2011). Treatments are made more accessible and can reduce the cost of implementation and the structured information and interactive quality (i.e. feedback) can facilitate rehearsal, improve self-monitoring and can aid generalisation beyond sessions (e.g. Anderson et al., 2004; Newman, 1999; Newman et al., 2011). Although computerised treatments may provide a potential cost-effective solution to increasing demand, concerns remain in relation to reduced compliance and research to date has been criticised for methodological rigor (e.g. lack of follow-up, quality of software). Furthermore, such interventions may be limited in that they are particularly effective for individuals with high motivation for seeking and engaging in therapeutic work (Newman et al., 2003; Newman et al., 2011).

AUTISM SPECTRUM CONDITIONS

Technologically supported interventions may be particularly suitable for some individuals with ASCs, for whom the demands (i.e. social, generalisation skills) of conventional therapy may be problematic. Such computerised interventions can take advantage of particular strengths, as software can be programmed to present material in a predominantly visual modality, in a consistent and predictable framework, and allow for individuals to practice tasks at a self-determined pace without the social demands that may prove difficult with this population (Golan & Baron-Cohen, 2006; Putnam & Chong, 2008; Swettenham, 1996). A number of studies have presented evaluations of computer-based training for social skills (Bernard-Opitz, Sriram, & Nakhoda-Sapuan, 2001; Hetzroni & Tannous, 2004; Silver & Oakes, 2001; Swettenham, 1996), and emotion recognition (e.g. Lacava, Golan, Baron-Cohen, & Myles, 2007, Silver & Oakes, 2001). These studies have been primarily limited to children, with the exception of a handful of programmes used to aid interpersonal functioning (Rajendran & Mitchell, 2000) and emotion recognition (Golan & Baron-Cohen, 2006) in adults.
Other recent studies have explored the use of hand-held devices or PDAs with children and adolescents with ASCs. Both Ferguson, Myles, and Hagiwara (2005) and Myles, Ferguson, and Hagiwara (2007) reported single case studies of adolescents with AS, in which improvements were made in relation to independence and homework completion (respectively) via PDA delivered prompts. Mechling, Gast and Seid (2009) developed a self-controlled prompting PDA to support the completion of cooking tasks for adolescents with autism. Kaliouby and Robinson (2005) conducted a study investigating the use of an ‘emotional hearing aid’, consisting of a PDA, camcorder and earpiece, which provided real-time feedback in real-world settings to assist the interpretation of facial expressions for children with AS. Similarly, Ranfelt, Wigram and Øhrstrøm (2009) report on an ongoing project in which a hand-held, computerised ‘interactive persuasive diary’ is used with adolescents with autism to help interpret and manage social situations (HANDS Project). These studies have contributed to the literature base for the feasibility and potential for involving technology in interventions for individuals with ASCs.
Experience sampling methodology (ESM) is an approach to assessment that aims to explore the day-to-day, moment-to-moment experiences of an individual (Delespaul, 1995; De Vries, 1992; Hektner, Schmidt & Csikszentmihalyi, 2007). It allows for multiple assessments within individuals and is particularly useful for investigating individual differences (e.g. thoughts, feelings, behaviour) and phenomena that vary across individuals, time and context. A particular strength of ESM relates to the fact that it does not rely on retrospective recall as heavily as traditional assessments and is thus, less likely to be affected by memory bias (Bolger, Davis, & Rafaeli, 2003; Stone et al., 1998). However, such multiple assessments can be time-consuming and may place greater demands on participants, potentially contributing to poor compliance rates and reactivity (Myin-Germeys, Oorschot, Collip, Lataster, Delespaul, & van Os, 2009).

ESM is considered to be a more accurate assessment of an individual's emotional and cognitive state (Palmier-Claus et al., 2011) and is an ecologically valid and detailed depiction of everyday experiences (Stone et al., 1998). This approach has been used predominantly in studies of individuals with psychosis, although it has also been used extensively to explore experiences and phenomena related to anxiety and mood disorders, personality disorders, bipolar disorders, stress reactivity and cortisol fluctuations, and developmental disorders (see Palmier-Claus et al., 2011; Myin-Germeys et al., 2009; Wenze & Miller, 2010 for reviews).

ESM typically involves completing questionnaires in response to a signal (e.g. watch beep) at random or pre-determined intervals over time (e.g. 6 days). There are three main recording contingencies used within ESM: a) signal-contingent, in which a signal prompts an individual to complete a questionnaire; b) interval-contingent, in which individuals complete a questionnaire after a specified period of time; and c) event-contingent, in which individuals complete questionnaires in response to a particular event. Traditionally, ESM studies were paper based, requiring individuals to
answer questions in response to beeps delivered via a wristwatch. However, this approach presented a number of problems, as for example it did not allow for a reliable measure of compliance because individuals could complete questionnaires retrospectively, and introduced both response bias as question order could not be randomised, and sampling bias as participants could choose when to respond (Barrett & Barrett, 2001).

In response to these challenges, there has been a shift towards the use of computerised diaries (e.g. PDA) in recent years (Barrett & Barrett, 2001; Granholm, Loh, & Swendsen, 2007). Such diaries have been used in a number of studies (e.g. Kimhy et al., 2006; Le, Choi, & Beal, 2006; Simons & Parkinson, 2006) and offer a number of advantages over the paper-based format (Palmier-Claus et al., 2011; Scollon, Kim-Prieto, & Diener, 2003). Data is time-stamped and time-controlled, as it is tagged with the exact time of initiation and participants must complete a questionnaire within a limited time. This subsequently allows for exploration of compliance and response times, which have been reported to be comparable if not higher than the traditional paper-based method (e.g. Green, Rafaeli, Bolger, Shrout, & Reis, 2006; Kimhy et al., 2006). Computerised diaries can also reduce error in data management as data can be transferred directly to software programmes and can be programmed to shut down between trials to conserve battery. Furthermore, such diaries allow for branching, in that questions are determined by responses on previous questions.

However, computerised diaries also present some disadvantages over paper-based formats (Barrett & Barrett, 2001; Palmier-Claus et al., 2011). Some devices store data on a temporary basis so loss of battery power can mean that data is deleted. As a result, demands on participants may increase as the device must be charged and data must be transferred on a regular basis. Although studies have also discussed the issue of reactivity in that the assessment process can alter an individual’s experience, which has implications for the validity of the responses (Barrett & Barrett, 2001), others have suggested that this may be minimal (Cruise, Broderick, Porter, Kaell, & Stone, 1996; Hufford, Shields, Shiffman, Paty, & Balabanis, 2002)
INTERVENTION

There has recently been discussion within the ESM field suggesting that this methodology could move beyond self-assessment and exploration towards intervention, from adherence to medication to treatment monitoring (Myin-Germeys, Birchwood, & Kwapil, 2011; Oorschot, Kwapis, Delespaul, & Myin-Germeys, 2009; Palmier-Claus et al., 2011; Wenze & Miller, 2010; Wichers et al., 2011). Heron and Smyth (2010) provided an extensive review of ‘ecological momentary interventions’ (i.e. day-to-day basis) used as adjuncts for the treatment and management of difficulties such as eating disorders, diabetes, physical inactivity and anxiety. Twenty-seven studies were identified predominantly using this methodology to provide on-going support and guidance for the practice of skills in-vivo via mobile phones or PDAs.

Myin-Germeys and colleagues (2011) and Wichers and colleagues (2011) recently suggested the use of real-time ESM approaches beyond the clinical setting in the delivery of moment-to-moment interventions. More specifically, these researchers discuss a hand-held device (‘PsyMate’) originally developed to facilitate the self-monitoring of psychotic symptoms and the prospect of its use in the delivery of real-time treatment. Concurrently, Wichers and colleagues (2011) report an on-going study in which this device is being used with individuals experiencing depression, to provide tailored feedback regarding thoughts, feelings and behaviours to help identify patterns and understand their condition.

In addition, a recent multiple case study used ESM to examine the use of a mobile phone application for the management of stress in the general adult population (Morris et al., 2010). The application was based on CBT and included elements such as breathing, relaxation and cognitive appraisal exercises to increase coping. It was initiated through prompting and participant activation throughout the day and was run in conjunction with weekly interviews with researchers to reflect on the study experience. This study provides further support for the potential involvement of ESM and mobile technology in momentary interventions.
3.2 ESM AND ASPERGER’S SYNDROME

There are only a handful of studies that have used ESM to explore the daily lives of individuals with ASC. Hurlburt, Happé, and Frith (1994) used what was termed Descriptive Experience Sampling to investigate the inner experiences of three adults with Asperger syndrome. Similar to ESM, individuals were instructed to record their daily experiences in response to random beeps and later interviewed to further describe. Results showed that the adults with AS predominantly reported experiences and thoughts as motionless visual images. This preliminary study also indicated that experience sampling was a feasible means of exploring the inner experiences of individuals with AS.

A recent study (Hintzen, Delespaul, van Os, & Myin-Germeys, 2010) used paper-based ESM to explore the social needs and interactions in daily life of eight adults with ASC (5 with AS, 3 with PDD-NOS). The adults with ASC (IQ scores >80) were compared to a control group matched on age, gender and education with regards to mood, social context, and activities over a 6 day period. The results indicated that there was no group difference in terms of time spent alone and levels of social activity. However, adults with ASC spent more time with familiar people (i.e. family) and reported more negative affect and anxiety when with unfamiliar people than the neurotypical controls, which Hintzen and colleagues (2010) suggest may hinder social needs.

Wood (2008) conducted a study examining the phenomenology of thoughts and daily experiences of adults with Asperger’s syndrome. The study employed ESM delivered via a hand-held computer (PDA) to present individuals with questions randomly throughout the day for three consecutive days. Adults (N=24) with Asperger’s were compared to a neurotypical control group (N=24) on a number of domains such as the content and form of thoughts, ratings of happiness and anxiety, and daily activities. Results indicated that in comparison to the control group, adults with Asperger’s experienced more thoughts in the form of images, more thoughts categorised as worrying and confusing, and often spent more time (i.e. more than 10 minutes) ruminating or worrying about the same thought. Interestingly, idiographic analyses revealed anxiety profiles, based on subjective ratings, varying greatly from low to high throughout the day.
4. RATIONALE

Anxiety and stress are everyday issues in the lives of individuals with AS. This population is considered particularly vulnerable to the experience of stress and anxiety across the lifespan, but system issues regarding services may mean that accessing timely support is difficult (e.g., Barnard et al., 2001; Ward & Russell, 2007). CBT is often the treatment of choice for the management of anxiety and numerous studies have demonstrated the effectiveness of this approach with this adult population (e.g., Cardaciotto & Herbert, 2004; Hare, 1997). There is extensive research discussing how to adapt and modify CBT to fit the needs of individuals with ASCs (Moree & Davis, 2011). However, despite suggestions for novel and exploratory interventions for people with AS (e.g. Rajendran & Mitchell, 2000), research studies have rarely gone beyond conventional individual or group CBT treatments.

Given the characteristics common to people with AS and suggestions highlighting the importance of coping with everyday life, in everyday contexts (Gaus, 2011; Hare, 2011), the PDA is particularly well suited. PDAs are ideal in that they can accommodate suggested modifications for working therapeutically with individuals with AS (e.g. Moree & Davis, 2011). PDAs are primarily visual and allow individuals to have control to work at their own pace. PDAs allow for repetition and the opportunity for individuals to build up coping skills within the everyday environment, which is particularly important when considering the consolidation of principles via computer delivered interventions (Clough & Casey, 2011). They can function as a ‘coach’, providing prompts in real time (i.e. throughout the day and across environments), strategies which have been suggested to aid the generalisation of skills (e.g., Cardaciotto & Herbert, 2004; Hare, 1997; Weiss & Lunsky, 2010). PDAs may be more suitable as they remove the social demands of therapeutic work and reduce reliance on memory, which may be problematic given the difficulties with autobiographical memory common amongst individuals with AS. Furthermore, programmes can be designed in such a way that techniques can be reduced to step-by-step directions that is applicable across situations and provides a structured and consistent approach.

Computerised interventions offer the opportunity to capture real-life, moment-to-moment experiences. Baron and colleagues (2006) note that common interventions for individuals with ASCs often stress the importance of the use of external strategies (i.e.
involving other people, changing the environment), with the little emphasis on self-management which may be helpful given the constant interplay with the environment. They also stress the importance of repeated assessment and observations in various settings when investigating stress and coping in this population as it allows for the examination of temporal change and the idiosyncratic interaction between an individual and their environment. The Wood (2008) ESM study into the experiences of adults with AS reported high levels of anxiety characterised by momentary variation. Computerised ESM (i.e. PDA) provides the opportunity for this type of exploration as it is well-suited for the investigation of fluctuating stress and anxiety. Furthermore, it allows for the application and evaluation (i.e. pre & post subjective ratings) of psychotherapeutic input on a moment-to-moment basis.

Previous studies have used computerised interventions for the treatment of anxiety in the general population (Newman et al., 2011) and PDAs have been used as adjuncts to interventions targeting independence for adolescents with ASCs (e.g. Myles et al., 2007). Momentary assessment has been used to explore the experiences and social lives of adults with AS (e.g. Hintzen et al., 2010) and there has been recent discussion around the potential opportunities of applying such methodology and technology to intervention. However, no study to date has adapted ESM to deliver a stress management intervention via a PDA for adults with AS.

The primary aims of this exploratory pilot study were to further examine the daily experience of anxiety amongst adults with AS and to provide ‘proof of principle’ for a stress management intervention delivered via a PDA, in real-time. The evaluation of feasibility has been discussed as a measurement of adherence, treatment integrity and consumer satisfaction (e.g., Pavuluri et al., 2004, White et al., 2010) as well as in terms of the importance of examining credibility and usability in the development of novel technology based interventions (e.g., Newman et al., 2011; Ranfelt et al., 2009).
5. AIMS AND HYPOTHESES

This exploratory study had two main aims:

1) To further explore the experiences of anxiety and everyday stress in individuals with AS.
2) To present a ‘Proof of Principle’ study, to evaluate the feasibility of using a hand-held computer (i.e. PDA) to deliver a stress management intervention for everyday stress and anxiety.

The first aim generated the following hypotheses:

**Hypothesis 1:** The current study will replicate findings from the previous study (Wood, 2008), namely:

a) Individuals with AS will have a comparable proportion of worrying and confusing thoughts.

b) Individuals with AS will have an attentional style characterised by a high degree of self-focus (i.e. internally directed thoughts).

c) A comparable proportion of individuals with AS will spend more than 10 minutes dwelling on a particular thought.

d) Individuals with AS will have a comparable proportion of thoughts in the form of images.

e) Heightened subjective ratings of anxiety (i.e. ≥ 3) will be associated with thoughts subjectively appraised as worrying and confusing, prolonged rumination (i.e. more than ten minutes), and with thoughts rated as internally-focused and anxious.

f) Heightened subjective ratings of anxiety (i.e. ≥ 3) will not be associated with being in the presence of others or in response to the alarm and the subsequent interruption to thinking.

**Hypothesis 2:** Adults with AS will demonstrate a reduction in overall subjective ratings of anxiety from the Baseline phase to the RTSM phase (i.e. 3 Baseline days vs. 3 RTSM days).

**Hypothesis 3:** Adults with AS will demonstrate a reduction in subjective ratings of anxiety after a stress management technique has been employed (i.e. pre vs. post intervention ratings).
The second aim was primarily exploratory in nature. With regards to the Real-Time Stress Management intervention, the study aimed to generate further hypotheses and research questions regarding the delivery of such an intervention via a PDA. This study aimed to explore the feasibility of the RTSM intervention in this way and provide initial data on which to base future modifications. Feasibility was primarily addressed through practicality, adherence, credibility, effectiveness, generalisability, contact and participant satisfaction.
6. METHOD

6.1 ETHICS
This study received ethical approval from the University of Manchester School of Psychological Sciences Ethics Committee and the National Autistic Society (Appendices A and B, respectively).

6.2 DESIGN
This exploratory study employed an ABAB case series design in order to determine the feasibility and effectiveness of a RTSM intervention in reducing anxiety or everyday stress in adults with AS.

A) The **baseline phase** lasted for 3 days and required participants to complete a PDA questionnaire in response to random beeps (10 per day, between 10am and 4pm). The questionnaire was identical to the questionnaire used in a previous study (Wood, 2008) and examined variables such as thought content, form of thought, attentional style, length of rumination, and level of subjective anxiety.

B) The **intervention phase** lasted for 3 days and involved the introduction of the Real-Time Stress Management programme (via the PDA). This was delivered in the same way as the Baseline phase (i.e. 10 beeps per day, between 10am and 4pm). Stress management techniques were presented if and when participants indicated a high level of anxiety, as determined by the responses on the PDA questionnaire.

The baseline-treatment phase (A-B₁ [6 days]) was followed by a 7-day gap during which participants did not have access to the PDAs and then a second baseline-treatment phase (A-B₂ [6 days]) was commenced. As the study progressed it was apparent that some participants were not able to commit to the two phases of the study. Therefore as a result of this and the time constraints of data collection, it was decided that participants would be offered the option of completing the first phase only
(i.e. AB) or both phases (i.e. ABAB), as initially designed. Measures of anxiety and depressive symptoms were administered at the beginning (i.e. baseline) and end of each 6 day phase.

Single case methodology is used to investigate change in a dependent variable (i.e. stress) as a result of an intervention or treatment on a single individual or small group. There is typically no independent comparison group as participants are used as their own controls (i.e. baseline vs. treatment). A small sample ABAB design is useful in this regard as the effect of an intervention can be hypothesised if the observed variable returns to baseline levels when the intervention is removed. This is difficult to judge with a simplified AB design and warrants caution when making inferences about intervention effects. Single case designs typically involve visual analysis of graphed data (e.g. Brossart, Parker, Olson, & Mahadevern, 2006; Morley & Adams, 1991).

### 6.3 Recruitment

Participants were recruited from an advertisement on the National Autistic Society website (Appendix C) and from local support and social groups for adults with Asperger’s in the Manchester and Liverpool area between September 2010 and April 2011 (Appendix D).

Individuals who expressed interest in participating were presented with information regarding the study via email or telephone and were briefly screened to determine whether they met certain inclusion criteria (e.g. diagnosis of AS, age, involvement in therapy, history of head injury). If an individual was deemed appropriate, they met individually with the researcher and were presented with the Participant Information Sheet (PIS; Appendix E). The PIS was read and reviewed to ensure that each individual understood what the study entailed and their choice to participate. The researcher also explained the process by which each participant would be assessed to determine whether inclusion criteria (i.e. IQ score, reading ability) were met. Interested individuals were then asked to sign a consent form (Appendix F).

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2 Of the nine participants that took part in this study, only four completed the full ABAB sampling period. As a result, the second phase (A-B2) for these individuals has been omitted from the analyses.
6.4 PARTICIPANTS

Participants were included if the following criteria were met:

a) Received a verifiable diagnosis of Asperger’s syndrome from a psychologist or medical practitioner using DSM-IV-TR or ICD-10 criteria.
b) Between the ages of 18 and 65 years.
c) Full scale IQ score within the non-intellectual disability range (i.e. > 70), as indicated by the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999).
d) Fluent in English. The Palm Pilot questionnaire and the RTSM intervention demand a reading ability of approximately 6 to 9 years respectively, as indicated by the Flesch-Kincaid scale (Table 3). Only individuals with a reading ability above the age of 9.0 years, as determined by the British Picture Vocabulary Scale (BPVS-II, Dunn et al., 1997), were included.

e) No history of acquired head injury.
f) Not currently receiving Cognitive Behavioural Therapy or other psychological intervention.

Exclusion criteria were as follows:

a) No verifiable diagnosis of Asperger’s syndrome.
b) Not between the ages of 18 and 65 years.
c) Full scale IQ within the range of intellectual disability (i.e. < 70).
d) Not fluent in English or had a reading ability below the age of 9.0 years.
e) Reported history of an acquired head injury.
f) Currently receiving Cognitive Behavioural Therapy or other psychological intervention.

<table>
<thead>
<tr>
<th>Flesch-Kincaid*</th>
<th>PDA Questionnaire</th>
<th>RTSM Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Ease Score</td>
<td>97 (“Very Easy”)</td>
<td>103 (“Very Easy”)</td>
</tr>
<tr>
<td>Grade Level</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Reading Age</td>
<td>9.0 years</td>
<td>6.0 years</td>
</tr>
</tbody>
</table>

TABLE 3: Readability statistics for the PDA questionnaire and the RTSM programme.
As a result, individuals were excluded if they were in the process of an ASC assessment or awaiting diagnosis (n = 2), lived outside the study catchment area (n = 9), were under the age inclusion criteria (n = 1) or had an intellectual disability (n = 1) (see Figure 1).

**FIGURE 1**: Participant recruitment and final sample.
6.5 MEASURES

6.5.1 HOSPITAL ANXIETY AND DEPRESSION SCALE

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983; Appendix G) is a brief screening measure of mood and anxiety symptomatology. It contains 14 statements with ratings ranging in severity (e.g. ‘most of the time’ to ‘not at all’, ‘definitely as much’ to ‘hardly at all’) and includes anxiety (HADS-A) and depression (HADS-D) subscales. Each statement is scored between 0 and 3, with higher scores suggesting more significant anxiety and/or depression (i.e. normal range: 0-7, mild to moderate: 8-10, moderate to severe: 11-21). This measure has demonstrated good internal consistency (HADS-A: Cronbach’s alpha ranging from 0.68 to 0.93; HADS-D: ranging from 0.67 to 0.90) and concurrent validity (see Bjelland, Dahl, Hang, & Neckelmann, 2002 and Herrmann, 1997 for reviews). The HADS has been used extensively in both clinical and community samples (Bjelland et al., 2002) and in numerous studies involving adults with AS (Abell & Hare, 2005; Blackshaw et al., 2001; Kanai et al., 2011; Meraj, 2004; Wood, 2008). The HADS was used in the current study as a baseline measure of anxiety and depressive symptoms as well as an indication of symptomatic change (i.e. baseline to intervention).

6.5.2 AUTISM-SPECTRUM QUOTIENT

The Autism-Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin & Clubley, 2001; Appendix H) is a brief, self-administered measure assessing the degree to which features associated with ASC are present in individuals without intellectual disability. The AQ computes 50 items, in five subscales: social skills, attention switching, attention to detail, communication, and imagination. A cut-off score of 32 discriminates between adults with AS or high functioning autism within the general population (Baron-Cohen et al., 2001), although more a conservative threshold (26) has been suggested for use in ‘clinic referred populations’ (Ketelaars et al., 2008; Wakabayashi, Baron-Cohen, Wheelwright, & Tojo, 2006; Woodbury-Smith, Robinson, Wheelwright, & Baron-Cohen, 2005).

The AQ has demonstrated good test-retest and inter-rater reliability, internal consistency (Cronbach’s alpha > 70) and discriminative validity (Austin, 2005; Baron-Cohen et al., 2001; Hoekstra, Bartels, Cath, & Boomsma, 2008; Kanai et al., 2011; Kurita, Koyama, & Osada, 2005; Wakabayashi et al., 2006; Woodbury-Smith et al., 2005).
Furthermore, it has been widely used in previous studies involving adults with Asperger’s syndrome (Abell & Hare, 2005; Golan & Baron-Cohen, 2006; Kanai et al., 2011; Ketelaars et al., 2008; Wood, 2008). The AQ was used in the current study to confirm diagnosis of AS.

6.5.3 BRITISH PICTURE VOCABULARY SCALE-II
The British Picture Vocabulary Scale (BPVS-II; Dunn, Dunn, Whetton, & Burley, 1997; Appendix I) is a brief measure of an individual’s receptive verbal ability in Standard English. The BPVS-II includes 12 sets of 12 items, each containing four pictures, and requires an individual to identify which picture corresponds with a particular word. The BPVS-II is most commonly used in children, although it has been used in previous studies of adults with ASC (e.g. Goddard et al., 2007; Howlin et al., 2004). Additionally, it has been reported to have good reliability (Cronbach’s alpha: 0.93; Dunn et al., 1997). Due to the language demands of the PDA questionnaires, the BPVS-II was used to assess whether each participant’s vocabulary and reading ability (equal to or above an age equivalent of 9.0) was sufficient for inclusion in this study.

6.5.4 WECHSLER ABBREVIATED SCALE OF INTELLIGENCE
The Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999; Appendix J) provides an estimate of IQ score. It involves four subtests (Block Design, Vocabulary, Similarities, & Matrix Reasoning) and produces a Verbal (VIQ), Performance (PIQ) and Full-Scale IQ (FSIQ) score. It is considered a short-form measure of general intellectual functioning and is widely used (ages 6-89), particularly when an assessment of an individual’s full cognitive profile is deemed unnecessary. The WASI is highly correlated with the full Wechsler Adult Intelligence Scale –III (Wechsler, 1997), upon which it was derived and has shown good internal consistency (Cronbach’s alpha: 0.94), test-retest reliability and inter-rater reliability (Wechsler, 1999).

The Vocabulary and Matrix Reasoning subtests of the WASI were administered as a short measure of intellectual ability. As a full-scale IQ score can be derived from these subtests, the WASI was used to confirm whether each participant’s IQ score was within or above the average range (> 70). It has been suggested to be a particularly suitable short-form measure of IQ score estimate for the purpose of research (Axelrod, 2002) and for use with individuals with ASCs (Minshew, Turner, & Goldstein, 2010).
6.5.5 EQUIPMENT

Each participant was provided with a Palm Pilot (m500 Series; Figure 2) on which to record daily responses. Each PDA had similar dimensions (11.41 x 7.67 x 1.17 cm), a touch screen with stylus and dock to charge the battery. Questionnaires were presented using ESP software (Intel Research Center, Seattle) and the PDA was programmed to shut down between trials to preserve battery life and ensure confidentiality of participants’ responses. Participants had 60 seconds (i.e. continuous beeping and vibration) to respond to a beep in order to complete a questionnaire and did not have access to previous questions or responses.

**FIGURE 2: PDA**

![PDA Image](image)

6.5.6 PDA QUESTIONNAIRE

The PDA questionnaire\(^3\) (Table 4) was developed in a previous study (Wood, 2008) to explore the experience of anxiety in adults with Asperger’s. It was designed using experience sampling software (ESP; Intel Research Center, Seattle) for use with PDAs (see Le, Choi, & Beal, 2006). It involved 13 questions formulated on the basis of previous momentary assessment studies and specific research questions (as outlined in Wood, 2008; Figure 3). ESP software allows for multiple question formats; a) ‘open text’ in which a response must be entered using a touch screen keyboard, b) ‘multiple choice’ in which a response is chosen from a number of various options and c) ‘analogue scale’ in which a response is made by selecting a number within a sliding scale (e.g. ranging from 1 to 5). Questions were intended to take approximately two minutes to complete. The questionnaire was programmed to beep and vibrate pseudo-randomly 10 times during the day (i.e. 10am to 4pm). ESP is designed to divide the

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\(^3\) The full PDA questionnaire ESP programme is presented in Appendix K.
daily data collection period by the number of desired beeps (e.g. 10 beeps over 6 hours) to generate windows equally spaced throughout the day, during which a beep can be initiated. The questionnaire and sampling design (i.e. time period, random initiation) were in accordance with recommendations for ESM studies (see Palmier-Claus et al., 2011).

**FIGURE 3:** Example of screen displays for the PDA questionnaire.
Wood (2008) noted that the expression ‘I lost my train of thought’ could be confusing to some individuals with AS, given the tendency for literal interpretation. As a result, this was checked and explained fully with each participant.

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### TABLE 4: PDA Questionnaire

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>RESPONSE TYPE</th>
<th>CODING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What were you thinking about just before the alarm sounded?</td>
<td>Open Text</td>
<td>Coding</td>
</tr>
</tbody>
</table>
| 2. How would you describe the thought you were having just before the alarm sounded? | Multiple Choice<br>- Confusing  
- Annoying  
- Worrying  
- Practical  
- Pleasurable  
- Comforting  
- Neutral | Numeric |
| 3. What was the form of the thought you were having?                     | Multiple Choice<br>- Like written symbols  
- Like written text  
- Like someone was talking to me  
- Like I was talking to myself  
- Like an image  
- Unsure | Numeric |
| 4. Was this a normal thought for you?                                    | Multiple Choice<br>- Yes  
- No  
- Unsure | Numeric |
| 5. How long had you been thinking about this before the alarm sounded?   | Multiple Choice<br>- > 1 minute  
- 1 to 5 minutes  
- 5 to 10 minutes  
- > 10 minutes | Numeric |
| 6. How often do you think about this?                                   | Analogue Scale<br>1 = (never)  
2 = (very sad)  
3 = (very relaxed)  
4 = (a great deal) | Numeric |
| 7. How happy were you feeling just before the alarm sounded?             | Analogue Scale<br>1 = (very happy) | Numeric |
| 8. How nervous were you feeling just before the alarm sounded?           | Analogue Scale<br>1 = (very nervous) | Numeric |
| 9. What were you doing just before the alarm sounded?                    | Open Text                          | Coded  |
| 10. How many people were you with just before the alarm sounded?         | Multiple Choice<br>- I was by myself  
- I was with one other person  
- I was with 2 or more people | Numeric |
| 11. How much did the alarm upset you?                                    | Analogue Scale<br>1 = (not at all)  
2 = (a great deal) | Numeric |
| 12. Did the interruption to your thinking upset you?                     | Multiple Choice<br>- Yes  
- No | Numeric |
| 13. In what way did the interruption to your thinking upset you?          | Multiple Choice<br>- It made me feel nervous  
- I lost my train of thought  
- It annoyed me  
- Other (Open text) | Numeric/Coded (if 'other' option selected) |
The Real-Time Stress Management Intervention (RTSM; Table 5) was developed by the principal researcher (CG) for the purpose of the current study. ESP was used to design the RTSM programme as an extension of the PDA questionnaire (Wood, 2008), in that participants would be presented with various stress management strategies and explicit instructions when subjective anxiety levels were high (i.e. ≥ 3 on question 8; Figures 4 and 5).

Selection of stress management techniques was initially made on the basis of findings from the Wood (2008) study, suggesting that individuals with AS experience anxiety characterised by visually-based thoughts, worrying and confusing thoughts and prolonged thinking. Strategies were also chosen on the basis of four parameters: a) evidenced effectiveness in managing anxiety, b) non-maleficence (i.e. do no harm), c) applicable across situations and d) adaptable given the constraints of the ESP programme. ESP software allows for flexibility with regards to programme design, although each technique had to be able to be incorporated into a step-by-step, instructional programme and delivered on a PDA within a relatively short period of time.

Given the common difficulties associated with ToM and alexithymia, suggestions have been made for a less traditionally cognitive and a more behavioural approach to intervention (e.g., Hare, 2011; Lang et al., 2010; Wood, 2008). Particular techniques have been effectively translated into computerised interventions for general and clinical populations (Newman et al., 2011). Relaxation (e.g. Buglione, De Vito, & Mulloy, 1990; Newman & Borkovec, 1995; Newman et al., 1999), stress management (e.g. Dolezal-Wood, Belar, & Snibe, 1998; Riva, Preziosa, Grassi, & Villani, 2005), coping statements (e.g. Newman et al., 1996), breathing retraining (e.g., Morris et al., 2010; Newman et al., 1999) and imagery (e.g., Riva, Grassi, Villani, & Preziosa, 2007) have shown to be effective in technology based management of anxiety. Furthermore, these self-control techniques have been recommended to aid the development of coping strategies in people with ASCs (e.g., Atwood, 2004; Gaus, 2007; Groden et al., 1994).

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5 The full ESP programme developed for the RTSM intervention is presented in Appendix L.
As a result, the techniques\(^6\) selected for the RTSM intervention included: a) *Relaxation*, b) *Attention*, c) *Deep breathing*, d) *Positive Self-Talk* and e) *Imagery*.

**RELAXATION**
The relaxation script was based upon relaxation programmes for individuals with disabilities (Cautela & Groden, 1978) and Progressive Muscle Relaxation (Jacobson, 1938). This technique aims to facilitate the identification of signs of stress and discrimination between tension and relaxation by systematically tensing and relaxing different muscle groups. It places emphasis on daily practice to develop skills and can be used in various settings (Baron et al., 2006). It has been recommended as a component in stress management for individuals with intellectual disabilities (e.g. Cautela & Groden, 1978) and for individuals with ASCs (Attwood, 1996; Baron et al., 2006; Gaus, 2007; Schopler & Mesibov, 1994).

**ATTENTION**
This is a technique that is often used to divert an individual’s attention away from distressing thoughts by increasing cognitive demands in other areas and by decreasing self-focus. Wood (2008) reported that heightened anxiety was associated with prolonged thinking (i.e. > 10 minutes). This strategy was included to help shift attention to an external focus and interrupt the prolonged thinking pattern.

**DEEP BREATHING**
Deep breathing is a technique often used to help individuals decrease the impact of physiological aspects of the stress response (e.g., accelerated heart rate and breathing). Individuals are required to consciously decelerate breathing by slowly inhaling and exhaling, in order to regain a regular breathing rate, as over-breathing (i.e. very quick and shallow breathing) can often exacerbate feelings of anxiety.

**POSITIVE SELF-TALK**
Positive self-talk or coping statements are strategies used to help provide contrary feedback to negative thoughts and provide rational responses when negative thinking patterns are activated. Cognitive restructuring is the process by which negative

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\(^6\) Evidence for the use of these techniques will not be outlined in great detail here as it goes beyond the scope of this thesis. Such techniques however have been used extensively in self-help interventions and clinician guidelines for the management of anxiety and stress (e.g., Keable, 1997; Smith, 2002; Wilkinson, Moore, & Moore, 2000; Williams, 2003).
thoughts are identified, assessed and subsequently challenged in the aim of modifying dysfunctional cognitions (Beck, 1976). Although it is considered an essential component in the management of anxiety, it was not included in the RTSM programme as it was not considered feasible within the parameters of the PDA design. In a previous study, Wood (2008) reported that independently coded anxious thoughts (i.e. coded by the researcher) were not consistently and explicitly associated with thoughts subjectively (i.e. by the participant) appraised as anxious. Participants often recorded subjectively rated ‘anxious’ thoughts (e.g., ‘I was thinking about a puzzle I was doing and whether the squares are in the same diameter’, p.134) that would likely prove difficult to challenge independently through traditional verbal reattribution. As a result, it was considered an unsuitable strategy as participants would likely struggle to fit the approach to the thought if no pre-baseline instruction was provided.

**IMAGERY**

Imagery is a technique used to help people manage anxiety through visual rehearsals of calming situations. It has been suggested as a useful strategy for relaxation for individuals with ASCs (e.g., Baron et al., 2006; Groden et al., 1994). Furthermore, studies have reported a visually-based thinking style for people with AS (e.g., Hurlburt et al., 1994; Wood, 2008), suggesting imagery techniques as a useful self-control strategy to moderate anxiety. Traditional imagery techniques often involve visualising calming scenes (e.g., sunny beach, flowing river), however such scripts may not be appropriate for individuals with AS given that their experiences are considered to be qualitatively different from that of the general population (i.e., sensory difficulties, autobiographical memory impairments (e.g., Bowler, 2007; Gaus, 2011). Hare and Paine (1997) also suggest that abstract metaphors may be less useful therapeutically than more concrete forms of analogy. This imagery script was modified and developed to be sufficiently directive in situ, concrete and relevant for individuals with AS.

**DESIGN**

The RTSM intervention was designed in accordance with recommendations both for the use of ESM diaries (e.g. Palmier-Claus et al., 2011) and for adaptations for computerised interventions for individuals with ASCs (e.g. Ranfelt, Wigram, & Øhrstrøm, 2009). Instructions were written clearly and briefly and were presented in a consistent manner to include step-by-step directions for each technique. In order to
preserve battery life and consider the daily contexts where techniques may be used, there was a time limit within which participants were required to respond to each question or step (400 seconds). However, participants could work at their own pace during the RTSM techniques.

ESM was also used as an adaptive approach to capture the real-time focus of the intervention. Recent suggestions have highlighted the potential benefit of interventions that help people with AS cope with everyday lives in everyday contexts (e.g. Gaus, 2011; Hare, 2011). A PDA delivered intervention run on a momentary basis provided the means by which this could be explored.

The primary aim of this exploratory study was to gather initial feasibility data on the use of a PDA to deliver a stress-management intervention in real-time and to generate ideas upon which to base future modifications. The RTSM intervention was designed to include commonly practiced approaches for the effective management of stress and anxiety in the general population and for individuals with disabilities. It was not designed to evaluate the effectiveness of these as stand alone techniques, beyond the PDA platform.

**FIGURE 4:** Example of screen displays of the RTSM intervention.
FIGURE 5: Real-Time Stress Management Intervention

1) What were you thinking about just before the alarm sounded?
2) How would you describe the thought you were having just before the alarm sounded?
3) What was the form of the thought you were having?
4) Was this a normal thought for you?
5) How long had you been thinking about this before the alarm sounded?
6) How often do you think about this?
7) How happy were you feeling just before the alarm sounded?

8) How nervous were you feeling just before the alarm sounded?

1) Very Relaxed
2) 
3) 
4) 
5) Very Nervous

If < 3

(Continue with PDA questionnaire)
9) What were you doing just before the alarm sounded?
10) How many people were you with just before the alarm sounded?
11) How much did the alarm upset you?
12) Did the interruption to your thinking upset you?
13) In what way did the interruption to your thinking upset you?

"That is fine for now. Thank you."

END
(until next sampling period)

If ≥ 3

Which technique would you like to try?
- Relaxation
- Attention
- Deep breathing
- Positive self-talk
- Imagery

E.g. Chooses ‘Relaxation’

Presented with simple instructions (e.g. muscle relaxation exercise, etc.)

Do you think this technique helped you feel less anxious?

How nervous are you feeling now?
1) Very Relaxed
2) 
3) 
4) 
5) Very Nervous

Continued

E.g. Chooses ‘Attention’

Presented with simple instructions (e.g. external focus, naming objects in the room, etc.)
(cont'd): Real-Time Stress Management Intervention

If < 3

"That is fine for now. Thank you."

END
(until next sampling period)

If ≥ 3

Would you like to try another technique?

YES

Which technique would you like to try?
- Relaxation
- Attention
- Deep breathing
- Positive self-talk
- Imagery

"That is fine for now. Thank you."

END
(until next sampling period)

NO

"That is fine for now. Thank you."

END
(until next sampling period)
**TABLE 5:** Real-Time Stress Management Intervention Programme

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>1.</td>
<td>Hello.</td>
</tr>
<tr>
<td>2.</td>
<td>What were you thinking about just before the alarm sounded?</td>
</tr>
</tbody>
</table>
| 3. | How would you describe the thought you were having just before the alarm sounded?  
   - a. confusing  
   - b. annoying  
   - c. worrying  
   - d. practical  
   - e. pleasurable  
   - f. comforting  
   - g. neutral |
| 4. | What was the form of the thought you were having?  
   - a. like written symbols  
   - b. like written text  
   - c. like someone was talking to me  
   - d. like I was talking to myself  
   - e. like an image  
   - f. unsure |
| 5. | Was this a normal thought for you?  
   - a. yes  
   - b. no  
   - c. unsure |
| 6. | How long had you been THINKING about this before the alarm sounded?  
   - a. < 1 min  
   - b. 1-5 min  
   - c. 5-10 min  
   - d. over 10 min |
| 7. | How often do you think about this?  
   - 1 (never)  
   - 2  
   - 3  
   - 4  
   - 5 (constantly) |
| 8. | How happy were you feeling just before the alarm sounded?  
   - 1 (very sad)  
   - 2  
   - 3  
   - 4  
   - 5 (very happy) |
| 9. | How nervous were you feeling just before the alarm sounded?  
   - 1 (very relaxed)  
   - 2  
   - 3  
   - 4  
   - 5 (very nervous) |
| 10. | You seem to be feeling nervous. What technique would you like to try?  
   - a. Relaxation  
   - b. Attention  
   - c. Deep Breathing  
   - d. Positive self-talk  
   - e. Imagery |
RELAXATION
a. Sometimes when we feel anxious, our muscles are tense, but we often do not realise.
b. Relaxing our muscles can help relax our mind.
c. Work slowly through each muscle in your body, tensing each for 5 seconds and then relaxing for 5 seconds.
d. You will gradually relax your muscles up your body, from your feet slowly up to your head.
e. Try to make sure your breathing is relaxed as well; slowly breathe in and slowly breathe out.
f. Start with your toes and feet, then move up your body to your calves...
g. Then tense and relax your thighs, bottom, stomach, shoulders, arms, hands and face.
h. Remember to tense each muscle for 5 seconds and then relax each muscle.
i. You can close your eyes while you relax if this helps.
j. Try to be aware of how much less tense you feel. Try this for the next minute.
k. Click the ‘DONE’ button when you are finished.
l. That is the end of the relaxation. This will become easier with practice. Well done.
m. Do you think that this technique helped you feel less nervous?
   i. Yes
   ii. No
n. How nervous are you feeling now?
   1(very relaxed) 2 3 4 5(very nervous)
o. Would you like to try another technique?
   i. Yes
   ii. No
p. Good work.

ATTENTION
a. When we are stressed, we tend to focus on our worrying thoughts.
b. We can become so focused that it is difficult to focus on anything else.
c. There are strategies you can use to help redirect your attention.
d. Let’s try a couple.
e. Try to focus on the objects around you. Name them in your mind.
f. Look around. There may be furniture, cars, books, and so on.
g. Try to be as specific as you can (e.g. chair, coat, sandwich, book, money).
h. Try this for a minute and click ‘DONE’ when you are finished.
i. Let’s try something else now.
j. Try to count back by 3 from 100.
k. 100...97...94...91....
l. Try this for a minute and click ‘DONE’ when you are finished.
m. Do you think that this helped you feel less nervous?
   i. Yes
   ii. No
n. How nervous are you feeling now?
   1(very relaxed) 2 3 4 5(very nervous)
o. Would you like to try another technique?
   i. Yes
   ii. No
p. Good work.
DEEP BREATHING

a. Sometimes when we are anxious, we change the way we breathe. It becomes quicker and shallower.

b. This makes it harder for us to cope with stressful situations and makes us feel more anxious.

c. We can learn how to change our breathing to help our mind and body relax.

d. Take a slow, deep breath, in through your nose for 4 seconds.

e. Inhale as fully as you can. One….two….three….four…..

f. Now exhale slowly and fully through your mouth, for a count of 4 seconds.

g. As you exhale, feel the tension and stress leave your body.

h. Keep breathing in and out slowly and deeply.

i. Repeat this rhythm for one minute.

j. If thoughts or feelings come to mind, just notice them and refocus on your breathing.

k. Click the ‘DONE’ button when you are finished.

l. That is the end of the breathing exercise. This will become easier with practice. Well done.

m. Do you think that this technique helped you feel less nervous?

   i. Yes
   ii. No

n. How nervous are you feeling now?

   1(very relaxed)  2  3  4  5(very nervous)

o. Would you like to try another technique?

   i. Yes
   ii. No

p. Good work.

SELF-TALK

a. What we say to ourselves can affect how we feel.

b. Sometimes we have thoughts that are negative and they can make us feel more anxious.

c. These thoughts can make us feel like we cannot cope and that we want to leave the situation.

d. However, these thoughts are usually unrealistic and not based on evidence. They usually go away eventually.

e. Sometimes saying positive things to ourselves can help these thoughts seem less important.

f. Read the following statements and repeat them to yourself (in your mind) 5 times.

g. Some of them will seem more appropriate for your situation than others.

h. ‘I can get through this.’

i. ‘I have got through it before and been ok.’

j. ‘I do not like this, but it will pass. Let it go.’

k. ‘These are just thoughts. It does not mean that they are true.’

l. Click the ‘DONE’ button when you are finished.

m. Do you think that this technique helped you feel less nervous?

   i. Yes
   ii. No

n. How nervous are you feeling now?

   1(very relaxed)  2  3  4  5(very nervous)

o. Would you like to try another technique?

   i. Yes
   ii. No

p. Good work.
**IMAGERY**

a. Sometimes worrying thoughts are like images in our mind.
b. When we are anxious, it can feel difficult to get our minds off these images and onto something else.
c. Visualising relaxing situations can help divert our attention and help us relax.
d. Take a few deep breaths.
e. Imagine that you are standing at an empty train station, waiting for a train. Imagine that you are feeling very relaxed.
f. Try to imagine the sound of the train, the feel of the breeze, the smell of the station as if you are actually there.
g. What else do you see? What do you hear? What do you smell?
h. Imagine your thoughts and feelings as if they are the trains passing by.
i. Try to imagine your thought printed on the side of the train as it passes. They simply pass by, but you do not try to stop them.
j. With each passing train, you feel more calm and more relaxed.
k. Spend a minute imagining the calm station and the trains passing by. Just let them go. One after another.
l. Click the ‘DONE’ button when you are finished.
m. Do you think that this technique helped you feel less nervous?
   i. Yes
   ii. No

n. How nervous are you feeling now?
   1(very relaxed)  2  3  4  5(very nervous)
o. Would you like to try another technique?
   i. Yes
   ii. No

p. Good work.

(If the participant’s subjective rating of anxiety was recorded < 3.)

11. What were you DOING just before the alarm sounded?

12. How many people were you with just before the alarm sounded?
   a. I was by myself
   b. I was with one other person
   c. I was with 2 or more people

13. How much did the alarm upset you?
   1(not at all)  2  3  4  5 (a great deal)

14. Did the interruption to your thinking upset you?
   a. Yes
   b. No

15. In what way did the interruption to your thinking upset you?
   a. It made me feel nervous
   b. I lost my train of thought
   c. It annoyed me
   d. Other (Text Entry)

16. In what way did the interruption to your thinking upset you?

17. Thank you. Please charge your PDA at the end of the day.

18. Goodbye.
6.6 PROCEDURE

Individuals who expressed interest in participating were presented with information regarding the nature of the study via email or telephone. A preliminary screening process was also conducted at this stage to determine whether they met particular inclusion criteria. If an individual was deemed appropriate, they met individually with the principal investigator and were presented with the Participant Information Sheet (PIS). The PIS was read and reviewed to ensure that each individual understood what the study entailed and their choice to participate. The researcher also explained the process by which each participant would be assessed to determine whether inclusion criteria (i.e. IQ score, reading ability) were met. Interested individuals were then asked to sign a consent form. The HADS (Zigmond & Snaith, 1983), BPVS-II (Dunn et al., 1997), the WASI (Wechsler, 1999) and the AQ (Baron-Cohen et al., 2001) were administered. In addition, details were gathered regarding diagnosis (i.e. year, service, documentation), mental health problems, history of therapeutic interventions and current medication (i.e. anxiolytics, anti-depressants).

Participants were trained in using the PDA and completed practice questions with the principal investigator. The design of the study was repeated and participants were informed of the plan of support (Appendix M) in the case of distress during the course of the study. Participants were also provided with a card to record meeting dates and details regarding sources of support (Appendix N).

Participants met with the principal investigator every three days during the study period, for a total of three contacts. Participants were contacted via email during data collection to remind them to charge the PDA and to answer any questions. At the end of the overall study period (6 days), participants were required to complete a brief questionnaire about the experience of taking part in this study (Appendix O). The study procedure is presented in Figure 6.
**FIGURE 6:** Study procedure.

**INTEREST EXPRESSED**

- Preliminary screening (via email or telephone)
  - Initial inclusion criteria *not* met
  - **END**
  - Initial inclusion criteria met
    - **Meet with PI**
      - PIS provided
      - Inclusion process reviewed
      - Consent requested
    - Consent *not* obtained
      - **END**
    - Consent obtained
      - **Continued**
        - Personal information obtained
        - HADS
        - BPVS-II
        - WASI
        - PDA demonstration & practice
        - Plan of Support reviewed
      - **END**

**START**

- **PDA QUESTIONNAIRE**
  - HADS administered
  - 3 days (email contact)

- **RTSM**
  - HADS administered
  - 3 days (email contact)

- Debrief & Satisfaction Survey
  - **END**

**END**
6.7 Data and Analyses

Data obtained from the PDA were transferred via a ‘Hot Sync’ function to a computer and into a statistical programme (SPSS) for analysis after each three day period. Data were included if participants completed a minimum of 10 valid reports (i.e. one third of the total) within each three day phase (Delespaul, 1995; Palmier-Claus et al., 2011). Manually coded data was coded independently by a second rater to ensure inter-rater reliability. Data were first analysed at a descriptive level (i.e. frequency) to investigate the phenomenology of anxiety. Chi-squared tests and odds ratios were used to determine which variables were associated with the subjective experience of elevated anxiety. In order to examine the impact of the RTSM intervention, subjective ratings of anxiety were aggregated by phase (i.e. Baseline, RTSM) and by day (i.e. Baseline: Day 1, Day 2, Day 3) and compared using repeated measures analyses for non-parametric data (Wilcoxon Signed Rank Test). Pre and post-technique anxiety ratings in the RTSM phase were also compared to assess whether there was a significant decrease in anxiety levels. Subjective anxiety scores were also converted to Z-scores as an indication of how many standard deviations each score was away from the mean and as a visual representation of each participant’s anxiety ‘profile’.

Data derived from ESM approaches are nested within three levels (beeps, days, and individuals). As a result, data is considered hierarchical and statistical analyses must take into account the lack of independence within data points. Although multilevel modelling, a variant of linear regression, is considered the most appropriate approach for ESM data (see Schwartz & Stone, 1998; Scollon, Kim-Preito, & Diener, 2003), the analyses in this study were limited by the small sample which meant multilevel modelling was not appropriate\(^7\). An alternative is summary measures analyses in which observations are aggregated to the higher level, in this case the participant, as aggregation removes the impact of participant effects (i.e. dependence of repeated observations within subjects). In this study it was possible to test hypotheses related to phase or day by the aggregation of beep data. Hence between day and phase hypotheses could be investigated using the Wilcoxon Signed Rank Test, which is robust for small sample inference and was thus deemed the most appropriate

\(^7\) Proposed analyses were devised in consultation with Dr. Chris Roberts (Senior Lecturer in Medical Statistics) and Dr. Jasper Palmier-Claus (Post-doctoral fellow), both of whom have expertise in the analysis of ESM data.
method of analysis for this data set. Data were analysed with SPSS Version 16 (SPSS Inc. 2007).

6.7.1 **MISSING DATA**

All participants completed at least 33% of the questionnaires during the 6 day data collection period. This percentage is standard minimum amount of data considered to be valid (Delespaul, 1995). However, there was an overall mean completion rate of 60.6% (range: 39.1% to 88.7%) meaning the data set involved a sizeable amount of missing data. This was due to a number of factors including competing demands (e.g. working, attending college, driving), limited access (e.g. forgetting the PDA, sleeping beyond start of daily collection period) and technical difficulties (e.g. spontaneous changes in beeping schedules). There were also occasions when a trial was initiated but was not fully completed as a result of a participant deciding not to answer all the questions part way through the questionnaire or running out of time. These occasions were considered a ‘miss’ and were categorised as ‘missing data’. Missing data was omitted from the data analyses.

6.7.2 **RELIABILITY AND CODING**

Particular variables (i.e. ‘thought’, ‘doing’) required manual coding before inclusion in analyses. Thoughts were coded manually into *focus*, *content*, and *anxious* as outlined by Hektner and colleagues (2007) and Wood (2008). *Focus* referred to whether a thought was internally (e.g. ‘I’m tired.’) or externally (e.g. ‘I was thinking about a game on my Nintendo DS.’) directed. *Content* referred to whether the thought involved another person. *Anxious* referred to whether thoughts were coded as anxious or not, independent of whether the participant appraised it as such. Furthermore, responses with regards to what the participants were doing when the PDA beeped was categorized as *social* or *activity* based. This is a system that has been employed in various other ESM studies (e.g. van Eck, Nicolsen, & Berkhof, 1998; Hintzen et al., 2010), although the category of ‘work’ was not included in the current study as the majority of participants were unemployed. *Social* referred to whether the action was social in nature (e.g. ‘Talking to my support worker.’) and *activity* referred to whether the action was related to a particular activity (e.g. ‘Doing housework.’).
Coding was completed independently by the principal investigator and a graduate student (ZT). Kappa values for inter-rater agreement for the focus variable was 0.63 (p<0.0005), content variable was 0.94 (p<0.0005), anxious variable was 0.79 (p<0.0005), social variable was 0.88 (p<0.0005) and the activity variable was 0.93 (p<0.0005).
7. Results

7.1 Sample Description

Fourteen adults with AS initiated the study, although four dropped out in the initial three days due to technical problems and one individual lost contact. Information regarding the final sample is presented in Table 6. The sample (N=9) was composed of five men and four women with diagnoses of Asperger’s syndrome. All participants had FSIQ scores within the average range (i.e. 85 – 115) and average reading ability age equivalents of 16.09 years old, in accordance with the inclusion criteria. With regards to the AQ, all participants obtained scores above the suggested cut-off of 26. Two individuals scored below the more conservative cut-off (i.e. 32), suggested for use in the general population.

<table>
<thead>
<tr>
<th>TABLE 6: Participant inclusion characteristics.</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>31.14</td>
<td>8.72</td>
<td>21.75 – 46.42</td>
</tr>
<tr>
<td>FSIQ Score</td>
<td>120.00</td>
<td>7.35</td>
<td>110 - 131</td>
</tr>
<tr>
<td>AQ</td>
<td>36.78</td>
<td>7.48</td>
<td>27 - 47</td>
</tr>
<tr>
<td>BPVS-II (age equivalent)</td>
<td>16.09</td>
<td>1.27</td>
<td>13.50 – 17.00</td>
</tr>
</tbody>
</table>

At baseline, mean HADS scores were 11.11 (SD: 3.62, Range: 7-17) for anxiety and 3.89 (SD: 2.85, Range: 0-9) for depression, indicating levels of anxiety within the moderate to severe range and levels of depression within the non-clinical range. The majority (7 of 9) individuals were taking psychotropic medication for the management of anxiety and/or low mood symptoms for at least six months. Seven had been involved in the past with mental health services, most often for diagnostic assessment (i.e. AS) and follow-up and five had engaged in Cognitive Behavioural Therapy as part of past treatment.

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8 One participant had comorbid diagnoses of Personality Disorder and Obsessive Compulsive Disorder (OCD) and another had a diagnosis of OCD.
9 This was primarily antidepressant medication. Other medication included hypnotics for the management of sleep difficulties (n=2) and atypical antipsychotics (n=1).
7.2 DESCRIPTIVES

7.2.1 PHENOMENOLOGY

The frequency and percentage of thought types in both phases are presented in Table 7. In the Baseline phase, the highest proportion of thoughts was appraised as worrying (25.71%), followed by practical (23.43%) and annoying (12.57%). In contrast, in the RTSM phase the highest proportion of thoughts were appraised as practical (40.54%), worrying (13.51%) and neutral (10.81%). There were significantly more practical thoughts (Odds Ratio: 2.23, 95% Confidence Interval: 1.34-3.71) and fewer thoughts appraised as worrying (OR: 0.45, 95% CI: 0.24-0.84) in the RTSM phase. Significantly more thoughts were coded as involving another person in the Baseline phase (OR: 3.21, 95% CI: 1.61-6.08).

TABLE 7: Frequency of thought type throughout Baseline and RTSM phases.

<table>
<thead>
<tr>
<th>THOUGHT</th>
<th>BASELINE (n=175)</th>
<th>RTSM (n=148)</th>
<th>( \chi^2 )</th>
<th>p</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worrying</td>
<td>45 (25.7%)</td>
<td>20 (13.51%)</td>
<td>6.68</td>
<td>0.010</td>
<td>-0.152</td>
</tr>
<tr>
<td>Practical</td>
<td>41 (23.4%)</td>
<td>60 (40.54%)</td>
<td>10.14</td>
<td>0.001</td>
<td>0.184</td>
</tr>
<tr>
<td>Annoying</td>
<td>22 (12.6%)</td>
<td>12 (8.1%)</td>
<td>0.08</td>
<td>0.772</td>
<td>-</td>
</tr>
<tr>
<td>Neutral</td>
<td>19 (10.9%)</td>
<td>16 (10.8%)</td>
<td>0.28</td>
<td>0.598</td>
<td>-</td>
</tr>
<tr>
<td>Comforting</td>
<td>17 (9.7%)</td>
<td>11 (7.4%)</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Confusing</td>
<td>16 (9.1%)</td>
<td>14 (9.5%)</td>
<td>1.26</td>
<td>0.263</td>
<td>-</td>
</tr>
<tr>
<td>Pleasurable</td>
<td>15 (8.6%)</td>
<td>15 (10.1%)</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Internal Focus</td>
<td>24 (14.5%)</td>
<td>19 (14.2%)</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: ES = effect size (Phi coefficient for 2 x 2 tables). Significance level was set at p < 0.05\(^{10}\).

Given the repetitive nature of ESM data, ‘n’ refers to data points, not individual participants.

\(^{\dagger}\)Yates' Continuity Correction for 2 x 2 contingency tables.

\(*\) There were 165 data points in the Baseline phase because 8 ambiguous thoughts were left uncoded (e.g. ‘Nothing in particular’, ‘Nothing really’) and 2 were unanswered.

\(\circ\) There were 134 data points in the RTSM phase because 9 ambiguous thoughts were left uncoded and 5 were unanswered.

\(^{10}\) Significance was set at 0.05. Bonferroni corrections for multiple comparisons were not applied due to the small data set and the risk of exacerbating the lower statistical power, as argued by Nakagawa (2004) and Perneger (1998).
The frequencies of thought form for both phases are presented in Table 8. There was a similar distribution of across the Baseline and RTSM phases, in that the greatest proportion of thoughts were described as ‘talking to myself’ and ‘like an image’. There were no significant differences between phases.

**TABLE 8:** Frequency of form of thought over baseline and RTSM phases.

<table>
<thead>
<tr>
<th>THOUGHT FORM</th>
<th>BASELINE (n=175)</th>
<th>RTSM (n=148)</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Like I was talking to myself</td>
<td>73 (41.7%)</td>
<td>58 (39.2%)</td>
<td>0.12</td>
<td>0.729</td>
<td>-</td>
</tr>
<tr>
<td>Image</td>
<td>55 (31.4%)</td>
<td>50 (33.8%)</td>
<td>0.11</td>
<td>0.741</td>
<td>-</td>
</tr>
<tr>
<td>Unsure</td>
<td>31 (17.7%)</td>
<td>36 (24.3%)</td>
<td>1.75</td>
<td>0.186</td>
<td>-</td>
</tr>
<tr>
<td>Text or symbols</td>
<td>10 (5.7%)</td>
<td>3 (2.0%)</td>
<td>1.95</td>
<td>0.163</td>
<td>-</td>
</tr>
<tr>
<td>Like someone talking to me</td>
<td>6 (3.4%)</td>
<td>1 (0.7%)</td>
<td>1.72</td>
<td>0.190</td>
<td>-</td>
</tr>
</tbody>
</table>

Frequencies of duration, regularity and novelty of thought as well as mood and anxiety ratings are presented in Table 9. The greatest proportion of thoughts in the Baseline and RTSM phases were rated as lasting between one and five minutes and were reported as frequent and typical. Participants rated mood as happy the majority of time in both phases (Baseline: 68.1% vs. RTSM: 85.8%), although this was significantly more often in the RTSM phase. Participants also more often reported elevated subjective anxiety in the Baseline phase (66.3% vs. 34.5%). Odds ratios revealed that participants were 3.24 times (95% CI: 1.79-5.87) more likely to rate mood as happy and were only 0.27 times (95% CI: 0.16-0.44) as likely to experience elevated anxiety in the RTSM phase.
TABLE 9: Frequency of thought duration, regularity of thought, mood, anxiety and novelty of thought.

<table>
<thead>
<tr>
<th></th>
<th>BASELINE (n=175)</th>
<th>RTSM (n=148)</th>
<th>$\chi^2$</th>
<th>p</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 minute</td>
<td>50 (28.6%)</td>
<td>35 (23.6%)</td>
<td>0.76</td>
<td>0.382</td>
<td>-</td>
</tr>
<tr>
<td>1 - 5 minutes</td>
<td>68 (38.9%)</td>
<td>66 (44.6%)</td>
<td>0.864</td>
<td>0.353</td>
<td>-</td>
</tr>
<tr>
<td>5 - 10 minutes</td>
<td>31 (17.7%)</td>
<td>27 (18.2%)</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>&gt; 10 minutes</td>
<td>26 (14.9%)</td>
<td>20 (13.5%)</td>
<td>0.03</td>
<td>0.854</td>
<td>-</td>
</tr>
<tr>
<td><strong>Often (&gt;3)</strong></td>
<td>111 (63.4%)</td>
<td>96 (64.9%)</td>
<td>0.02</td>
<td>0.879</td>
<td>-</td>
</tr>
<tr>
<td><strong>Mood (&gt;3, happy)</strong></td>
<td>114 (68.1%)</td>
<td>127 (85.8%)</td>
<td>17.01</td>
<td>0.000</td>
<td>0.237</td>
</tr>
<tr>
<td><strong>Anxiety (&gt;3)</strong></td>
<td>116 (66.3%)</td>
<td>51 (34.5%)</td>
<td>31.26</td>
<td>0.000</td>
<td>0.317</td>
</tr>
<tr>
<td><strong>Usual (yes)</strong></td>
<td>129 (73.7%)</td>
<td>81 (76.4%)</td>
<td>2.81</td>
<td>0.094</td>
<td>-</td>
</tr>
</tbody>
</table>

Details of participants’ situational context are presented in Table 10. The majority of the time participants were *alone* and engaged in an *activity* almost half of the time (48.0%). Participants were significantly more often in *social* contexts when in the Baseline phase and thus, only 0.36 (95% CI: 0.15-0.81) times as likely to be engaged in a similar situation in the RTSM phase.

TABLE 10: Frequencies of situational context.

<table>
<thead>
<tr>
<th></th>
<th>BASELINE (n=175)</th>
<th>RTSM (n=92)*</th>
<th>$\chi^2$</th>
<th>p</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Situation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By myself</td>
<td>109 (62.3%)</td>
<td>66 (68.8%)</td>
<td>0.87</td>
<td>0.352</td>
<td>-</td>
</tr>
<tr>
<td>With one other person</td>
<td>35 (20.0%)</td>
<td>13 (13.5%)</td>
<td>1.36</td>
<td>0.244</td>
<td>-</td>
</tr>
<tr>
<td>With two or more people</td>
<td>31 (17.7%)</td>
<td>17 (17.7%)</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Activity Related</strong></td>
<td>84 (48.0%)</td>
<td>51 (53.1%)</td>
<td>0.72</td>
<td>0.397</td>
<td>-</td>
</tr>
<tr>
<td><strong>Social Related</strong></td>
<td>40 (22.9%)</td>
<td>9 (9.4%)</td>
<td>6.44</td>
<td>0.011</td>
<td>-0.167</td>
</tr>
</tbody>
</table>

*Note:* There were 92 data points (N=92) as these questions were not completed if an RTSM strategy was employed (N=51, plus 5 missing).
Participant reactions to the PDA beeps in both phases are presented in Table 11. The majority of the participants indicated that they were not disrupted or upset by the beep. There were 34 (19.4%) occasions when participants reported that the beep had been ‘annoying’, caused a ‘loss in train of thought’, made them ‘nervous’ or for another reason. There were no significant differences between phases.

**TABLE 11**: Frequencies of participant reactions to the PDA beep.

<table>
<thead>
<tr>
<th></th>
<th>BASELINE (n=175)</th>
<th>RTSM (n=96)</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interruption (&lt;3, no)</strong></td>
<td>154 (88.0%)</td>
<td>87 (90.6%)</td>
<td>0.21</td>
<td>0.648</td>
<td>-</td>
</tr>
<tr>
<td><strong>Upsetting (no)</strong></td>
<td>141 (80.6%)</td>
<td>80 (83.3%)</td>
<td>0.16</td>
<td>0.691</td>
<td>-</td>
</tr>
</tbody>
</table>

**How**

<table>
<thead>
<tr>
<th></th>
<th>BASELINE (n=175)</th>
<th>RTSM (n=96)</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annoyed me</td>
<td>16 (9.1%)</td>
<td>6 (6.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost my train of thought</td>
<td>12 (6.9%)</td>
<td>7 (7.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>†Other</td>
<td>4 (2.3%)</td>
<td>2 (2.1%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Made me nervous</td>
<td>2 (1.1%)</td>
<td>1 (1.0%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† Included disruption to an activity (e.g., ‘Was just about to have to a shower’, ‘I want to eat in peace’, ‘Difficulty to respond, my hands were wet’, ‘Because I was walking, it is raining’), and distraction (e.g. ‘It distracted me slightly from what I was doing’, ‘It distracted me’).
7.2.2 Associations with Anxiety

Table 12 presents the frequency of thoughts when participants indicated elevated levels of anxiety (i.e. ≥ 3) and 2 x 2 chi-squared analyses. Worrying (Baseline: OR: 16.79, 95% CI: 3.73-104.73; RTSM: OR: 15.67, 95% CI: 3.97-72.15) thoughts were significantly associated with heightened anxiety in both phases of this study and confusing thoughts were significantly associated with heightened anxiety in the Baseline phase (100%). In the Baseline phase, anxiety was negatively associated with the neutral (OR: 0.25, 95% CI: 0.08-0.74), comforting (OR: 0.18, 95% CI: 0.05-0.58) and pleasurable (OR: 0.16; 95% CI: 0.04-0.57) thoughts. In the RTSM phase, anxiety was negatively associated with pleasurable thoughts. In the RTSM phase, there was a negative association between thoughts that were coded as internally focused and heightened anxiety (OR: 0.33, 95% CI: 0.11-0.99) and a positive association between elevated anxiety and thoughts coded as anxious (OR: 3.88, 95% CI: 1.09-14.46).

### TABLE 12: Frequency of thought type when reporting elevated anxiety (i.e. ≥ 3).

<table>
<thead>
<tr>
<th>THOUGHT TYPE</th>
<th>BASELINE</th>
<th></th>
<th></th>
<th>RTSM</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>χ²</td>
<td>p</td>
<td>ES</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Worrying</td>
<td>43</td>
<td>95.6</td>
<td>21.49</td>
<td>0.000</td>
<td>0.364</td>
<td>17</td>
<td>85.0</td>
</tr>
<tr>
<td>Practical</td>
<td>24</td>
<td>58.5</td>
<td>1.02</td>
<td>0.312</td>
<td>-</td>
<td>17</td>
<td>28.3</td>
</tr>
<tr>
<td>Annoying</td>
<td>17</td>
<td>77.3</td>
<td>0.86</td>
<td>0.355</td>
<td>-</td>
<td>6</td>
<td>50.0</td>
</tr>
<tr>
<td>Neutral</td>
<td>7</td>
<td>36.8</td>
<td>6.86</td>
<td>0.009</td>
<td>-</td>
<td>-</td>
<td>12.5</td>
</tr>
<tr>
<td>Comforting</td>
<td>5</td>
<td>29.4</td>
<td>9.70</td>
<td>0.002</td>
<td>-</td>
<td>-</td>
<td>18.2</td>
</tr>
<tr>
<td>Confusing</td>
<td>16</td>
<td>100.0</td>
<td>7.37</td>
<td>0.007</td>
<td>0.226</td>
<td>7</td>
<td>50.0</td>
</tr>
<tr>
<td>Pleasurable</td>
<td>4</td>
<td>26.7</td>
<td>9.67</td>
<td>0.002</td>
<td>-</td>
<td>-</td>
<td>7.16</td>
</tr>
<tr>
<td>Internal Focus</td>
<td>18</td>
<td>75.0</td>
<td>0.49</td>
<td>0.482</td>
<td>-</td>
<td>11</td>
<td>57.9</td>
</tr>
<tr>
<td>Other Person</td>
<td>35</td>
<td>74.1</td>
<td>0.43</td>
<td>0.508</td>
<td>-</td>
<td>7</td>
<td>43.8</td>
</tr>
<tr>
<td>Anxious</td>
<td>23</td>
<td>79.3</td>
<td>1.89</td>
<td>0.169</td>
<td>-</td>
<td>9</td>
<td>64.3</td>
</tr>
</tbody>
</table>

**Note:** ES = effect size (Phi coefficient for 2 x 2 tables).
†Yates’ Continuity Correction for 2 x 2 contingency tables.
Table 13 presents reported thought forms when participants indicated heightened anxiety and 2 x 2 chi squared tests. Anxiety was negatively associated with thoughts in the form of text or symbols in the Baseline phase (OR:0.20, 95% CI: 0.04-0.89). There were no other significant associations between thought form and anxiety.

**TABLE 13**: Form of thought type when reporting elevated anxiety (i.e. ≥ 3).

<table>
<thead>
<tr>
<th>TYPE</th>
<th>BASELINE</th>
<th>RTSM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Talking to myself</td>
<td>54</td>
<td>74.0</td>
</tr>
<tr>
<td>Image</td>
<td>37</td>
<td>67.3</td>
</tr>
<tr>
<td>Unsure</td>
<td>20</td>
<td>64.5</td>
</tr>
<tr>
<td>Text or symbols</td>
<td>3</td>
<td>30.0</td>
</tr>
<tr>
<td>Someone talking to me</td>
<td>2</td>
<td>33.3</td>
</tr>
</tbody>
</table>

*Note: ES = effect size (Phi coefficient for 2 x 2 tables).†Yates’ Continuity Correction for 2 x 2 contingency tables.*

Table 14 presents the duration, novelty and regularity of thought as well mood rating when experiencing elevated anxiety. The majority of thoughts lasting over 10 minutes occurred alongside heightened anxiety, although this association was not significant. Anxiety was negatively associated with the ‘happy’ mood (i.e. when rated as ‘sad’) in both phases (Baseline OR: 0.02, 95% CI:0.00-0.11, RTSM OR: 0.16, 95% CI: 0.05-0.48), in that the likelihood of rating mood as ‘happy’ decreased by factors of 0.02 and 0.16, respectively when experiencing anxiety.

**TABLE 14**: Frequency of thought duration, regularity of thought, mood, and novelty of thought when reporting elevated anxiety.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>BASELINE</th>
<th>RTSM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Duration (&gt; 10 min.)</td>
<td>15</td>
<td>57.7</td>
</tr>
<tr>
<td>Often (&gt;3)</td>
<td>77</td>
<td>69.4</td>
</tr>
<tr>
<td>Mood (&gt;3, happy)</td>
<td>56</td>
<td>49.1</td>
</tr>
<tr>
<td>Usual (yes)</td>
<td>82</td>
<td>63.6</td>
</tr>
</tbody>
</table>

*Note: ES = effect size (Phi coefficient for 2 x 2 tables).†Yates’ Continuity Correction for 2 x 2 contingency tables.*
Table 15 presents details regarding participants’ situational context when experiencing heightened anxiety. There was a significant association between anxiety and whether an individual was alone or in the company of one other person. Individuals were 2.56 (95% CI: 1.28-5.16) times more likely to report heightened anxiety when alone, but only 0.29 (95% CI: 0.13-0.66) times as likely when with someone else. There was no association between the experience of elevated anxiety when in the presence of two or more people or when engaged in activity based or socially related situations.

**TABLE 15:** Frequencies of situational context when reporting elevated levels of anxiety.

<table>
<thead>
<tr>
<th>Situation</th>
<th>n</th>
<th>%</th>
<th>χ²</th>
<th>p</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=171*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By myself</td>
<td>81</td>
<td>74.31</td>
<td>7.41</td>
<td>0.007</td>
<td>0.218</td>
</tr>
<tr>
<td>With one other person</td>
<td>15</td>
<td>42.86</td>
<td>9.48</td>
<td>0.002</td>
<td>-0.248</td>
</tr>
<tr>
<td>With two or more people</td>
<td>20</td>
<td>64.51</td>
<td>0</td>
<td>0.984</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>55</td>
<td>65.48</td>
<td>0.10</td>
<td>0.747</td>
<td>-</td>
</tr>
<tr>
<td>Social Related</td>
<td>23</td>
<td>57.50</td>
<td>1.71</td>
<td>0.191</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note:** Analyses were not completed on these variables in the RTSM phase as this question was not presented if anxiety levels were high (i.e. ≥ 3).
* There were 171 data points as 4 of this question were left unanswered.

There were no significant associations between reactions to the PDA beeps and experiences of elevated anxiety (Table 16), suggesting that the PDA itself did not contribute to participants’ anxiety.
**TABLE 16**: Frequencies of participant reactions to the PDA beep when reporting elevated levels of anxiety.

<table>
<thead>
<tr>
<th></th>
<th>BASELINE</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>(\chi^2)</td>
<td>(p)</td>
<td>ES</td>
</tr>
<tr>
<td><strong>Interruption (&lt;3, no)</strong></td>
<td>99</td>
<td>64.28</td>
<td>1.61</td>
<td>0.204</td>
<td>-</td>
</tr>
<tr>
<td><strong>Upsetting (no)</strong></td>
<td>96</td>
<td>68.10</td>
<td>0.68</td>
<td>0.410</td>
<td>-</td>
</tr>
<tr>
<td><strong>How</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annoyed me</td>
<td>10</td>
<td>62.50</td>
<td>0.00</td>
<td>0.951</td>
<td>-</td>
</tr>
<tr>
<td>Lost my train of thought</td>
<td>6</td>
<td>50.00</td>
<td>0.17</td>
<td>0.684</td>
<td>-</td>
</tr>
<tr>
<td>Made me nervous</td>
<td>2</td>
<td>100.00</td>
<td>0.23</td>
<td>0.632</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note**: ES = effect size (For 2 x 2 tables, phi coefficient was used as a measure of effect size).

† Yates’ Continuity Correction for 2 x 2 contingency tables.
7.2.3 RTSM

The aim of the RTSM intervention was two-fold: to determine whether it was feasible to deliver an intervention in this way and whether it could help decrease subjective anxiety throughout the day.

COMPLIANCE

With regards to compliance, participants completed an average of 19.4 (SD= 5.83) questionnaires in the Baseline phase, 16.33 (SD= 5.10) in the RTSM phase and 35.78 (SD= 9.37) overall. During the RTSM intervention phase, individuals reported elevated anxiety levels (i.e. over 3) on 51 (33.8%) occasions. Participants employed a variety of techniques and indicated techniques were helpful 58.8% (n=30) of the time (Table 17). The majority (n=33, 66.0%) of post-technique anxiety ratings (\( \bar{x} = 2.84 \), SD = 0.77) remained elevated (i.e. > 3) and participants chose the option of attempting another technique (i.e. 2\(^{nd}\) attempt) on seven occasions (18.2%). Five of these post-technique anxiety ratings (\( \bar{x} = 3.00 \), SD = 0.82) remained elevated. Mean response time revealed that techniques were completed in 10.87 seconds. Table 18 presents the timing of techniques, per participant over each day of the RTSM phase. Techniques were employed only when an individual indicated heightened levels of anxiety (i.e. ≥ 3). Six of the participants did not engage in any RTSM techniques on at least one day of the three days and four did not use a technique on the final day. One participant did not employ a technique at all during the entire RTSM phase (Participant 8). Visual inspection suggests a gradual decrease in the number of interventions used over the course of the RTSM phase.
### TABLE 17: RTSM techniques and technique completion times.

<table>
<thead>
<tr>
<th>Technique</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Attempt (n=50)*</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Attempt (n=7)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>12 (24.0%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>Self-Talk</td>
<td>12 (24.0%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>Deep Breathing</td>
<td>11 (22.0%)</td>
<td>-</td>
</tr>
<tr>
<td>Imagery</td>
<td>10 (20.0%)</td>
<td>3 (42.9%)</td>
</tr>
<tr>
<td>Relaxation</td>
<td>6 (12.0%)</td>
<td>2 (28.6%)</td>
</tr>
</tbody>
</table>

Overall Technique Completion Time (seconds)

[\bar{x} (sd), Range] 10.87 (7.02) 1.83-28.34 19.40 (13.82) 4.27-46.05

* One participant did not complete the programme after selection of a technique and are thus, not included in subsequent analyses.
† For five individuals.

### TABLE 18: Participants’ use of RTSM techniques over the three day RTSM phase.

<table>
<thead>
<tr>
<th>PARTICIPANT</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
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<td>4</td>
<td>•</td>
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<td></td>
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<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td>•</td>
<td>•</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>6</td>
<td>•</td>
<td></td>
<td></td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td>•</td>
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<td>7</td>
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<td>•</td>
<td>•</td>
<td></td>
<td>•</td>
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<td>•</td>
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<tr>
<td>8</td>
<td></td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td>•</td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TIME</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

**Note:** Techniques were only presented if an individual indicated elevated anxiety (i.e. ≥ 3), thus each ‘•’ represents a point during which subjective anxiety was high and a technique was used within a specific time period.
SUBJECTIVE ANXIETY

With regards to anxiety, subjective ratings were aggregated by *phase* (i.e. Baseline and RTSM) and by *day* for each participant, such that each participant had a single mean anxiety rating for each phase and each day during data collection.

*a) Day*
Scores from the *first* ($\bar{x} = 2.46$, SD = 0.75) and *last* ($\bar{x} = 2.09$, SD = 0.62) day of the RTSM phase were compared to determine whether anxiety ratings decreased during the three day intervention period. A Wilcoxin Signed Rank Test did not reveal a significant decrease ($Z = -1.78$, *p* = 0.075). Comparisons were also conducted between the *first* ($\bar{x} = 2.71$, standard deviation = 1.14) and *last* ($\bar{x} = 2.92$, SD = 0.99) day of the Baseline phase to determine whether using the PDA (i.e. without the intervention) inadvertently affected anxiety ratings, although this was not significant ($Z = -0.94$, *p* = 0.345). Furthermore, comparisons were conducted to determine whether a significant change in subjective anxiety occurred at the *end* of both phases (i.e. day 3 and day 6 of the collection period). Scores at the end of the Baseline phase ($\bar{x} = 2.92$, sd = 0.99) were not significantly different from scores at the end of the RTSM phase ($\bar{x} = 2.09$, sd = 0.62; $Z = -1.89$, *p* = 0.058).

*b) Phase*
Aggregated scores from the Baseline ($\bar{x} = 2.92$, SD = 0.96) and RTSM ($\bar{x} = 2.26$, SD = 0.56) phase were compared to determine whether anxiety ratings decreased between phases. A Wilcoxin Signed Rank Test revealed a significant decrease in subjective ratings of anxiety in the RTSM phase ($z = -2.52$, *p* = 0.012, ES = 0.59). Subjective ratings of anxiety were provided before (i.e. pre) and after (i.e. post) a technique was completed. These pre and post technique ratings were compared to determine whether employment of a technique decreased anxiety levels. A Wilcoxin Signed Rank Test revealed a significant difference in pre ($\bar{x} = 3.31$, sd = 0.28) and post ($\bar{x} = 2.91$, sd = 0.51) subjective ratings of anxiety ($Z = -2.37$, *p* = 0.018, ES = 0.84).

At the end of the RTSM phase (i.e. end of data collection), mean HADS scores were 10.12 (SD: 2.70, Range: 6-14) for anxiety and 4.25 (SD: 3.28, Range: 0-9). Comparisons of pre (i.e. baseline) and post (i.e. end of RTSM phase) HADS scores failed to indicate significant reductions for anxiety ($Z = -1.26$, *p* = 0.21) or depression ($Z = -0.32$, *p* = 0.75).
7.2.4 Anxiety Profiles

Subjective ratings of anxiety were also used to examine participants' anxiety profiles (Figure 7). Individual subjective anxiety scores (i.e. per beep, per participant) were converted to Z-scores as a visual representation of each participant's anxiety levels over the course of the 6 day period. Dashed lines are used to represent different days in order to indicate ratings of anxiety through each phase and use of the PDA over the course of the study. It is possible that changes in anxiety scores and frequency of use of the PDA are due to the RTSM techniques or due to iatrogenic factors of engaging in the process itself. However, Wood (2008) reported positive feedback from participants regarding the use of PDA in this way and preliminary feedback from this study is not dissimilar.
**FIGURE 7**: Participant anxiety profiles (Z-scores).

**PARTICIPANT 1** was a 23 year-old man currently living with his parents and attending college. He received a diagnosis of AS at the age of 9 years and had previously been involved in therapy for the management of anxiety (aged 20). He was taking antidepressant medication. Participant 1 reported that disruptions in sleep patterns often meant that he missed the initiation of the PDA schedule (i.e. 10 am to 12 pm). He also reported that he had forgotten to take the PDA with him on the first day of the Baseline phase and thus, completed no trials until the second day. Similarly, no trials were completed during the second day of the RTSM phase as he was attending college. He expressed interest in taking part in the full (i.e. ABAB) study, but contact was lost after the first 6 days. [HADS Baseline: A17D15, Post-RTSM: A12D9]
**Participant 2** was a 39-year-old man who received a diagnosis of AS 5 years previously. He was living independently with support from his family and was currently unemployed. He received post-diagnostic input from psychological services. He was taking antidepressant medication and medication to help with sleep difficulties. Participant 2 completed the later part of the study during a period of significant anxiety and mood difficulty. He was highly motivated to complete trials and completed the entire 12 days of data collection with a very high adherence rate (Baseline: 26 of 30 trials; RTSM: 30 of 30 trials). A high proportion of his thoughts were related to short-term plans (e.g. ‘What I need to do today’) and often recorded thoughts as ‘Nothing in particular’ in the RTSM phase. Participant 2 also required a high level of contact (i.e. email, text) and support whilst taking part in this study (e.g. reminding to charge the PDA, discussion regarding accessing further support). [HADS Baseline: A7D2, Post-RTSM: A8D2]
Participant 3 was a 25 year-old man who received a diagnosis of AS two years previously. He was living independently and attending college. He had been involved in psychological therapy for two years for the management of low mood and was discharged eight months before this study. Participant 3 was not currently taking any medication. He did not complete trials whilst at college and thus completed two of ten on the second day of the RTSM phase. There were two occasions when he did not fully complete a trial after it had been initiated. He was motivated and organised and required minimal support during the study process. He also reported interest in exploring his own thoughts and a number of personal strategies, primarily visual based (e.g. trying to imagine a game console in great detail), he already successfully engaged in as a means of managing anxiety. Participant 3 completed the entire 12 days of data collection. [HADS Baseline: A8D0, Post-RTSM: A10D1]
**PARTICIPANT 4** was a 46 year-old woman who received a diagnosis of AS at the age of 43. She lived independently, with ongoing support and was unemployed. She was currently taking antidepressant medication and medication for sleeping difficulties. She reported psychotherapeutic input for the management of depression seven years before this study. Participant 4 completed the full 12 days of data collection, although she reported technical problems with the PDA and expressed confusion with the structure and format of some of the questions (e.g. scales responses, categorising thoughts). She also reported difficulty describing thoughts that had synaesthetic qualities (i.e. thoughts that were both visual and tactile). She required support through out data collection to resolve these difficulties and problem solve around how best to record her thoughts and feelings. Participant 4 reported forgetting to carry the PDA and purposely leaving the PDA behind at times (e.g. Day 3 of the Baseline and RTSM phase) when she was rushed or frustrated. She expressed irritation at the PDA trial beeps when she was already engaged in a relaxing or enjoyable activity (e.g. drawing) and felt her focus was disrupted. She also expressed frustration as she felt the trials occurred too often. On five occasions, Participant 4 did not fully complete trials she had been initiated. She reported that sometimes the PDA shut down before she could complete the questionnaire or she ran out of time. [HADS Baseline: A10D4, Post-RTSM: A9D8]
**PARTICIPANT 5** was a 28 year-old woman who was diagnosed as having AS at the age of 26. She lived independently and was employed part-time. She reported being given comorbid diagnoses of Obsessive Compulsive Disorder and Borderline Personality Disorder. She also reported an extensive history of involvement with mental health services (e.g. Cognitive Analytic Therapy, Cognitive Behavioural Therapy, Art Therapy, Counselling, etc.) since the age of 12 years. Participant 5 initially expressed a high level of motivation to complete a high number of trials, although expressed frustration of the beeps in the RTSM phase of the study. There were eight occasions when she did not fully complete a trial after it had been initiated. She completed six days of data collection and then contact was lost. [HADS Baseline: A9D7, Post-RTSM: not provided]
**Participant 6** was a 37 year-old man who was diagnosed as having AS at the age of 35. He lived independently with his partner and children and had gained a degree at college, although was currently unemployed. He reported receiving a past diagnosis of a psychotic disorder and anti-psychotic medication, which was subsequently dropped upon receiving a diagnosis of AS. He reported psychological input 15 years before this study for the management of anxiety. He was currently not taking any psychotropic medication. Participant 6 reported experiencing a particularly stressful period of time during this study, although he was highly motivated to complete trials. He was very technologically skilled and enjoyed the study process (e.g. PDA, recording thoughts). He had also participated in numerous research studies involving people with Asperger’s syndrome. There were three occasions when he did not fully complete a trial after it had been initiated. Participant 6 completed the entire 12 days of data collection. [HADS Baseline: A14D8, Post-RTSM: A14D6]
**PARTICIPANT 7** was a 34 year-old woman who received a diagnosis of AS three years previously. She lived independently with her children and was currently unemployed. She had received psychological input sporadically for three years up until 10 years before this study. She was currently not taking medication due to past experiences of side effects. Participant 7 reported heightened anxiety as a result of technical problems with the PDA and gaining awareness of the ‘erratic nature’ of her thoughts through the study process. She reported that she would often wait for each PDA trial and attempted to identify her thoughts before the trial had begun. Participant 7 also reported times when her thoughts and her behaviour were not linked, although felt that this could not be captured adequately on the PDA questionnaire. She expressed that she could feel anxious about what she was doing, but felt the thought she was having was unrelated. There were three occasions when she did not fully complete a trial once it had been initiated. She expressed that the period in which this study took place was particularly stressful and the increasing awareness into her thoughts exacerbated her anxiety. As a result, she did not complete any trials on the final day of data collection and discontinued participation after six days.

[HADS Baseline: A9D3, Post-RTSM: A9D0]
PARTICIPANT 8 was a 22 year-old man who received a diagnosis of AS at the age of 13. He lived with his parents and worked part-time. He reported receiving a comorbid diagnosis of OCD and psychological input for the management of symptoms three years before this study. He had been taking antidepressant medication since his diagnosis of AS. Participant 8 reported technical problems with the PDA that meant the daily beeps were unreliable, although was motivated to complete trials. Participant 8 was also technologically skilled and had participated in numerous research studies previously. Although he completed six days of data collection, he reported a low level of anxiety (score of 2) consistently over the entire RTSM phase. As he never reported heightened subjective anxiety (i.e. >3), he was never offered techniques via the RTSM intervention. As a result, this phase has not been included in Participant 8’s anxiety profile. [HADS Baseline: A10D3, Post-RTSM: A6D3]
**PARTICIPANT 9** was a 21 year-old woman who received a diagnosis of AS at the age of 19. She lived independently as a student. She received counselling for low mood around the time of diagnosis and was taking antidepressant and antipsychotic medication at the time of this study. During the course of this study, Participant 9 experienced a stressful event and expressed low mood with thoughts of self-harm. However, she remained interested in taking part and was motivated to complete the study. She completed the full 12 days of data collection. There were two occasions when she did not fully complete a trial that she had initiated. Participant 9 completed only approximately half of the trials in the RTSM phase as she was attending lectures during this period. **[HADS Baseline: A16D7, Post-RTSM: A13D5]**

![Graph showing anxiety z-scores for Participant 9](image-url)
7.2.5 PARTICIPANT FEEDBACK

A short ‘satisfaction survey’ was completed at the end of the study to explore participants’ experiences of taking part. Feedback revealed that the majority of participants felt that they were provided with adequate information about the study and felt comfortable using the PDA. All of the participants who responded felt that the PDA interfered with their daily lives to some degree and more than half reported the PDA increased their anxiety. Only one participant reported finding the strategies helpful, but almost half reported thinking they would use them again. Feedback from participants is presented in Table 20.

**TABLE 20: Participant feedback.**

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the experience of participating in the study what you expected?</td>
<td>3</td>
<td>4</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Did you get enough information about the study beforehand?</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Did you feel comfortable using the PDA?</td>
<td>6</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Were the instructions for using the PDA clear enough?</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Did you find that using the PDA increased your anxiety?</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Did using the PDA interfere with your day?</td>
<td>1</td>
<td>6</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Did you find the strategies helpful in managing your stress?</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Do you think you will continue using any of the strategies?</td>
<td>4</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Based on 7 responses.*

With regards to the question of whether anything could be improved, participants provided the following responses:

- **EASE OF USE**
  - One participant mentioned that sometimes the PDA was difficult to navigate and a brighter screen would have been helpful (Participant 1).
  - One participant had difficulty with the touch screen keyboard (P4).
  - Three participants mentioned that technical problems with the PDA, mostly unreliable beeping schedules, increased anxiety as they
were waiting for the beep (e.g. ‘Will it work?’, ‘When will it go off?’, ‘Have I broken it?’) (P4, P6, P7).

- One participant suggested the use of phone or computer applications as an alternative to the PDA (P6).

**QUESTIONS**

- One participant suggested more categories in relation to thought appraisals as they often found their thoughts ‘didn’t necessarily fit’ (e.g. ‘sad thoughts’) (P4).

- Two participants reported difficulty with the scaling of questions (e.g. mood and anxiety) expressing that they often ‘got lost in the middle’ of two extremes (P4) or that certain responses were ‘difficult to quantify’ in this way (P7). Both preferred providing responses in relation to words (i.e. ‘a little bit’, ‘somewhat’) and suggested an option for providing further explanation (i.e. open text response).

- One participant asked for more time to complete questionnaires and suggested a ‘wait’ or ‘pause’ button as well as a ‘back’ button to return to previous questions (P4).

- One participant felt it was difficult to appraise ‘sad’ thoughts as they did not ‘fit’ within the categories available on the questionnaire.

- One participant reported frustration between providing thoughts, mood ratings and behaviour (P7). She felt as though there were often times where there was no link between thoughts and behaviour and feelings of anxiety were related to what she was doing rather than what she was thinking. She suggested an option for participants to provide an explanation of such instances.

**TECHNIQUES**

- One participant requested more variation in the imagery instruction (P2).
8. Discussion

This exploratory study aimed to further examine the phenomenology of everyday anxiety and stress in adults with AS by replicating findings reported in a previous study (Wood, 2008). This study also aimed to investigate the feasibility of implementing a real-time stress management intervention via a PDA.

8.1 Review of Results

Results of this study indicated that approximately half of thoughts in the Baseline phase were appraised as worrying (25.7%) or practical (23.4%). In comparison, significantly more thoughts were appraised as practical (40.5%) and fewer thoughts appraised as worrying (13.5%) in the intervention phase. In both phases, the majority of thoughts were reported as talking to themselves or in the form of images. The majority of thoughts were described as typical (i.e. ‘normal’), frequent and lasting under five minutes. More thoughts were coded as involving another person in the Baseline phase than in the RTSM phase.

With regards to mood ratings, participants rated themselves as happy the majority of the time, although such ratings were more likely in the RTSM phase (68.1% vs. 85.8%). Participants also reported heightened subjective anxiety significantly less often in the RTSM phase (34.5% vs. 66.3%). In both phases, participants reported spending the majority of time alone. Half of the time participants reported being engaged in an activity. Participants were significantly less likely to be in a social situation in the RTSM phase, which may reflect the reluctance of participants to use techniques in the presence of others.

The RTSM intervention was initiated a third (33.8%) of the time, when participants indicated heightened levels of anxiety. A variety of techniques were attempted, although the majority of the post-technique subjective ratings of anxiety remained elevated. Quick response times (i.e. technique completion time) suggested that either participants rushed through the instructions to finish the trial without completing the technique or attempted the technique once all the instructions had been viewed. There was no significant decrease in subjective anxiety ratings from day-to-day
(i.e. day analysis) or with regards to the HADS anxiety scores. There was a decrease in subjective anxiety from Baseline to RTSM intervention and between subjective ratings provided before and after a technique was employed. Furthermore, profiles of subjective anxiety reflected periods of variable (i.e. high to low) anxiety throughout the day.

8.2 Sample

This sample comprised of nine adults (five men, four women), most of whom received diagnoses of AS in adulthood. Three participants were students, two were in part-time employment and four were unemployed. Two participants reported comorbid mental health conditions. The majority of participants had a history of involvement with mental health services and were taking psychotropic medication for the management of anxiety and/or low mood. At the time of the study, participants reported symptoms of anxiety within the moderate to severe range as measured by the HADS.

8.3 Phenomenology & Anxiety

Hypothesis 1:

a) Individuals with AS will have a comparable proportion of worrying and confusing thoughts.

Approximately half the thoughts in both phases were appraised as either worrying (Baseline: 25.7% & RTSM: 13.5%) or practical (23.4% & 40.5%). However, whereas the proportion was equal during baseline, significantly fewer thoughts were appraised as worrying in the intervention phase. This may reflect that participants were appraising their thoughts differently, through the process of recording during the RTSM phase. Thoughts appraised as confusing represented a small proportion across the phases (9.1% & 9.5%). In contrast, Wood (2008) reported that individuals with AS appraised thoughts as 15.6% worrying, 14.0% confusing and 17.8% practical.

b) Individuals with AS will have an attentional style characterised by a high degree of self-focus (i.e. internally directed thoughts).

A small proportion of thoughts were coded as self-focused in both phases (14.5% & 14.2%) of this study, which is in contrast to the high proportion (34.0%) reported by
Wood (2008). This suggests that self-focus was less characteristic of the phenomenology of anxiety in the current sample.

c) A comparable proportion of individuals with AS will spend more than 10 minutes dwelling on a particular thought.

Individuals in the current study reported the majority of thoughts as lasting less than five minutes in both phases (67.5% & 68.2%). Only a small proportion of thoughts were rated as lasting more than ten minutes (14.9% & 13.5%). This is in contrast to Wood (2008) who reported less than half (46.9%) of thoughts were rated as lasting under five minutes and almost a third (31.1%) lasting over ten minutes, suggesting a repetitive or prolonged process of thinking.

d) Individuals with AS will have a comparable proportion of thoughts in the form of images.

With regards to form, the majority of thoughts were described as talking to myself (41.7% & 39.4%) or as an image (31.4% & 33.8%). This is comparable to Wood (2008), who reported a high occurrence of visual thoughts (40.0%) and thoughts in the form of talking to myself (37.5%) amongst adults with AS. This is also similar to the Hurlburt and colleagues (1994) study that reported a high proportion of image-based thoughts.

e) Heightened subjective ratings of anxiety (i.e. ≥ 3) will be associated with thoughts subjectively appraised as worrying and confusing, prolonged rumination (i.e. more than ten minutes), and with thoughts rated as internally-focused and anxious.

Heightened anxiety in the current study was associated with worrying thoughts both in the Baseline phase and the RTSM phase. Confusing thoughts were associated with anxiety only during baseline, even though proportion of thought appraised as confusing remained the same across phases (9.1% vs. 9.5%). Whereas all these thoughts in the Baseline phase were associated with heightened anxiety, only half were associated with anxiety during the intervention phase.

Wood (2008) found 14.0% of thoughts were appraised as confusing and these thoughts were associated with elevated anxiety. It was suggested that this may be due
to participants’ difficulty understanding and articulating their own thoughts, which may be similar to the finding in the Baseline phase of the current study. However, the difference found in the intervention phase may reflect some impact of the intervention by which the process reduced anxiety despite the presence of confusing thoughts. This is in contrast to Wood (2008) and may be related to the difference in proportions of thoughts appraised as confusing (9.1% & 9.5% vs. 14.0%).

In comparison to the Wood (2008) study, elevated anxiety was not associated with prolonged thinking (i.e. > 10 minutes), although thoughts were not rated as lasting this length of time often in the current study (14.9% & 13.5% vs. 30.1%). A similar proportion of thoughts were coded as internally focused (14.5% & 14.2%) and anxious (17.6% & 10.4%) in both phases of this study. However, it was only anxious coded thoughts in the intervention phase that were associated with anxiety. In other words, elevated anxiety was not associated with anxious thoughts during baseline, which is similar to the finding by Wood (2008) that anxious feelings were not always accompanied by anxious thoughts. Previous models have suggested that increased self-focus may contribute to the maintenance of anxiety in people with AS (e.g. Abell & Hare, 2005). In contrast, participants in this sample reported thoughts that were brief, externally-focused and had no association with heightened subjective anxiety.

Differences in proportions of appraisals between phases in this study and the characteristics of these appraisals (i.e. worrying, practical, confusing) raise another question regarding the content of these thoughts. The PDA questionnaire as it stands does not identify whether an individual’s worrying or practical thoughts are past or future oriented. One participant mentioned that he would become anxious at the thought of a past traumatic incident. Another participant reported the categorisation of ‘sad’ thoughts (e.g., ‘thinking about my mother’s death.’) problematic, as they did not adequately fit within the existing categories (i.e. worrying, annoying) in the questionnaire. Such an approach may help elucidate these thoughts as being more characteristic of worry (i.e. future focus) or rumination (i.e. past focus). This may be a useful examination in future research in order to consider the impact of temporal focus on the experience of anxiety.

With regards to mood ratings, participants predominantly rated themselves as happy and anxious in the first three days of baseline. They also reported feeling happy
and less anxious in the intervention phase. This indicates that participants rated mood as both happy and highly anxious the majority of the time in the first three days of the study and were less likely to rate elevated anxiety in the intervention phase. This could reflect the difficulty with the scale upon which individuals rated their mood. This was reported by two participants who felt it was difficult to quantify emotional states in this way and may have meant that a neutral mood (i.e. neither happy nor sad) would be coded as either sad or happy. Although the use of visuals and scales to facilitate recording of emotions in this population have been suggested (e.g., Attwood, 1999; Hare, 1997), a variety of visual representations should be considered during development of new software programmes to meet the individual needs of people with AS.

The finding that reports of heightened anxiety decreased in the RTSM phase may reflect a positive effect of the intervention on subjective anxiety. Thoughts coded as anxious were also associated with elevated subjective anxiety only in the RTSM phase, which could reflect participants becoming more aware and skilled at articulating their anxious thoughts (i.e., connection between thoughts and emotions). Alternatively, this could also be due to participants becoming aware of the contingency between high anxiety ratings (i.e. ≥ 3) and the initiation of RTSM techniques, rather than a decrease in subjective anxiety due to the techniques themselves. In other words, participants may have intentionally under-reported subjective anxiety in order to complete the trial more quickly. This has been discussed as a potential limitation of the branching capability of questions in computerised diaries (e.g. Palmier-Claus et al., 2011). It is possible that allowing participants to initiate the onset of the programme could facilitate a greater sense of control and provide a potential solution. Whether similar results (i.e. less subjective anxiety ratings) would then be found requires further exploration.

f) Heightened subjective ratings of anxiety (i.e. ≥ 3) will not be associated with being in the presence of others or in response to the alarm and the subsequent interruption to thinking.

During the Baseline phase, elevated anxiety was associated with time spent alone and participants were less likely to experience heightened anxiety when in the company of one other person. This finding could reflect the possibility that more trials were completed when participants were on their own or that being in the presence of another
individual functioned as a distraction from anxiety provoking thoughts. Hintzen and colleagues (2010) found that adults with AS did not differ from neurotypical controls in their time spent alone, but more time was spent in the presence of people with whom they were familiar. Individuals with AS were also more anxious when in the presence of strangers. Further research might examine the level of familiarity of others in their environment and associations with anxiety. Participants were also significantly less likely to be in a social context in the intervention phase, which may reflect the reluctance of participants to use techniques in the presence of others.

There were no associations between anxiety and the impact of the PDA process. The majority of the time participants did not report any disruption to thinking or upset as a result of the PDA during the course of the study. There were occasions when individuals reported frustration when a trial interrupted an activity. This is similar to the Wood (2008) study that reported minimal impact on the lives of participants.

**HYPOTHESIS 2:** Adults with AS will demonstrate a reduction in overall subjective ratings of anxiety from the Baseline phase to the RTSM phase (i.e. 3 Baseline days vs. 3 RTSM days).

There was a significant decrease in participants' subjective ratings between the Baseline and RTSM phases, suggesting that individuals reported less anxiety in the intervention phase. This could be related to the techniques employed as part of the RTSM intervention or could be related to the decrease of thoughts appraised as worrying and reports of improved mood.

**HYPOTHESIS 3:** Adults with AS will demonstrate a reduction in subjective ratings of anxiety after a stress management technique has been employed (i.e. pre vs. post intervention ratings).

Comparisons between subject ratings of anxiety provided before and after a technique in the RTSM phase revealed a significant difference. There was a decrease in anxiety ratings after a technique was employed suggesting an impact of the RTSM intervention on the experience of anxiety in this sample.
8.4 RTSM Intervention

A primary aim of this study was to provide preliminary data for the development and feasibility of a real-time intervention for stress management. In the current study, feasibility of the RTSM intervention was addressed through consideration of practicality, adherence, credibility, effectiveness, generalisability, contact and participant satisfaction.

Practicality

With regards to ease of use, participants were instructed on how to use the PDA to answer questions at the beginning of the study. Participants commented that responding to questions was straightforward and was very similar to a mobile phone. The majority of the time participants did not report any disruption or upset as a result of the PDA during the course of the study. There were occasions when individuals reported frustration when a trial interrupted an activity, which might suggest that trials initiated by the participant may be more acceptable and practical. There were also occasions when trials were not fully completed once initiated, which may mean that participants initiated the trial to stop the PDA beeping if they did not wish to complete it or the trial was initiated unintentionally when contact was made with the touch screen. Upon completion of the study, the majority of participants indicated some degree of interference with their daily lives. Both Kimhy and colleagues (2006) and Wood (2008) reported minimal impact of computerised diaries on the lives of participants and Hintzen and colleagues (2010) did not comment on the impact of using paper and pencil diaries for people with AS. Although a sampling period of six days is considered standard within ESM research (Palmier-Claus et al., 2011), this may reflect the fact that the sampling period in the current study was longer than others studies (e.g. Wood, 2008) and may have placed additional demands on participants during the RTSM techniques.

One of the most significant limitations of the intervention was the unreliability of the PDAs. On a number of occasions, the devices would not beep in accordance with the pseudo-random schedule programmed via ESP. PDAs would stop initiating trials all together or stop midway through the sampling period. This added to the frustration and anxiety reported by some of the participants and contributed to the majority of individuals who dropped out in the initial phase of data collection. This has not been identified as a particular limitation regarding the use of PDAs in this type of research,
although it is likely related to software (i.e. ESP), as this issue presented inconsistently on a number of different devices. This has detrimental implications for the implementation of an intervention of this kind on this model of PDA and thus newer, more advanced models may prove a more appropriate option in this regard. Furthermore, this study involved an ESM approach which relied on pseudo-random trials throughout the day. It is possible that a participant-contingent schedule, in which participants initiate trials independently, may provide an alternative solution.

Another limitation in terms of practicality relates to reactivity. Some individuals reported frustration related to the unpredictability of the PDA beeps and reported heightened anxiety as a result. Feedback suggested that some participants were waiting for subsequent beeps and could have potentially been preparing responses in advance. One participant reported elevated anxiety as a result of increasing awareness into the ‘erratic nature’ of her thoughts. However, further discussion with participants revealed that they did not feel as though their daily experiences were altered as a result. A number of studies have reported on reactivity associated with ESM of this kind (e.g., Heron & Smyth, 2010; Palmier-Claus et al., 2011; Scollon et al., 2003), as it is possible that the process itself could influence individual experiences. Others however, have suggested that reactivity may in fact be minimal and does not impact significantly on thoughts and behaviour (e.g., Hufford et al., 2002; Johnson et al., 2009).

There is a general consensus that the subjective experiences of individuals with AS are qualitatively different from those of the general population (e.g. Hurlburt et al., 1994; Wood, 2008). One participant in this study expressed difficulty distinguishing between thoughts and overall experiences and provided descriptions that suggested synaesthetic qualities (Simner, 2011). Recording thoughts on the PDA in verbal form was thus problematic and she reported dissatisfaction with how merely providing a thought failed to capture the full experience. Hurlburt, Happé, and Frith (1994) discussed one participant who had difficulty differentiating between an object in reality, an image of an object and the thought of an object. They also discussed another participant who had difficulty distinguishing between thinking and behaviour (i.e. engaging in a behaviour equates to thinking about the same behaviour). It is possible that the participants in this study experienced the same difficulty and thus, should be
considered in the development and adaptation of future ambulatory interventions of this kind.

Furthermore, this study raised the question of practicality of the RTSM intervention across settings. Participants reported spending the majority of their time alone, although were less engaged in social activities in the RTSM phase. This may reflect that more assessments were completed during baseline or participants were reluctant to engage with the PDA (and techniques) when in the presence of others.

**Adherence**

Compliance rates indicated that participants completed approximately more than half of the questionnaires during baseline and intervention (64.7% & 54.3%, respectively). Missing data was primarily due to missing trials and situational factors in which using the PDA was not appropriate (e.g. college lecture, driving, meeting, phone calls). Brief response times also suggested that participants may have been completing questions, but were practicing techniques for a limited period of time. Issues regarding compliance rates have been discussed in a number of ESM studies (Broderick & Stone, 2006; Heron & Smyth, 2010). Newman and colleagues (2011) suggest that computerised interventions are most effective with motivated individuals seeking support for psychological difficulties, although compliance tends to be lower when such interventions are employed with minimal therapist face-to-face contact. Participants seemed motivated to take part in this research, although response and completion rates suggest that motivation was related to completing trials as opposed to practicing techniques. However, the impact of motivation on compliance is unclear and compliance itself may be difficult to measure (Broderick & Stone, 2006). Palmier-Claus and colleagues (2011) suggest that factors influencing compliance could be investigated by comparing different subsections of data, which may reveal changes related to decreasing engagement over sampling periods.

Some studies have included preliminary sessions (i.e. pre-intervention) in which participants are provided with information about the intervention (see Newman et al., 2003). Compliance rates provided by the ESM process allow for the examination of response and completion times, but do not provide an indication of whether a technique was carried out as intended. It is not known whether participants in this study completed the strategies as per the directions. Individuals within this study were given
the opportunity at the beginning of the study to practice responding to questions on the PDA, but were not informed about the techniques involved or instructed on how they should be performed so as to not bias baseline data. However, it is possible that an intermediate session (i.e. between Baseline and the RTSM intervention) in which participants practice each technique with the assistance of the researcher would have been helpful with regards to increasing adherence and potentially, the effectiveness of the intervention.

**CREDIBILITY**
Newman and colleagues (2003) suggest that the credibility of an intervention relies on a number of factors, including the clarity of writing, how easily the programme was understood, and the intervention techniques included. Similarly, Ranfelt, Wigram, and Øhrstrøm (2009) highlight the importance of participants' belief that the intervention is 'effective and reliable'. Participants indicated that they felt the techniques were helpful in reducing subjective anxiety in situ 60% of the time, although they all reported afterwards that they would continue to use elements of the intervention to some degree. This may have impacted upon the perceived credibility of the RTSM intervention and should be considered in future modifications.

**EFFECTIVENESS**
Findings from the current study indicated that although the RTSM intervention was used less often as a result of decreased subjective anxiety ratings, participants appeared to spend very little time practicing the techniques. There was no decrease in subjective anxiety over each day. However, the subjective ratings from baseline to intervention and ratings provided before and after a given technique decreased, suggesting that the RTSM had some impact on the experience of anxiety in these adults. It is not clear whether this is related to engaging in the techniques themselves or the distraction resulting from using the PDA. However, there was no associated decrease in ratings of subjective anxiety at the end of baseline, suggesting that engaging with the PDA for a number of days did not significantly impact (i.e. decrease) upon this experience on its own.

Administration of the HADS provided an index of symptoms of anxiety at baseline and at the end of the study. The mean anxiety score for the participants was within the moderate to severe range, indicating clinically significant levels of anxiety.
Participants were motivated to take part and although the majority were taking medication for the management of anxiety or low mood, none were currently accessing mental health services. The techniques chosen for this intervention were based on strategies often used within the *self-help* domain of psychological input and perhaps may have not been appropriate given the high levels of anxiety symptomatology of this sample.

ESM allows for the examination of temporal fluctuations in phenomena. Statistical analyses common to this type of data (i.e. Multi-Level Modelling) can examine the relationship between one beep and the next. Such an approach could investigate whether a RTSM technique employed at one time point had an impact upon the level of subjective anxiety (i.e. greater or lesser) at the subsequent time point. However, due to limited data and small sample size, the current study did not possess enough power for this type of analysis. Future research should consider investigating the short-term effects of this type of intervention throughout the day (i.e. hour to hour, beep to beep).

**GENERALISABILITY**

Generalising skills beyond therapy sessions has been highlighted as a particular issue for individuals with ASCs engaged in psychotherapeutic interventions (e.g., Anderson & Morris, 2006; Hare, 1997). Studies of children have suggested the use of parent involvement (e.g., Reaven & Hepburn, 2003; White et al., 2010) and studies involving adults have suggested using others as ‘coaches’ as potential solutions (e.g., Cardaciotto & Herbert, 2004; Weiss & Lunsky, 2010). The use of the PDA platform aimed to perform a similar function, in that it would act as a prompting system when individuals experienced anxiety. Frequency of use and response times indicated that although participants were using the techniques, practice times were very brief.

This study cannot answer the question of whether participants would continue to use the techniques beyond the daily sampling period and overall study duration. Although, feedback indicated that most of the participants thought they would continue to use the strategies once the study was complete. Additionally, this study cannot answer the question of whether individuals might become prompt dependent over a longer period of time, which has implications for the generalisability of the intervention. This question also raises the concern that the PDA itself could become merely a
distraction technique or a maintenance factor (i.e. safety behaviour, avoidance). A safety behaviour is a response intended to prevent a feared outcome (Salkovskis, 1991). However, such behaviours can maintain anxiety as they maintain preoccupation with threat and prevent disconfirmation of the belief that the feared outcome will occur if they do not carry them out (Salkovskis, 1991; Wells, et al., 1995). Whether the PDA RTSM intervention has the potential to maintain anxiety in this way during stressful situations requires further investigation.

Previous studies involving PDAs with this population have included self-fading prompts to help in this respect (e.g. Mechling et al., 2009). Prompts were reduced as participants became more familiar and skilled with the technique, which subsequently increased participants’ sense of achievement and control. This highlights the potential impact of tailoring interventions as individuals’ needs change through the course of treatment. It is possible that modifications could be made to the RTSM programme to tailor the intervention to individuals in a much more flexible and dynamic way.

CONTACT
Newman and colleagues (2003; 2011) discuss the impact of varying levels of contact (i.e., self-help only, minimal contact) in research involving computerised interventions. The RTSM programme was intended as a minimal contact intervention, in that individuals could use the PDA as a portable ‘coach’ throughout their day-to-day lives. However, researcher contact (non-therapeutic) with participants could involve up to six meetings (i.e. ABAB) and multiple emails (as reminders of meetings and charging the PDA) over the 19 day study period. This process seemed somewhat problematic for some participants who struggled to work within the boundaries of the research relationship. These individuals reported living quite socially isolated lives and expressed frustration over past experiences with mental health services, often in terms of difficulties with access or inconsistent support over time. It is possible that these factors made it difficult for some individuals with AS to disengage with the study process upon completion. Some computerised interventions have incorporated regular (i.e. ‘check-in’) sessions to review the process (e.g. Morris et al., 2010), although this level of contact may be a particular difficulty for some individuals with AS and should be considered further in future studies.
FEEDBACK/SATISFACTION

This study was primarily exploratory in nature, with the aim of providing pilot data on the feasibility of a PDA delivered, real-time intervention for adults with AS. Part of this process also aimed to elicit participant feedback upon which to make future modifications. Newman and colleagues (2011) stress the importance of eliciting feedback from participants as to whether the intervention was perceived to be comprehensible, helpful, and whether improvements could be made.

Feedback revealed that the majority of participants felt that they were provided with adequate information about the study and felt comfortable using the PDA. All of the participants who responded felt that the PDA interfered with their daily lives to some degree and more than half reported the PDA increased their anxiety. The majority (six of seven responders) of participants reported that they did not find the strategies helpful, although most reported thinking they would use them again.

With regards to the PDA and RTSM programmes specifically, participants discussed difficulties with navigating through the questions, the quality of the touch screen, the unreliability of the ESM trials and other technical problems. Suggestions included strategies to improve the ease of use (e.g. back button, wait button, brighter screen) and the quality of the questionnaire (e.g. more categories for thought appraisals, alternatives for mood ratings, more variety of techniques).

8.5 RECRUITMENT AND ATTRITION

During the course of this study, it proved difficult to maintain engagement of participants as well as coordinate meetings with their schedules. Often individuals expressed interest via email (N=37), although did not continue once they had received the Participant Information Sheet. It is possible that the PIS, although extensive, provided information that was confusing to participants. The researcher attempted to contact these individuals to gain clarity as to why interest was lost at this early stage and feedback centred primarily on geographical distance from the study base and life circumstances. Individuals that met with the researcher for the initial meeting to discuss what participation would involve, were more likely to continue with the study. Difficulties with recruitment and attrition have been noted as particularly problematic in ESM research (e.g. Palmier-Claus et al., 2011).
The researcher was contacted by 37 individuals interested in participating in this study. Thirteen were excluded as they failed to meet inclusion criteria or were out of the study catchment area and contact was lost with an additional ten individuals. More than a third (36%, five of 14) of individuals who consented to taking part in this study dropped out within the first three days. This was predominantly due to technical problems with the PDAs and interference with their daily routines, which speaks to the quality of the PDAs and to the feasibility and acceptability of this intervention. High drop-out rates are common amongst ESM studies (Scollon et al., 2003) and may reflect participant burden due to the high number of questionnaires (e.g. Barrett & Barrett, 2001) or difficulties with executive functioning (e.g., planning, goal adherence, prioritising) that may be problematic for adults with ASCs when independently using computerised interventions (Golan & Baron-Cohen, 2006). Individuals who completed the study presented as highly motivated and had often participated in numerous research studies before which raises the concern regarding the representativeness of the sample. The potential for sampling bias has been discussed in reference to ESM studies as it is often the most willing and motivated individuals that take part (Scollon, Kim-Prieto, & Diner, 2003).

8.6 LIMITATIONS

This exploratory pilot study has a number of limitations that should be taken into account when interpreting the findings. This study involved a very small sample size that limits the generalisability of the results and did not include a comparison group meaning that findings cannot be interpreted as a result of the PDA intervention itself. Recruitment was problematic and limited the sample size. Furthermore, the previous study (Wood, 2008) upon which the present study was based, reported subjective anxiety profiles of adults with AS that were characterised by high variability, which was not found in the neurotypical control group. A control group similar in regards to anxiety profiles would be unlikely and it was decided that this pilot study would present a small sample case series at this preliminary stage.

Characteristics of the sample in this current study also present as limitations to the findings. The sample included individuals with AS who were highly motivated to participate in this research and had often participated in research in the past, which could introduce sampling bias (Oorschot et al., 2009). The majority of the participants
who took part received diagnoses of AS in adulthood, which means the findings cannot be generalised to individuals who may have received a diagnosis in childhood. Two individuals reported receiving co-morbid diagnoses, which raise the possibility that some of the findings may not be attributable to AS per se. The majority of participants was also on psychotropic medication, predominantly anti-depressants for the management of anxiety, and had variable histories of mental health service use. As a result, findings, such as the reduction of subjective anxiety may be related to medication or past therapy rather than the impact of the RTSM intervention itself. However, participants had all been on medication for longer than six months and still reported high levels of anxiety (i.e. HADS) indicating that changes in subjective anxiety were unlikely to be due to the medication alone.

The original study design (i.e. ABAB) aimed to provide a short-term follow-up by comparing anxiety ratings at the end of the first phase and the beginning of the second phase (i.e. one week). Given difficulties with recruitment and time restrictions of data collection, this was not possible and analyses were completed solely on the first baseline-intervention phase. Newman and colleagues (2011) comment that few studies of computerised interventions include follow-up assessments that would allow for the evaluation of long-term effects. The current study did not include a follow-up and is thus limited in this regard. Follow-up data would provide information as to the potential applicability and generalisability of techniques across environments over time and should be considered in future designs.

The analyses used in the current study were limited by a number of factors. Standard statistical analyses for ESM studies (i.e. Multi-level modelling, MLM) were not appropriate, due to small sample size and missing data. The researcher intended to recruit a sample of 18 individuals with AS. However, difficulties with recruitment and technological problems meant that this was not possible. Sample size in ESM studies is defined as the total number of data points at each level (i.e. participant, day, beep) and it is suggested that such studies have as many points at the highest level (i.e. participants) for optimal power (Snijders, 2005). Power is dependent upon the research question and the level of analysis. Thus, despite the number of data points in this study, power was reduced due to the small number of participants.
Multi-level modelling is generally considered the analysis of choice as it addresses issues of dependency in hierarchical data (Schwartz & Stone, 1998). Furthermore, it allows for the investigation of relationships amongst different variables between and within levels in the hierarchy at the same time. Had a larger sample been achieved, MLM would have allowed for the assessment of factors associated with the experience of anxiety and factors associated with daily variations in anxiety. A multi level model could have been used to estimate the effect of particular variables (e.g. social activity, focus of thought, length of thinking) on subjective anxiety or explore which variables predicted variation in anxiety both within and across individuals throughout the day. MLM would have also allowed an investigation of how anxiety varied from beep to beep and whether the RTSM intervention at one beep impacted upon the experience of anxiety at the subsequent beep. The current analyses were limited in that they highlighted associations between variables and anxiety without fully capitalising on the temporal nature (i.e. beep to beep) of the data, where individual and daily trends can be found.

Given the small sample size it was not possible for further analyses, such as regression, that would be useful for determining whether particular variables predict heightened subjective anxiety. Furthermore, regression with clustering (i.e. participant, day) could be used with a larger sample in order to take into account the nesting of the data at the participant level. Aggregation was used in this study as an appropriate alternative, as it removes the effect of participant. However this can be considered ‘suboptimal’ when analysing participants with varying numbers of assessments as this can potentially violate the assumption of homoskedasticity (i.e. equal variances) (see Schwartz & Stone, 1998). Multi-level modelling is considered the most appropriate method of analysis for nested ESM data (Schwartz & Stone, 1998). Such an approach with replication of this study and a larger sample would provide greater possibilities and flexibility with regards to analysis.

8.7 CLINICAL IMPLICATIONS AND FUTURE DIRECTIONS

The sample included in this study was composed of nine adults with Asperger's. Almost half were unemployed and two reported co-morbid mental health conditions, although many had described experiencing low mood and anxiety at some point. The majority of participants had histories of involvement with mental health services and were taking psychotropic medication. At the time of the study, participants reported
symptoms of anxiety within the moderate to severe range, which is similar to other studies with this population (e.g. Abell & Hare, 2005; Meraj, 2004; Wood, 2008). Three of the nine participants reported ideations of self-harm. The safety protocol was explained to each participant at the initial meeting and the limitations of the researcher’s involvement were clarified (i.e. sign-posting). When thoughts of self-harm were expressed, the researcher contacted the participant, reiterated the points of contact and problem-solved with regards to accessing available supports. Self-harm has been reported in research involving adults with Asperger’s (e.g., Hare, 1997; Hare, Jones, & Paine, 1999; Hare & Paine, 1997) and reflects the complexity of the sample.

Unemployment, mental health difficulties and medication use as reported in this group are similar to what is known about the adult life in AS (e.g., Balfe & Tantam, 2010; Barnard et al., 2001). This is in contrast to the sample reported by Wood (2008), in which individuals had no co-morbid mental health problems and were not taking psychotropic medication. This may relate to the differences found between the current study and the Wood (2008) study in relation to the phenomenology of anxiety. Despite the heterogeneous nature, this sample reflects a close representation of adults with AS living in the community; the population for which this intervention is primarily intended.

The RTSM intervention in this study was developed at this preliminary stage as a standard, stand alone intervention. As a result, each participant was provided with an identical intervention only differing in the particular technique chosen at a particular time. Recently, Morris and colleagues (2010) developed a CBT mobile phone application for the management of stress in the general population. In addition to the aim of developing adaptive strategies for moderating stress, Morris and colleagues (2010) aimed to increase individuals’ self-awareness and insight into their own emotional and behavioural patterns in times of stress. A number of recent studies discuss computerised interventions in which feedback is provided in real-time and in real-world contexts to aid insight (Kaliouby & Robinson, 2005; Newman et al., 2011; Ranfelt et al., 2009; Wichers et al., 2011). Such feedback can be utilised to facilitate the monitoring of treatment, to identify individual triggers and ultimately increase an individual’s awareness into adaptive and potentially maladaptive responses to various situations.
Research and autobiographical accounts suggest that the experience of anxiety in individuals with AS is qualitatively different from that of the general population (e.g. Dubin, 2009; Schleismann & Gillis, 2011; Wood, 2008). These individuals appear to be more prone to stress and anxiety in their day-to-day lives and may be additionally disadvantaged with regards to coping as a result of the condition itself (e.g. Groden et al., 1994). Groden and colleagues (2001) and Tantam (2000) stress the importance of an idiosyncratic approach in order to identify stressors, needs and coping skills specific to each individual. Preliminary assessment sessions used to gather this information before an intervention and regular meetings with researchers to discuss and practice implementing intervention strategies have been incorporated into other studies involving mobile devices (e.g. Morris et al., 2010; Newman et al., 1999). Additionally, Newman and colleagues (1999) discuss a manual outlining the rationale for a handheld intervention and the techniques that were included. This was provided to participants before initiating the computerised treatment for anxiety. Further studies could explore the impact of including a preliminary session (i.e. pre-baseline) in which participants could discuss the rationale in greater detail or a session in which participants can practice techniques with the assistance of the researcher between the baseline and the intervention phase. Alternatively, future research into RTSM interventions could incorporate a module presenting such information on the device itself to enable participants to review the material at their convenience (e.g. in situ).

An idiosyncratic approach may have implications for the potential clinical utility of a RTSM intervention. Ideally, such programmes could be tailored initially to the individual and their particular circumstances. They could also be tailored on an ongoing basis, developing in conjunction with individuals as they gain insight and skills through the course of treatment. Ranfelt and colleagues (2009) discuss the development of a real-time psycho-behavioural mobile device to support the social functioning of adolescents with high functioning autism (HANDS Project). The project highlights the importance of individualisation, as every diary is customised to each adolescent in accordance with their particular needs and activities. Furthermore, modules are added, further developed and removed based upon the frequency of use on an ongoing basis to further tailor the programme. Gathering information from each individual and providing specific feedback in situ may help facilitate awareness of how their thoughts, feelings and behaviours impact on their experiences. Current software allows for branching of questions, in which the subsequent question is determined by
the previous response, as in the current study. A more advanced design beyond those
developed for use in ESM research could provide the platform to extend the RTSM
intervention to a more idiosyncratic and interactive (i.e. feedback) real-time treatment.
Additionally, such an approach may be perceived as more personally relevant and may
thus, impact upon the factors (e.g., motivation, adherence, credibility) that minimised
the feasibility of the PDA RTSM intervention in the current study.

Cognitive restructuring was not included in the RTSM intervention despite being
a standard and effective element of CBT (e.g. Beck, 1976; Wells, 1997) and despite
being a common component of computerised psychotherapeutic interventions (e.g.,
Morris, et al., 2010; Newman et al., 1999). Previous research using this methodology in
the adult AS population indicated that individuals often experienced anxiety without
anxious thoughts, which suggested that this may reflect difficulties accessing and
articulating thoughts (Wood, 2008). Additionally, Weiss and Lunsky (2010) reported
that participants required additional time to become proficient at challenging tho
oughts in this way beyond the group CBT format. For these reasons, it was considered to be
problematic for the inclusion and implementation of a cognitive restructuring module in
the RTSM intervention, particularly as participants did not get training in the application
of these techniques beforehand. However, future studies incorporating prelimi
ary practice sessions and ongoing support (i.e. regular meetings) in which participants can
refine these skills, may prove less problematic.

The sample in this study reported anxiety within the moderate to severe range
and variable profiles of daily subjective anxiety. This is consistent with previous studies
(e.g., Abell & Hare, 2005; Wood, 2008) adding to the evidence that anxiety and stress
are common in the lives of adults with AS. Previous studies in the general population
have used ESM to investigate the relationship between affective and physiological (i.e.
cortisol) responses during daily life stress (e.g. Jacobs et al., 2007; Myin-Germeys et
al., 2003). Minor stressful events or daily hassles are associated with mood fluctuations
(e.g., Myin-Germeys et al., 2003; van Eck et al., 1998) and can have a negative impact
on an individual's sense of well-being over time (Almeida, 2005; Cohen et al., 2005;
DeLongis et al., 1982). ESM research can highlight the psychological and behavioural
components of anxiety and stress in AS and could potentially be used to explore the
physiological aspect as well.
There have been a number of recent reviews on the use of psychophysiological ambulatory monitoring (Ebner-Preimer & Kubiak, 2007; Haynes & Yoshioka, 2007; Houtveen & de Geus, 2009) and multimodal assessment (Ebner-Priemer & Turll, 2009). It has been suggested that the impact of stress is determined by the perception of threat and the perception of coping (Lazarus & Folkman, 1994; van Eck et al., 1998). Further studies have reported that continuous stressors may have a larger impact with regards to cortisol release than short-term stressors and may be influenced by the degree to which individuals successfully coped in the past (e.g. van Eck et al., 1998; Smyth et al., 1998). Both Wood (2008) and the current study have used ESM to highlight high levels and fluctuating anxiety throughout the day. Other studies have demonstrated atypical physiological responses to stress in individuals with AS (e.g., Levin et al., 2011; Lopata et al., 2008). Myrtek (2004) reported a study in which participants’ levels of physiological arousal were used (via biosensors) to trigger participants to complete a questionnaire about their experiences and tailored feedback was provided in response. Individuals with AS may have difficulty identifying their emotional states, particularly in the early stages (e.g., Fitzgerald & Bellgrove, 2006) and physiological assessment provides a measure of stress which can be independent from self-report. Future research could use ESM and momentary psychophysiological methods to investigate how appraisals of coping impact upon the experiences of stress and the relationship between daily stress and physiological response in adults with AS. Such methods could also be used to provide feedback in order to aid the development and generalisation of daily coping skills.

The current study highlighted a number of difficulties regarding the feasibility of using PDAs to deliver momentary interventions. However, a number of recent reviews highlight interest in mobile based interventions (Free et al., 2010; Newman, Szkodny, Llera, & Przeworski, 2011). Wichers and colleagues (2011) comment on the gap in research in which ESM is used to provide individually tailored feedback on emotions and behaviour. Over recent years, there has been increasing discussion regarding the use of mobile phones (i.e. smartphones’) in psychotherapeutic work (Boschen & Casey, 2008; Clough & Casey, 2011; Preziosa, Grassi, Gaggioli, & Riva, 2009). Such devices are low in cost, user-friendly, allow for interactive feedback and wireless data transfer. They may also increase engagement as they are socially relevant and are typically already incorporated into an individual’s daily life (Boschen & Casey, 2008; Preziosa et al., 2009). In addition, mobile phones allow for the delivery of intervention
programmes *alongside* other phone functions, which would likely improve acceptability and eliminate the need for the device to be shut-down between trials. Mobile phones have already been used in the delivery of therapeutic applications including mood diaries (e.g. Matthews, Doherty, Sharry, & Fitzpatrick, 2008; Preziosa, Grassi, Gaggioli, & Riva, 2009), relaxation (e.g. Grassi, Preziosa, Vilani, & Riva, 2007; Preziosa et al., 2005), stress management (e.g. Morris et al., 2010) and in the treatment of anxiety disorders more generally (e.g. Ekbreg et al., 2011). Mobile phones have rarely been used with the AS population (e.g. Ranfelt et al., 2009) and could provide a more feasible and practical platform for stress management interventions in the future.

### 8.8 CONCLUSIONS

Only three studies to date have investigated the inner experiences of adults with AS on a momentary basis and only one has focused specifically on the experience of anxiety and stress (Wood, 2008). The current study is the first to adapt experience sampling methodology for the delivery of a PDA stress management intervention in real-time. This exploratory study aimed to provide ‘proof-of-principle’ for the delivery of an intervention via a PDA for adults with AS. Despite the weaknesses and limitations, the current study has provided preliminary data for the feasibility of a momentary (i.e. ESM based) intervention in Asperger’s. The difficulties with the PDA platform itself limited the feasibility of this particular intervention, suggesting that another ambulatory device, such as mobile phones, may be more suitable. The results and participant feedback have also provided useful guidance for future modifications.

The findings of this study have added to the *snapshot* of what is known about the experience of anxiety in this population. Mapping out this experience from moment-to-moment has allowed examination of the phenomenology of anxiety, highlighting both its variable and idiosyncratic nature, which have implications for psychotherapeutic work. This study has highlighted a need for ongoing person-to-person support and input in the delivery of a RTSM intervention, beyond what was anticipated. This suggests that such interventions may be more appropriate and beneficial as an *adjunct* than a stand alone treatment.
9. REFERENCES


Medical Research Council (2001). *MRC review of autism research: epidemiology and causes.* UK: MRC.


20 August 2010

Project Ref: 62707P
Title: Anxiety and Asperger’s syndrome: An investigation into a novel real-time stress management approach.
Type: 3rd year
Level: Level 2
Research Group: Clinical & Health Psychology
Supervisor: Dougall Hare
Author: Carolyn Gracey

Dear Carolyn,

Thank you for your recent submission to the School of Psychological Sciences Ethics Committee.

The Committee has made the following decision regarding the project:

Approved

Please address the following comments:

1. Amendments received and noted July 2010.

What to do now:

If the decision is: Approved
Correct any minor points mentioned and submit copies of any amended documentation to the SREC. Ensure that the project reference number appears on all documentation. The project may commence.

If the decision is: Conditional approval
Overall, the project is satisfactory but some changes are required. The project may not start until you receive Final Approval.
1. Download the Amendments Coversheet from the Intranet. Detail the changes you have made in the space provided. Submit the documents you have been asked to amend or include.
2. Leave the documents in the Ethics Amendments/Resubmissions pigeon hole. Amendments are reviewed every Tuesday.

If the decision is: Resubmission required
There are several major concerns with the project.
1. Re-submit all documents, including the application form and cover sheet, making the changes requested by the SREC. Use the original reference number unless instructed otherwise.
2. Leave the documents in the Ethics Amendments/Resubmissions pigeon hole by 5pm on the Tuesday one week prior to the meeting in which you would like your resubmission reviewed.

It is your responsibility to inform the Committee of all new research that you undertake. Please note that any research that you undertake (including research undertaken by your students or research assistants) that has not been submitted to the committee has not been approved by either the Ethics Committee or the School of Psychological Sciences. In the event of an
investigation into the ethics of such research being undertaken by the British Psychological Society, neither the department nor the Ethics Committee can be held responsible. You will also not be covered by the insurance policies taken out by the University to provide protection for members carrying out research with human participants.

Yours sincerely,

[Signature]

Dr Daniela Montaldi (Chair)
Dr Martin Lea
Dr Patti Adank
Dr Karolina KluK De Kort
Dr Penny Bunton
Jayne Ward (administrator)
APPENDIX B: National Autistic Society Approval Letter

Carolyn Gracey
School of Psychological Sciences
The University of Manchester
Coupland 1 Building
Oxford Road
M13 9PL

1st July 2010

RE: Carolyn Gracey. Ethical Approval ref: 627/07P

Anxiety and Asperger's syndrome: An investigation into a novel real-time stress management approach.

To whom it may concern

This letter is to confirm that following confirmation of conditional ethical approval for the research study above, that The National Autistic Society are happy for the project to be advertised via the NAS website and local branches.

If you have any queries please contact Richard Mills, Director of Research (richard.mills@nas.org.uk) or Dr Gina Gomez de la Cuesta, Action Research Leader (georgina.gomez@nas.org.uk).

Yours faithfully

Mark Lever
NAS Chief Executive

Accept difference. Not indifference.
School of Psychological Sciences

Everyday life stress and Asperger's syndrome:
An investigation into a novel real-time stress management approach.

We are a team of researchers interested in exploring how people with Asperger's syndrome think and feel throughout the day. We are also interested in looking at different practical strategies that can help manage feelings of stress. To help us with our studies, we are looking for people (over the age of 16 years) with Asperger's syndrome who are willing to spend some of their time using a handheld computer to record their thoughts and feelings and to try out some practical techniques to help deal with everyday life stress.

If you are interested in hearing more about the study or taking part please contact:
carolyn.gracey@postgrad.manchester.ac.uk
Tel: +44 (0) 161 306-0400

THIS PROJECT HAS BEEN APPROVED BY THE SCHOOL OF PSYCHOLOGICAL SCIENCES RESEARCH ETHICS COMMITTEE
APPENDIX D: Support Group Advertisement

SCHOOL OF PSYCHOLOGICAL SCIENCES

Everyday life stress and Asperger’s syndrome:
An investigation into a novel real-time
stress management approach.

We are a team of researchers interested in exploring how people with Asperger’s syndrome think and feel throughout the day. We are also interested in looking at different practical strategies that can help manage feelings of stress. To help us with our studies, we are looking for people with Asperger’s syndrome who are willing to spend some of their time using a handheld computer to record their thoughts and feelings and to try out some practical techniques to help deal with everyday life stress.

THIS PROJECT HAS BEEN APPROVED BY THE
SCHOOL OF PSYCHOLOGICAL SCIENCES RESEARCH ETHICS COMMITTEE

If you are interested in hearing more about the study or taking part please contact:
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Title of project:
Anxiety and Asperger’s syndrome: An investigation into a novel real-time stress management approach.

Introduction
This project is aiming to look at how people with Asperger’s syndrome think and feel throughout the day. It is also designed to explore how different strategies can help these individuals manage feelings of stress and anxiety. By taking part in the study you will help researchers better understand how people with Asperger’s experience anxiety and how novel approaches could help in terms of management and support.

What will I be asked to do if I take part?
If you choose to take part in the study, you will be asked to record your thoughts and feelings on a hand-held computer (Personal Digital Assistant, PDA) throughout the day for 12 days. At the start of the study, you will be shown how to use it to record your thoughts and feelings so that you are comfortable recording your experiences on your own. The PDA will beep at random intervals for three days (10 times per day, between 10am and 4pm) and you will be asked questions such as “What were you thinking about when you heard the beep?”, “Was the thought pleasant?”, “How anxious are you feeling?”. It should take no more than 3 minutes to answer all the questions. For the next 3 days, the PDA will present you with various strategies that may help you relax if you are feeling stressed. Some such strategies include changing your attention to focus on things around you or deep breathing.

This study will run twice with a week gap in between for a total of 19 days (i.e. 6 days, 7 day break, 6 days). During the study days, you will be asked questions about your daily experiences and provided with strategies to help manage your stress. The experimenter will exchange the PDAs every
three days and talk to you about your experiences using it. The overall impact on your everyday life of carrying the PDA will be relatively minimal, as you can go about your daily activities as usual.

**Will my data be anonymous?**

No personal information will be held on the PDA itself. You will be assigned a unique identifying number so that only the researcher can match your personal details to the data.

**Will my data be confidential?**

All data collected will be strictly confidential. The data collected on the PDA will be transferred to a computer, encrypted and stored in a locked cabinet. All the data will then be deleted from the PDA. It is hoped that the results of this project will be published in a professional/academic journal. However, all personal details will remain confidential.

**Do I have to take part?**

It is your choice whether you participate; you do not have to take part in the study. If you decide to take part and then later change your mind, either before you start the study or during it, you can withdraw without giving your reasons, and, if you wish, your data will be destroyed. If you complete the study, we will not be able to destroy your data because it is stored in an anonymous format and it will not be possible to link personal details with your specific responses. However, we would like to reassure you that this means your identity is completely protected.

**Where can I obtain further information if I need it?**

If you want any more information about the project please contact Carolyn Gracey or Dr. Dougal Julian Hare. Contact details are as fo

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**This project has been approved by the**

**School of Psychological Sciences Research Ethics Committee.**
This project has been approved by the School of Psychological Sciences Research Ethics Committee

SCHOOL OF PSYCHOLOGICAL SCIENCES
Consent form

Title of Project:
Anxiety and Asperger’s syndrome: An investigation into a novel real-time stress management approach.

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have you read the Participant Information Sheet?</td>
<td>YES/NO</td>
<td>Initials:……</td>
</tr>
<tr>
<td>2. Have you received enough information about the study?</td>
<td>YES/NO</td>
<td>Initials:……</td>
</tr>
<tr>
<td>3. Do you consent to recording information on a hand held computer as detailed in the Participant Information Sheet?</td>
<td>YES/NO</td>
<td>Initials:……</td>
</tr>
<tr>
<td>4. Do you understand that you do not need to take part in the study and if you do enter you are free to withdraw:</td>
<td>YES/NO</td>
<td>Initials:……</td>
</tr>
<tr>
<td>* at any time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* without having to give a reason for withdrawing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* and without detriment to you?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Do you agree to take part in this study?</td>
<td>YES/NO</td>
<td>Initials:……</td>
</tr>
</tbody>
</table>

Name of participant: .................................. Signed: .................................
Date: ..........................

Name of researcher: .................................. Signed: .................................
Date: ..........................
Do you consent for the data to be retained and used for future studies?

**YES/NO**

Initials:……

Name of participant: ……………………  Signed: ...............................  Date: ..................

Name of researcher: ..........................  Signed: ...............................  Date: ..................

This project has been approved by the
School of Psychological Sciences Research Ethics Committee
### ANXIETY AND ASPERGER'S

**APPENDIX G: Hospital Anxiety and Depression Scale**

**Hospital Anxiety and Depression Scale (HADS)**

Name: __________________________ Date: __________________________

Clinicians are aware that emotions play an important part in most illnesses. If your clinician knows about these feelings he or she will be able to help you more.

This questionnaire is designed to help your doctor to know how you feel. Read each item below and underline the reply which comes closest to how you have been feeling in the past week. Ignore the numbers printed at the edge of the questionnaire.

Don’t take too long over your replies, your immediate reaction to each item will probably be more accurate than a long, thought-out response.

<table>
<thead>
<tr>
<th>AD</th>
<th>I feel tense or ‘wound up’</th>
<th>A D</th>
<th>I feel as if I am slowed down</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Most of the time</td>
<td>1</td>
<td>Nearly all the time</td>
</tr>
<tr>
<td>2</td>
<td>A lot of the time</td>
<td>2</td>
<td>Very often</td>
</tr>
<tr>
<td>3</td>
<td>From time to time, occasionally</td>
<td>3</td>
<td>Sometimes</td>
</tr>
<tr>
<td>4</td>
<td>Not at all</td>
<td>4</td>
<td>Not at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AD</th>
<th>I still enjoy the things I used to enjoy</th>
<th>A D</th>
<th>I get a sort of frightened feeling like</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Definitely as much</td>
<td>1</td>
<td>‘butterflies’ in the stomach</td>
</tr>
<tr>
<td>1</td>
<td>Not quite so much</td>
<td>2</td>
<td>Not at all</td>
</tr>
<tr>
<td>2</td>
<td>Only a little</td>
<td>3</td>
<td>Occasionally</td>
</tr>
<tr>
<td>3</td>
<td>Hardly at all</td>
<td></td>
<td>Quite often</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Very often</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AD</th>
<th>I get a sort of frightened feeling as if something awful is about to happen</th>
<th>A D</th>
<th>I have lost interest in my appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very definitely and quite badly</td>
<td>1</td>
<td>Definitely</td>
</tr>
<tr>
<td>2</td>
<td>Yes, but not too badly</td>
<td>2</td>
<td>I don’t take as much care as I should</td>
</tr>
<tr>
<td>3</td>
<td>A little, but it doesn’t worry me</td>
<td>3</td>
<td>I may not take as much care as I take just as much care as ever</td>
</tr>
<tr>
<td>4</td>
<td>Not at all</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AD</th>
<th>I can laugh and see the funny side of things</th>
<th>A D</th>
<th>I feel restless as if I have to be on the move</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>As much as I always could</td>
<td>1</td>
<td>Very much indeed</td>
</tr>
<tr>
<td>2</td>
<td>Not quite so much now</td>
<td>2</td>
<td>Quite a lot</td>
</tr>
<tr>
<td>3</td>
<td>Definitely not so much now</td>
<td>3</td>
<td>Not very much</td>
</tr>
<tr>
<td>4</td>
<td>Not at all</td>
<td>4</td>
<td>Not at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AD</th>
<th>Worrying thoughts go through my mind</th>
<th>A D</th>
<th>I look forward with enjoyment to things</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A great deal of the time</td>
<td>1</td>
<td>As much as I ever did</td>
</tr>
<tr>
<td>2</td>
<td>A lot of the time</td>
<td>2</td>
<td>Rather less than I used to</td>
</tr>
<tr>
<td>3</td>
<td>Not too often</td>
<td>3</td>
<td>Definitely less than I used to</td>
</tr>
<tr>
<td>4</td>
<td>Very little</td>
<td>4</td>
<td>Hardly at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AD</th>
<th>I feel cheerful</th>
<th>A D</th>
<th>I get sudden feelings of panic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Never</td>
<td>1</td>
<td>Very often</td>
</tr>
<tr>
<td>2</td>
<td>Not often</td>
<td>2</td>
<td>Quite often</td>
</tr>
<tr>
<td>3</td>
<td>Sometimes</td>
<td>3</td>
<td>Not very often</td>
</tr>
<tr>
<td>4</td>
<td>Most of the time</td>
<td>4</td>
<td>Not at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AD</th>
<th>I can sit at ease and feel relaxed</th>
<th>A D</th>
<th>I can enjoy a good book or radio or television programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Definitely</td>
<td>1</td>
<td>Often</td>
</tr>
<tr>
<td>2</td>
<td>Usually</td>
<td>2</td>
<td>Sometimes</td>
</tr>
<tr>
<td>3</td>
<td>Not often</td>
<td>3</td>
<td>Not often</td>
</tr>
<tr>
<td>4</td>
<td>Not at all</td>
<td>4</td>
<td>Very seldom</td>
</tr>
</tbody>
</table>

**Now check that you have answered all the questions**

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>AD</th>
<th>A D</th>
<th>AD</th>
<th>A D</th>
<th>AD</th>
<th>A D</th>
<th>AD</th>
<th>AD</th>
<th>AD</th>
<th>A D</th>
<th>AD</th>
<th>A D</th>
<th>AD</th>
<th>A D</th>
<th>AD</th>
<th>A D</th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
</tbody>
</table>

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APPENDIX H: The Adult Autism Spectrum Quotient

The Adult Autism Spectrum Quotient (AQ)
Ages 16+

SPECIMEN, FOR RESEARCH USE ONLY.

For full details, please see:

The Autism Spectrum Quotient (AQ) : Evidence from Asperger Syndrome/High Functioning Autism, Males and Females, Scientists and Mathematicians
Journal of Autism and Developmental Disorders 31:5-17

Name:........................................... Sex:...........................................

Date of birth:................................... Today’s Date:.................................

How to fill out the questionnaire
Below are a list of statements. Please read each statement very carefully and rate how strongly you agree or disagree with it by circling your answer.

DO NOT MISS ANY STATEMENT OUT.

Examples

<table>
<thead>
<tr>
<th>E1. I am willing to take risks.</th>
<th>definitely agree</th>
<th>slightly agree</th>
<th>slightly disagree</th>
<th>definitely disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>E2. I like playing board games.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>E3. I find learning to play musical instruments easy.</td>
<td>definitely agree</td>
<td>slightly disagree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>E4. I am fascinated by other cultures.</td>
<td>definitely agree</td>
<td>slightly disagree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>1. I prefer to do things with others rather than on my own.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>2. I prefer to do things the same way over and over again.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>3. If I try to imagine something, I find it very easy to create a picture in my mind.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>4. I frequently get so strongly absorbed in one thing that I lose sight of other things.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>5. I often notice small sounds when others do not.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>6. I usually notice car number plates or similar strings of information.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>7. Other people frequently tell me that what I’ve said is impolite, even though I think it is polite.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>8. When I’m reading a story, I can easily imagine what the characters might look like.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>9. I am fascinated by dates.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>10. In a social group, I can easily keep track of several different people’s conversations.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>11. I find social situations easy.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>12. I tend to notice details that others do not.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>13. I would rather go to a library than a party.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>14. I find making up stories easy.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>15. I find myself drawn more strongly to people than to things.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>16. I tend to have very strong interests which I get upset about if I can’t pursue.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>17. I enjoy social chit-chat.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>18. When I talk, it isn’t always easy for others to get a word in edgeways.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>19. I am fascinated by numbers.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td>20. When I’m reading a story, I find it difficult to work out the characters’ intentions.</td>
<td>definitely agree</td>
<td>slightly agree</td>
<td>slightly disagree</td>
<td>definitely disagree</td>
</tr>
<tr>
<td></td>
<td>Anxiety and Asperger's</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>I don’t particularly enjoy reading fiction.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>I find it hard to make new friends.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>I notice patterns in things all the time.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>I would rather go to the theatre than a museum.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>It does not upset me if my daily routine is disturbed.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>I frequently find that I don’t know how to keep a conversation going.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>I find it easy to “read between the lines” when someone is talking to me.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>I usually concentrate more on the whole picture, rather than the small details.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>I am not very good at remembering phone numbers.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>I don’t usually notice small changes in a situation, or a person’s appearance.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>I know how to tell if someone listening to me is getting bored.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32.</td>
<td>I find it easy to do more than one thing at once.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>When I talk on the phone, I’m not sure when it’s my turn to speak.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34.</td>
<td>I enjoy doing things spontaneously.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.</td>
<td>I am often the last to understand the point of a joke.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>I find it easy to work out what someone is thinking or feeling just by looking at their face.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37.</td>
<td>If there is an interruption, I can switch back to what I was doing very quickly.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38.</td>
<td>I am good at social chit-chat.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39.</td>
<td>People often tell me that I keep going on and on about the same thing.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.</td>
<td>When I was young, I used to enjoy playing games involving pretending with other children.</td>
<td>definitely agree slightly agree slightly disagree definitely disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>---</td>
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<td>---</td>
</tr>
<tr>
<td>41. I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.).</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
<tr>
<td>42. I find it difficult to imagine what it would be like to be someone else.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
<tr>
<td>43. I like to plan any activities I participate in carefully.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
<tr>
<td>44. I enjoy social occasions.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
<tr>
<td>45. I find it difficult to work out people’s intentions.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
<tr>
<td>46. New situations make me anxious.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
<tr>
<td>47. I enjoy meeting new people.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
<tr>
<td>48. I am a good diplomat.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
<tr>
<td>49. I am not very good at remembering people’s date of birth.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
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<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
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<tr>
<td>50. I find it very easy to play games with children that involve pretending.</td>
<td>definitely</td>
<td>slightly</td>
<td>slightly</td>
<td>definitely</td>
</tr>
<tr>
<td></td>
<td>agree</td>
<td>agree</td>
<td>disagree</td>
<td>disagree</td>
</tr>
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</table>

Developed by:
The Autism Research Centre
University of Cambridge

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APPENDIX I: British Picture Vocabulary Scale (Second Edition)

The British Picture Vocabulary Scale Second Edition

Performance Record

Name (last) ___________________________ (first) ___________________________
School _______________________________ 
Home Address ___________________________
Reason for Testing
LANGUAGE OF TEST HOME: □ Standard English □ Other ________
DISABILITY: □ None □ Suspected □ Confirmed □ Other ________
(Specify foreign language or type of English dialect spoken.)

Sex: M □ F □ (Circle)
Teacher _______________________________
Tel. _________________________________

Norms Table B

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<tr>
<th>Standardized Score</th>
<th>Percentile Rank</th>
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<tr>
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<tr>
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Dates

Date of Testing
Date of Birth
Age in years and completed months

Record of Scores

Raw Score

Confidence Bands

Standardized Score

Percentile Rank

Age Equivalent

Please see Textbook for details of Calculation and Interpretation (pages 10 to 18)
APPENDIX J: Wechsler Abbreviated Scale of Intelligence
APPENDIX K: PDA Questionnaire

%MSG STARTTRIAL|Hello.
110| What were you THINKING about just before the alarm sounded? %TYPE Text
120| How would you describe the thought you were having just before the alarm sounded? %TYPE List|confusing|worrying|practical|pleasureable|comforting|neutral
130| What was the form of the thought you were having? %TYPE List|like written symbols|like written text|like someone was talking to me|like I was talking to myself|like an image|unsure
140| Was this a normal thought for you? %TYPE Buttons|yes|no|unsure
150| How long had you been thinking about this before the alarm sounded? %TYPE List|< 1 min|1-5 min|5-10 min|over 10 min
160| How often do you think about this? %TYPE Popup|1(never)|2|3|4|5 (constantly)
170| How happy were you feeling just before the alarm sounded? %TYPE Popup|1(very sad)|2|3|4|5 (very happy)
180| How nervous were you feeling just before the alarm sounded? %TYPE Popup|1(very relaxed)|2|3|4|5 (very nervous)
190| What were you DOING just before the alarm sounded? %TYPE Text
200| How many people were you with just before the alarm sounded? %TYPE List|I was by myself|I was with one other person|I was with 2 or more people
210| How much did the alarm upset you? %TYPE Popup|1(not at all)|2|3|4|5 (a great deal)
220| Did the interruption to your thinking upset you? %TYPE Buttons|yes|no %NEXT 250
230| In what way did the interruption to your thinking upset you? %TYPE List|It made me feel nervous %NEXT 250|I lost my train of thought %NEXT 250|It annoyed me %NEXT 250|other
240| In what way did the interruption to your thinking upset you? %TYPE Text
250| Thank you. Please charge your PDA at the end of the day.|OK
260| Goodbye.|OK
APPENDIX L: Real-Time Stress Management ESP Programme

%MSG STARTTRIAL|Hello.
110| What were you thinking about just before the alarm sounded? %TYPE Tex
120| How would you describe the thought you were having just before the alarm sounded? %TYPE List|confusing|worrying|practical|pleasureable|comforting|neutral
130| What was the form of the thought you were having? %TYPE List|like written symbols|like written text|like someone was talking to me|I was talking to myself|like an image|unsure
140| Was this a normal thought for you? %TYPE Buttons|yes|no|unsure
150| How long had you been THINKING about this before the alarm sounded? %TYPE List|< 1 min|1-5 min|5-10 min|over 10 min
160| How often do you think about this? %TYPE Popup|1(never)|2|3|4|5 (constantly)
170| How happy were you feeling just before the alarm sounded? %TYPE Popup|1(very sad)|2|3|4|5 (very happy)
180| How nervous were you feeling just before the alarm sounded? %TYPE Popup|1(very relaxed)|2|3|4|5 (very nervous)
300| You seem to be feeling nervous. What technique would you like to try? %TYPE List|Relaxation|Deep Breathing|Positive self-talk|Imagery
600| What technique would you like to try? %TYPE List|Relaxation|Deep Breathing|Positive self-talk|Imagery
900| RELAXATION|OK.
310| Sometimes when we feel anxious, our muscles are tense, but we often do not realise.|OK.
311| Relaxing our muscles can help relax our mind.|OK.
312| Work slowly through each muscle in your body, tensing each for 5 seconds and then relaxing for 5 seconds.|OK.
313| You will gradually relax your muscles up your body, from your feet slowly up to your head.|OK.
314| Try to make sure your breathing is relaxed as well; slowly breathe in and slowly breathe out.|OK.
315| Start with your toes and feet, then move up your body to your calves…|OK.
316| Then tense and relax your thighs, bottom, stomach, shoulders, arms, hands and face.|OK.
317| Remember to tense each muscle for 5 seconds and then relax each muscle.|OK.
318| You can close your eyes while you relax if this helps.|OK.
319| Try to be aware of how much less tense you feel. Try this for the next minute.|OK.
320| Click the ‘DONE’ button when you are finished.| DONE.
321| That is the end of the relaxation. This will become easier with practice. Well done.|OK.
322| Do you think that this technique helped you feel less nervous? %TYPE Buttons|yes|no
323| How nervous are you feeling now? %TYPE Popup|1(very relaxed)|2|3|4|5 (very nervous)
324| Would you like to try another technique? %TYPE Buttons|yes|no
325| Good work.|OK
600| RELAXATION|OK.
331| Sometimes when we feel anxious, our muscles are tense, but we often do not realise.|OK.
332| Relaxing our muscles can help relax our mind.|OK.
333| Work slowly through each muscle in your body, tensing each for 5 seconds and then relaxing for 5 seconds.|OK.
334| You will gradually relax your muscles up your body, from your feet slowly up to your head.|OK.
335| Try to make sure your breathing is relaxed as well; slowly breathe in and slowly breathe out.|OK.
336| Start with your toes and feet, then move up your body to your calves…|OK.
337| Then tense and relax your thighs, bottom, stomach, shoulders, arms, hands and face.|OK.
338| Remember to tense each muscle for 5 seconds and then relax each muscle.|OK.
339| You can close your eyes while you relax if this helps.|OK.
340| Try to be aware of how much less tense you feel. Try this for the next minute.|OK.
Click the ‘DONE’ button when you are finished. [DONE]

That is the end of the relaxation. This will become easier with practice. Well done. [OK]

Do you think that this technique helped you feel less nervous? %TYPE Buttons [yes] [no]

How nervous are you feeling now? %TYPE Popup [1 (very relaxed)] [2] [3] [4] [5 (very nervous)]

That is all for now. [OK] %NEXT 6006

Sometimes when we feel anxious, our muscles are tense, but we often do not realise. [OK]

Relaxing our muscles can help relax our mind. [OK]

Work slowly through each muscle in your body, tensing each for 5 seconds and then relaxing for 5 seconds. [OK]

You will gradually relax your muscles up your body, from your feet slowly up to your head. [OK]

Try to make sure your breathing is relaxed as well; slowly breathe in and slowly breathe out. [OK]

Start with your toes and feet, then move up your body to your calves... [OK]

Then tense and relax your thighs, bottom, stomach, shoulders, arms, hands and face. [OK]

Remember to tense each muscle for 5 seconds and then relax each muscle. [OK]

You can close your eyes while you relax if this helps. [OK]

Try to be aware of how much less tense you feel. Try this for the next minute. [OK]

Click the ‘DONE’ button when you are finished. [DONE]

That is the end of the relaxation. This will become easier with practice. Well done. [OK]

Do you think that this technique helped you feel less nervous? %TYPE Buttons [yes] [no]

How nervous are you feeling now? %TYPE Popup [1 (very relaxed)] [2] [3] [4] [5 (very nervous)]

That is all for now. [OK] %NEXT 6006

Sometimes when we feel anxious, our muscles are tense, but we often do not realise. [OK]

Relaxing our muscles can help relax our mind. [OK]

Work slowly through each muscle in your body, tensing each for 5 seconds and then relaxing for 5 seconds. [OK]

You will gradually relax your muscles up your body, from your feet slowly up to your head. [OK]

Try to make sure your breathing is relaxed as well; slowly breathe in and slowly breathe out. [OK]

Start with your toes and feet, then move up your body to your calves... [OK]

Then tense and relax your thighs, bottom, stomach, shoulders, arms, hands and face. [OK]

Remember to tense each muscle for 5 seconds and then relax each muscle. [OK]

You can close your eyes while you relax if this helps. [OK]

Try to be aware of how much less tense you feel. Try this for the next minute. [OK]

Click the ‘DONE’ button when you are finished. [DONE]

That is the end of the relaxation. This will become easier with practice. Well done. [OK]

Do you think that this technique helped you feel less nervous? %TYPE Buttons [yes] [no]

How nervous are you feeling now? %TYPE Popup [1 (very relaxed)] [2] [3] [4] [5 (very nervous)]

That is all for now. [OK] %NEXT 6006

Sometimes when we feel anxious, our muscles are tense, but we often do not realise. [OK]

Relaxing our muscles can help relax our mind. [OK]

Work slowly through each muscle in your body, tensing each for 5 seconds and then relaxing for 5 seconds. [OK]

You will gradually relax your muscles up your body, from your feet slowly up to your head. [OK]

Try to make sure your breathing is relaxed as well; slowly breathe in and slowly breathe out. [OK]
Start with your toes and feet, then move up your body to your calves...OK.
Then tense and relax your thighs, bottom, stomach, shoulders, arms, hands and face. OK.
Remember to tense each muscle for 5 seconds and then relax each muscle. OK.
You can close your eyes while you relax if this helps. OK.
Try to be aware of how much less tense you feel. Try this for the next minute. OK.
Click the 'DONE' button when you are finished. DONE
That is the end of the relaxation. This will become easier with practice. Well done. OK.
Do you think that this technique helped you feel less nervous? %TYPE Buttons|yes|no
How nervous are you feeling now? %TYPE Popup|1 (very relaxed) | 2 | 3 | 4 | 5 (very nervous)
That is all for now. OK %NEXT 6006
ATTENTION|OK.
When we are stressed, we tend to focus on our worrying thoughts. OK.
We can become so focussed that it is difficult to focus on anything else. OK.
There are strategies you can use to help redirect your attention. OK.
Let's try a couple. OK.
Try to focus on the objects around you. Name them in your mind. OK.
Look around. There may be furniture, cars, books, and so on. OK.
Try to be as specific as you can (e.g. chair, coat, sandwich, book, money). OK.
Try this for a minute and click ‘DONE’ when you are finished. DONE
Let's try something else now. OK.
Try to count back by 3 from 100. OK.
100...97...94...91...OK.
Try this for a minute and click ‘DONE’ when you are finished. DONE
Do you think that this helped you feel less nervous? %TYPE Buttons|yes|no
How nervous are you feeling now? %TYPE Popup|1 (very relaxed) | 2 | 3 | 4 | 5 (very nervous)
Would you like to try another technique? %TYPE Buttons|yes %NEXT 2000|no
Good work. OK %NEXT 6006
ATTENTION|OK.
When we are stressed, we tend to focus on our worrying thoughts. OK.
We can become so focussed that it is difficult to focus on anything else. OK.
There are strategies you can use to help redirect your attention. OK.
Let’s try a couple. OK.
Try to focus on the objects around you. Name them in your mind. OK.
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Try to be as specific as you can (e.g. chair, coat, sandwich, book, money). OK.
Try this for a minute and click ‘DONE’ when you are finished. DONE
Let’s try something else now. OK.
Try to count back by 3 from 100. OK.
100...97...94...91...OK.
Try this for a minute and click ‘DONE’ when you are finished. DONE
Do you think that this helped you feel less nervous? %TYPE Buttons|yes|no
How nervous are you feeling now? %TYPE Popup|1 (very relaxed) | 2 | 3 | 4 | 5 (very nervous)
That is all for now. OK %NEXT 6006
ATTENTION|OK.
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Try to be as specific as you can (e.g. chair, coat, sandwich, book, money). OK.

Try this for a minute and click ‘DONE’ when you are finished. DONE

Let’s try something else now. OK.

Try to count back by 3 from 100. OK.

100…97…94…91… OK.

Try this for a minute and click ‘DONE’ when you are finished. DONE

Do you think that this helped you feel less nervous? %TYPE Buttons[yes|no]

How nervous are you feeling now? %TYPE Popup[1 (very relaxed)|2|3|4|5 (very nervous)]

That is all for now. OK %NEXT 6006

ATTENTION OK.

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When we are stressed, we tend to focus on our worrying thoughts. OK.

We can become so focused that it is difficult to focus on anything else. OK.

There are strategies you can use to help redirect your attention. OK.

Let’s try a couple. OK.

Try to focus on the objects around you. Name them in your mind. OK.

Look around. There may be furniture, cars, books, and so on. OK.

Try to be as specific as you can (e.g. chair, coat, sandwich, book, money). OK.

Try this for a minute and click ‘DONE’ when you are finished. DONE

Let’s try something else now. OK.

Try to count back by 3 from 100. OK.

100…97…94…91… OK.

Try this for a minute and click ‘DONE’ when you are finished. DONE

Do you think that this helped you feel less nervous? %TYPE Buttons[yes|no]

How nervous are you feeling now? %TYPE Popup[1 (very relaxed)|2|3|4|5 (very nervous)]

That is all for now. OK %NEXT 6006

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We can become so focused that it is difficult to focus on anything else. OK.

There are strategies you can use to help redirect your attention. OK.

Let’s try a couple. OK.

Try to focus on the objects around you. Name them in your mind. OK.

Look around. There may be furniture, cars, books, and so on. OK.

Try to be as specific as you can (e.g. chair, coat, sandwich, book, money). OK.

Try this for a minute and click ‘DONE’ when you are finished. DONE

Let’s try something else now. OK.

Try to count back by 3 from 100. OK.

100…97…94…91… OK.

Try this for a minute and click ‘DONE’ when you are finished. DONE

Do you think that this helped you feel less nervous? %TYPE Buttons[yes|no]

How nervous are you feeling now? %TYPE Popup[1 (very relaxed)|2|3|4|5 (very nervous)]

That is all for now. OK %NEXT 6006

DEEP BREATHING OK.

DEEP BREATHING OK.

Sometimes when we are anxious, we change the way we breathe. It becomes quicker and shallower. OK.

This makes it harder for us to cope with stressful situations and makes us feel more anxious. OK.

We can learn how to change our breathing to help our mind and body relax. OK.

Take a slow, deep breath, in through your nose for 4 seconds. OK.

Inhale as fully as you can. One…two…three…four….. OK.

Now exhale slowly and fully through your mouth, for a count of 4 seconds. OK.

As you exhale, feel the tension and stress leave your body. OK.

Keep breathing in and out slowly and deeply. OK.

Repeat this rhythm for one minute. OK.

If thoughts or feelings come to mind, just notice them and refocus on your breathing. OK.

Click the ‘DONE’ button when you are finished. DONE

That is the end of the breathing exercise. This will become easier with practice. Well done. OK.

Do you think that this technique helped you feel less nervous? %TYPE Buttons[yes|no]

How nervous are you feeling now? %TYPE Popup[1 (very relaxed)|2|3|4|5 (very nervous)]

That is all for now. OK %NEXT 6006

Would you like to try another technique? %TYPE Buttons[yes %NEXT 3000|no}
Sometimes when we are anxious, we change the way we breathe. It becomes quicker and shallower.\textit{OK.}

This makes it harder for us to cope with stressful situations and makes us feel \textit{more} anxious.\textit{OK.}

We can learn how to change our breathing to help our mind and body relax.\textit{OK.}

Take a slow, deep breath, in through your nose for 4 seconds.\textit{OK.}

Inhale as fully as you can. One....two....three....four.....\textit{OK.}

Now exhale slowly and fully through your mouth, for a count of 4 seconds.\textit{OK.}

As you exhale, feel the tension and stress leave your body.\textit{OK.}

Keep breathing in and out slowly and deeply.\textit{OK.}

Repeat this rhythm for one minute.\textit{OK.}

If thoughts or feelings come to mind, just notice them and refocus on your breathing.\textit{OK.}

Click the ‘DONE’ button when you are finished.\textit{DONE}

That is the end of the breathing exercise. This will become easier with practice. \textit{Well done.} \textit{OK.}

Do you think that this technique helped you feel less nervous? \textit{\%TYPE Buttons} yes\textit{\%} no

How nervous are you feeling now? \textit{\%TYPE Popup}[1 (very relaxed)]2[3]4[5 (very nervous)]

Good work.\textit{OK \%NEXT 6006}

Sometimes when we are anxious, we change the way we breathe. It becomes quicker and shallower.\textit{OK.}

This makes it harder for us to cope with stressful situations and makes us feel \textit{more} anxious.\textit{OK.}

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As you exhale, feel the tension and stress leave your body.\textit{OK.}

Keep breathing in and out slowly and deeply.\textit{OK.}

Repeat this rhythm for one minute.\textit{OK.}

If thoughts or feelings come to mind, just notice them and refocus on your breathing.\textit{OK.}

Click the ‘DONE’ button when you are finished.\textit{DONE}

That is the end of the breathing exercise. This will become easier with practice. \textit{Well done.} \textit{OK.}

Do you think that this technique helped you feel less nervous? \textit{\%TYPE Buttons} yes\textit{\%} no

How nervous are you feeling now? \textit{\%TYPE Popup}[1 (very relaxed)]2[3]4[5 (very nervous)]

Good work.\textit{OK \%NEXT 6006}

Sometimes when we are anxious, we change the way we breathe. It becomes quicker and shallower.\textit{OK.}

This makes it harder for us to cope with stressful situations and makes us feel \textit{more} anxious.\textit{OK.}

We can learn how to change our breathing to help our mind and body relax.\textit{OK.}

Take a slow, deep breath, in through your nose for 4 seconds.\textit{OK.}

Inhale as fully as you can. One....two....three....four.....\textit{OK.}

Now exhale slowly and fully through your mouth, for a count of 4 seconds.\textit{OK.}

As you exhale, feel the tension and stress leave your body.\textit{OK.}

Keep breathing in and out slowly and deeply.\textit{OK.}

Repeat this rhythm for one minute.\textit{OK.}
If thoughts or feelings come to mind, just notice them and refocus on your breathing.\textcopyright OK.

Click the ‘DONE’ button when you are finished.\textcopyright DONE

That is the end of the breathing exercise. This will become easier with practice. Well done.\textcopyright OK.

Do you think that this technique helped you feel less nervous? \%TYPE Buttons\textcopyright yes\%no

How nervous are you feeling now? \%TYPE Popup1(very relaxed)\%2\%3\%4\%5(very nervous)

Good work.\textcopyright OK \%NEXT 6006

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Sometimes when we are anxious, we change the way we breathe. It becomes quicker and shallower.\textcopyright OK.

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That is the end of the breathing exercise. This will become easier with practice. Well done.\textcopyright OK.

Do you think that this technique helped you feel less nervous? \%TYPE Buttons\textcopyright yes\%no

How nervous are you feeling now? \%TYPE Popup1(very relaxed)\%2\%3\%4\%5(very nervous)

Good work.\textcopyright OK \%NEXT 6006

SELF-TALK\textcopyright OK.

What we say to ourselves can affect how we feel.\textcopyright OK.

Sometimes we have thoughts that are negative and they can make us feel more anxious.\textcopyright OK.

These thoughts can make us feel like we cannot cope and that we want to leave the situation.\textcopyright OK.

However, these thoughts are usually unrealistic and not based on evidence. They usually go away eventually.\textcopyright OK.

Sometimes saying positive things to ourselves can help these thoughts seem less important.\textcopyright OK.

Read the following statements and repeat them to yourself (in your mind) 5 times.\textcopyright OK.

Some of them will seem more appropriate for your situation than others.\textcopyright OK.

'I can get through this.'\textcopyright OK.

'I have got through it before and been ok.'\textcopyright OK.

'I do not like this, but it will pass. Let it go.'\textcopyright OK.

'These are just thoughts. It does not mean that they are true.'\textcopyright OK.

Click the ‘DONE’ button when you are finished.\textcopyright DONE

Do you think that this technique helped you feel less nervous? \%TYPE Buttons\textcopyright yes\%no

How nervous are you feeling now? \%TYPE Popup1(very relaxed) \%NEXT 6006\%2 \%NEXT 6006\%3\%4\%5(very nervous)

Would you like to try another technique? \%TYPE Buttons\textcopyright yes \%NEXT 4000\%no

Good work.\textcopyright OK \%NEXT 6006

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'I do not like this, but it will pass. Let it go.'\textcopyright OK.

'These are just thoughts. It does not mean that they are true.'\textcopyright OK.

Click the ‘DONE’ button when you are finished.\textcopyright DONE

Do you think that this technique helped you feel less nervous? \%TYPE Buttons\textcopyright yes\%no

How nervous are you feeling now? \%TYPE Popup1(very relaxed) \%NEXT 6006\%2 \%NEXT 6006\%3\%4\%5(very nervous)

That is all for now.\textcopyright OK \%NEXT 6006

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'I can get through this.'

These are just thoughts. It does not mean that they are true.

Click the ‘DONE’ button when you are finished.

Do you think that this technique helped you feel less nervous?

How nervous are you feeling now?

That is all for now.

What we say to ourselves can affect how we feel.

Sometimes we have thoughts that are negative and they can make us feel more anxious.

These thoughts can make us feel like we cannot cope and that we want to leave the situation.

However, these thoughts are usually unrealistic and not based on evidence. They usually go away eventually.

Sometimes saying positive things to ourselves can help these thoughts seem less important.

Read the following statements and repeat them to yourself (in your mind) 5 times.

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That is all for now.

What we say to ourselves can affect how we feel.

Sometimes we have thoughts that are negative and they can make us feel more anxious.

These thoughts can make us feel like we cannot cope and that we want to leave the situation.

However, these thoughts are usually unrealistic and not based on evidence. They usually go away eventually.

Sometimes saying positive things to ourselves can help these thoughts seem less important.

Read the following statements and repeat them to yourself (in your mind) 5 times.

Some of them will seem more appropriate for your situation than others.

'I can get through this.'

These are just thoughts. It does not mean that they are true.

Click the ‘DONE’ button when you are finished.

Do you think that this technique helped you feel less nervous?

How nervous are you feeling now?

That is all for now.
Sometimes worrying thoughts are like images in our mind.
When we are anxious, it can feel difficult to get our minds off these images and onto something else.
Visualising relaxing situations can help divert our attention and help us relax.
Take a few deep breaths.
Imagine that you are standing at an empty train station, waiting for a train. Imagine that you are feeling very relaxed.
Try to imagine the sound of the train, the feel of the breeze, the smell of the station, as if you are actually there.
Imagine your thoughts and feelings as if they are the trains passing by.
Try to imagine your thought printed on the side of the train as it passes. They simply pass by, but you do not try to stop them.
With each passing train, you feel more calm and more relaxed.
Spend a minute imagining the calm station and the trains passing by. Just let them go. One after another.
Try to imagine the sound of the train, the feel of the breeze, the smell of the station, as if you are actually there.
Imagine your thoughts and feelings as if they are the trains passing by.
Imagine you can see your thought printed on the side of the train as it passes. They simply pass by, but you do not try to stop them.
With each passing train, you feel more calm and more relaxed.
Spend a minute imagining the calm station and the trains passing by. Just let them go. One after another.
Click the ‘DONE’ button when you are finished.
Do you think that this technique helped you feel less nervous?
How nervous are you feeling now?
Imagine that you are standing at an empty train station, waiting for a train. Imagine that you are feeling very relaxed.
Try to imagine the sound of the train, the feel of the breeze, the smell of the station, as if you are actually there.
Imagine your thoughts and feelings as if they are the trains passing by.
Imagine you can see your thought printed on the side of the train as it passes. They simply pass by, but you do not try to stop them.
With each passing train, you feel more calm and more relaxed.
Spend a minute imagining the calm station and the trains passing by. Just let them go. One after another.
Click the ‘DONE’ button when you are finished.
Sometimes worrying thoughts are like images in our mind. OK.
When we are anxious, it can feel difficult to get our minds off these images and onto something else. OK.
Visualising relaxing situations can help divert our attention and help us relax. OK.
Take a few deep breaths. OK.
Imagine that you are standing at an empty train station, waiting for a train. Imagine that you are feeling very relaxed. OK.
Try to imagine the sound of the train, the feel of the breeze, the smell of the station, as if you are actually there. OK.
What else do you see? What do you hear? What do you smell? OK.
Imagine your thoughts and feelings as if they are the trains passing by. OK.
Try to imagine your thought printed on the side of the train as it passes. They simply pass by, but you do not try to stop them. OK.
With each passing train, you feel more calm and more relaxed. OK.
Spend a minute imagining the calm station and the trains passing by. Just let them go. One after another. OK.
Click the ‘DONE’ button when you are finished. DONE.
Do you think that this technique helped you feel less nervous? %TYPE Buttons|yes|no
How nervous are you feeling now? %TYPE Popup|1 (very relaxed)|2|3|4|5 (very nervous)
That is all for now. OK %NEXT 6006
IMAGERY|OK.
Sometimes worrying thoughts are like images in our mind. OK.
When we are anxious, it can feel difficult to get our minds off these images and onto something else. OK.
Visualising relaxing situations can help divert our attention and help us relax. OK.
Take a few deep breaths. OK.
Imagine that you are standing at an empty train station, waiting for a train. Imagine that you are feeling very relaxed. OK.
Try to imagine the sound of the train, the feel of the breeze, the smell of the station, as if you are actually there. OK.
What else do you see? What do you hear? What do you smell? OK.
Imagine your thoughts and feelings as if they are the trains passing by. OK.
Try to imagine your thought printed on the side of the train as it passes. They simply pass by, but you do not try to stop them. OK.
With each passing train, you feel more calm and more relaxed. OK.
Spend a minute imagining the calm station and the trains passing by. Just let them go. One after another. OK.
Click the ‘DONE’ button when you are finished. DONE.
Do you think that this technique helped you feel less nervous? %TYPE Buttons|yes|no
How nervous are you feeling now? %TYPE Popup|1 (very relaxed)|2|3|4|5 (very nervous)
That is all for now. OK %NEXT 6006
IMAGERY|OK.
Sometimes worrying thoughts are like images in our mind. OK.
When we are anxious, it can feel difficult to get our minds off these images and onto something else. OK.
Visualising relaxing situations can help divert our attention and help us relax. OK.
Take a few deep breaths. OK.
Imagine that you are standing at an empty train station, waiting for a train. Imagine that you are feeling very relaxed. OK.
Try to imagine the sound of the train, the feel of the breeze, the smell of the station, as if you are actually there. OK.
What else do you see? What do you hear? What do you smell? OK.
Imagine your thoughts and feelings as if they are the trains passing by. OK.
Try to imagine your thought printed on the side of the train as it passes. They simply pass by, but you do not try to stop them. OK.
With each passing train, you feel more calm and more relaxed. OK.
Spend a minute imagining the calm station and the trains passing by. Just let them go. One after another. OK.
Click the ‘DONE’ button when you are finished. DONE.
5513| Do you think that this technique helped you feel less nervous? %TYPE Buttons|yes|no
5514| How nervous are you feeling now? %TYPE Popup|1 (very relaxed)|2|3|4|5 (very nervous)
5515| That is all for now.|OK %NEXT 6006
6000| What were you DOING just before the alarm sounded? %TYPE Text
6001| How many people were you with just before the alarm sounded? %TYPE List|I was by myself|I was with one other person|I was with 2 or more people
6002| How much did the alarm upset you? %TYPE Popup|1 (not at all)|2|3|4|5 (a great deal)
6003| Did the interruption to your thinking upset you? %TYPE Buttons|yes|no %NEXT 6006
6004| In what way did the interruption to your thinking upset you? %TYPE List|It made me feel nervous|I lost my train of thought|It annoyed me|other %NEXT 6006
6005| In what way did the interruption to your thinking upset you? %TYPE Text
6006| Thank you. Please charge your PDA at the end of the day.|OK.
6007| Goodbye.|OK.
APPENDIX M: Plan of Support

Plan of Support

The following plan outlines the protocol to be taken if participants become emotionally distressed during the course of this study.

Action:
- Participants who score within the moderate to severe range on either domain of the Hospital Anxiety and Depression Scale at any point during the study will be encouraged to contact their G.P. to seek advice for their distress. The researcher will assist with this process if the participant wishes. The researcher will ensure that the participant has a G.P. and knows the contact details (i.e. name, telephone number).

- Participants will be given a contact (e.g. email, University telephone number) for the researcher if they become distressed at any point during the study.

- If a participant becomes distressed out of hours, they will be directed to the emergency G.P. telephone number or emergency social services, and will be assisted with this if necessary.

- Participants will also be given a contact for the National Autistic Society Autism Helpline, a confidential service available Monday to Friday (10am to 4pm).

- Participants who become distressed will be reminded that they can withdraw from the study at any time and will be asked if they would like to continue.

- Additional contact details for Dr. Hare will be provided by the researcher if deemed necessary and if other avenues of support are unavailable.

This research involves a low-level intervention for everyday stress experienced by individuals with Asperger’s syndrome. This is delivered via a hand-held computer that participants carry with them as they go about their daily activities. The researcher will meet with each participant several times (when the device is exchanged) during the course of the study and will discuss any questions or concerns. As discussed above, participants will be given contact details for the researcher and details for additional support if need be (e.g. G.P., emergency contact, Autism Helpline, etc.). However, as a trainee clinical psychologist with ongoing clinical supervision, I am able to assess acute and chronic emotional distress and would use my clinical judgement as appropriate.

Participants who express distress will be encouraged to seek support via the aforementioned routes, however the decision regarding whether or not such support is accessed is up to the participant themselves. If the participant shows a level of distress deemed by the researcher to make them a risk to themselves or others, then an appropriate contact will be made with the G.P., social services or community mental health team. Contact numbers for this support and for the researcher will be given as additional support.
APPENDIX N: Date and Contact Cards

**DATES**

FIRST MEETING: ______________
SECOND MEETING: ______________
THIRD MEETING: ______________
FOURTH MEETING: ______________
FIFTH MEETING: ______________
LAST MEETING: ______________

**OTHER NOTES:**

__________________________________________
__________________________________________
__________________________________________
__________________________________________
__________________________________________

**Contacts**

Email: carolyn.gracey@postgrad.manchester.ac.uk

Phone: 0161 306 0400

National Autistic Society:
Website: www.autism.org.uk
Helpline: 0845 070 4004

Lines are open 10am-4pm, Monday to Friday.

The Autism Helpline gives impartial, confidential information, advice and support to people with autism spectrum disorders, their families, professionals, researchers and students.

Other: ________________________________
APPENDIX O: Satisfaction Survey

Satisfaction Survey

We are interested in how you experienced being a participant in this study. Please circle your answer.

1. Was the experience of participating in the study what you expected?
   YES         SOMEWHAT         NO

2. Did you get enough information about the study beforehand?
   YES         SOMEWHAT         NO

3. Did you feel comfortable using the palm pilot?
   YES         SOMEWHAT         NO

4. Were the instructions for using the palm pilot clear enough?
   YES         SOMEWHAT         NO

5. Did you find that using the palm pilot increased your anxiety?
   YES         SOMEWHAT         NO

6. Did using the palm pilot interfere with your day?
   YES         SOMEWHAT         NO

7. Did you find the stress-reduction strategies helpful in managing your stress?
   YES         SOMEWHAT         NO

8. Do you think you will continue using any of the strategies now that the study is over?
   YES         SOMEWHAT         NO

9. Do you think anything could be improved?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________