**Article:**

Spikins, Penny orcid.org/0000-0002-9174-5168 (2009) Autism, the Integrations of 'Difference' and the Origins of Modern Human Behaviour. Cambridge Archaeological Journal. pp. 179-201. ISSN 0959-7743

https://doi.org/10.1017/S0959774309000262

# Autism, the integrations of ‘difference’ and the origins of modern human behaviour

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## Abstract

It is proposed here that the archaeological evidence for the emergence of ‘modern behaviour’ (160,000–40,000 bp) can best be explained as the rise of cognitive variation within populations through social mechanisms for integrating ‘different minds’, rather than by the development of a single ‘modern human mind’. Autism and the autistic spectrum within human populations are used as an example of ‘different minds’ which when integrated within society can confer various selective benefits. It is proposed that social mechanisms for incorporating autistic difference are visible in the archaeological record and that these develop sporadically from 160,000 years bp in association with evidence for their consequences in terms of technological innovations, improved efficiency in technological and natural spheres and innovative thinking. Whilst other explanations for the emergence of modern human behaviour may also contribute to observed changes, it is argued that the incorporation of cognitive differences played a significant role in the technological, social and symbolic expression of ‘modern’ behaviour.

## Introduction

### The appearance of modern human behaviour

The appearance of what has been termed 'modern human behaviour' has been a key area of archaeological discussion for many years. 'Modern' behaviour is identified in the archaeological record through the appearance of new behavioural elements broadly associated with the spread of anatomically modern humans (Stringer 2002, Mellars 1989a, 1989b, 1996, 1999, 2005, 2006, Hensilwood and Marean 2003), see table 1. Attention has particularly focused on *technological/economic changes* with the appearance of innovative, diverse and standardised flint tool technology (Mellars 1989a, 1989b, 1996, 2005, 2006, Bar-Yosef 2002) widespread bone technology (Mithen 1996, Mellars 1989a, b, 1996, 2005, Bar-Yosef 2002) and marine exploitation (Marean et al 2007) and on *social/cognitive changes* with the appearance of widespread evidence for the use of ochre (McBrearty and Brooks 2000, Marean 2007), art (Henshilwood et al 2001, Henshilwood and Marean 2003, Connard and Bolus 2003) elaborate burial (Mellars 1989a, 1989b, 1996, 1999) and long distance communication networks (Gamble 1999, Bar-Yosef 2002). The appearance of modern human behavioural traits is also associated with consequences within population dynamics and biology such as significant geographical expansion (Mellars 2006b,c), increases in longevity (Caspari and Lee 2006) and reductions in foraging stress (Kaufman 2001, Underdown 2006). Though there is broad agreement on the archaeological signatures of modern human behaviour (Hensilwood and Marean 2003, Mellars 2005, 2006a,b,c), its origins are variously seen as sudden and dramatic in their arrival (Mellars 2006c) or more slowly adopted (McBrearty and Brooks 2000, D'Errico et al 1998) and to variously exclude (Mellars 1989a, 1989b, 1996, 1999, 2005, 2006b, c) or include (D'Errico et al 1998) archaic species such as Neanderthals.

### Modern human behaviour and key cognitive changes

It has been tempting to search for one key cognitive change which might provide a full explanation for the rise of 'modern' behaviour through the appearance of the 'modern human mind'. Proposals for such a key change have included the fluid linkages of mental modules (Mithen 1995, 1996), development of modes of consciousness and trance states (Lewis-Williams ref), advances in working memory (Wynn and Cooleridge 2004), the rise of the capacity for symbolic thought (Mellars 1989a, 1989b, 1996) or changes in the construction of identity (Gamble 2007). Such cognitive changes might theoretically have occurred in the small populations in Africa which gave rise to modern humans (Mellars 2005a, 2005b, 2006). 'Modern human behaviour' would thus have spread with the progressive geographical expansion of biologically modern populations. Certainly elements of modern human behaviour are initially represented in Africa at about 100-160,000 years ago, around the time of the development of biologically modern human populations (Hensilwood and Marean 2003, Mellars 2006c, Marean et al 2007, Mellars 2007). MtDNA evidence further supports a potential population expansion out of Africa associated with modern behaviour at 60,000 years ago (Mellars 2006c, 2007) and ‘modern human behaviour’ also shows a marked development and contrast to that of Neanderthals when modern humans expand into Europe around 40-30,000 years ago.

However, though attempts have been made to apply directly progressive models of behavioural changes (see Foley and Lahr 2003; Mellars 2006b,c) the archaeological record is complex and in many regions defies a simple ‘spread’ model. If there is no simple ‘spread’ of modern human behaviour the direct link to biology is called into question (Zilhão 2007). Behavioural changes are for example less abrupt or less marked in Asia where symbolic behaviour is not immediately expressed (James and Petraglia 2005) whilst in contrast modern symbolic behaviour and particularly the use of red ochre appears to arise much earlier than the posited origins of modern humans in Africa (McBrearty and Brooks 2000). In the Levant (Kaufman 2001, Shea 2003) modern humans are present without any significant behavioural change at 80,000 years ago and are subsequently replaced by Neanderthals. In Europe so called ‘transitional industries’ illustrate a capacity in Neanderthals for reproducing ‘modern’ behaviour in personal ornamentation and stone tool types (Harrold 1989, Hublin et al 1996, Mellars 1999, D’Errico et al 1998, Valoch 2000, Coolidge and Wynn 2004, Chase 2007). Various authors have suggested that the emergence of modern human behaviour had a significant social component, though the precise character of this remains elusive (Gamble 2007, Zilhão 2007, Petitt 2007) and it is difficult to explain the progressive nature of modern human behavioural change.

**Significant questions**

Several questions remain. Despite evidence for significant behavioural changes on a large temporal and spatial scale, on a regional scale there is little absolute association between genetically modern humans, recorded in MtDNA evidence and anatomically in cranial and skeletal material, and ‘modern human behaviour’. Further research or interpretations appear to be needed. There is no clear ‘map’ between behavioural and biological changes or explanation for why large scale behavioural changes and population expansion occur significantly (approximately 100,000 years) later then the biological origin of modern humans, or the earliest evidence for such behaviour in the archaeological record. The nature and causes of ‘modern human behaviour’ has remained open to debate (Kuhn and Hovers 2006), with the situation complicated since the lack of *material expression* of behaviour cannot be seen as evidence for its absence, the so called ‘Sapient Paradox’ (Renfrew 2007: 79). Demographic changes have provided a recent key focus for explanations of the adoption of innovations (Shennan 2001, Hovers and Belfer-Cohen 2006), with larger and more stable populations more likely to adopt ‘inventions’ to become ‘innovations’ (Hovers and Belfer-Cohen 2006) but these explanations still fail to explain why such demographic changes take place. A focus on behavioural *traits,* without references to a theory of the social or cognitive structures underlying behaviour is perhaps the root cause of difficulties in understanding this key stage (Hensilwood and Marean 2003).

Here it is argued that a key limitation to interpretations has been the assumption that modern humans can be characterised by a single ‘modern mind’ against which previous species might be compared. Much as there is no one single type of olfactory system that could be the ‘norm’ but instead a range of normal genetically coded variation in biology within populations (Weiss 2007), there may be no single ‘normal’ mind but a range of interrelated variations. A model of the origins of modern human behaviour as based on cognitive differences, potentially maintained through social mechanisms, might provide a better explanation for many of the characteristics of the archaeological record.

The autistic spectrum is used as an example of cognitive differences within populations which, through their integration within society, might play a significant role in the emergence of ‘modern human behaviour’.

## Autism and the prehistory of cognitive differences

Autism as a significant ‘difference in mind’

Amongst cognitive based differences in ‘mind’, autism and autistic differences are particularly relevant to the question of cognitive differences and modern human behaviour. Although autism was once seen as a rare and poorly understood ‘disorder’, there have been significant advances in our understanding of the condition in recent years (Baron-Cohen 2006a; 2006b, Baird et al 2006, Grinker 2007). Whilst archaeology as a discipline is only beginning to take up the challenge of autism and population differences in cognition the potential role and significance to society of autistic conditions is increasingly clear.

The significance of autism has potentially been overlooked due to a traditional emphasis on autism as a severe disorder associated with extreme behaviour. Whilst the talents of autistic ‘savants’, such as ‘Nadia’ who had extraordinary drawing abilities despite almost no language (Selfe 1977, Treffert 1989) attract attention, these individuals are not only very rare but also clearly outside ‘society’ particularly given their inabilities to communicate effectively with others. Indeed the diagnostic criteria for autism reflect a focus on extreme and antisocial behaviour (table 2). In recent years however there has been an increasing focus on other autistic conditions, in particular Asperger’s Syndrome, which, whilst denoting a clear difference in ‘mind’ do not necessarily involve any significant social exclusion. The key significant different between Asperger’s Syndrome and classic autism is that these individuals can use language effectively (table 2) often being relatively successful in society with their ‘difference’ even other unrecognised until later life (Griffin 2006, Attwood 1998). Whilst those with Asperger’s Syndrome share difficulties in *empathising* (feeling an appropriate emotion in relation to another’s emotion, Baron-Cohen and Wheelwright 2004) with those with autism they may be socially competent, and able to *predict* behaviour, using a rule based method of socialising which nonetheless often ‘works’ (Baron-Cohen and Wheelwright 2004, Attwood 1998: 114, Baron-Cohen 2006a, 2006b). Consequently these individuals think ‘differently’ but may not behave in an extremely different way to others as they can learn (and discuss) what is ‘acceptable’ as rules (Baron-Cohen 2000; Molley and Vasil 2002) even if they lack the emotional understanding of other people which depends on empathising with another’s emotions.

Temple Grandin, professor of animal behaviour, provides a useful example of the level of effective integration within society which those with autistic conditions can play (Grandin 1995; Grandin and Johnson 2006). With marked language delays and inability to empathise with others she was diagnosed with severe autism in childhood. Through language therapy her communication skill later developed such that she is a leading author, with regular contributions to Science and Nature – effectively becoming someone with Asperger’s Syndrome with a role in society and considerable respect for her analytical abilities.

Several of the features of 'milder' autistic conditions such as Asperger's have been linked to areas of particularly 'brilliance' or achievement (table 4) (Fitzgerald 2003; 2005, Fitzgerald and Walker 2006, Fitzgerald and O'Brien 2007, Ortiz 2008). It is not difficult to see how attention to detail, exceptional memory, a thirst for knowledge and narrow obsessive focus can lead to significant achievement in certain realms, particularly when often coupled with a desire for social isolation, a 'turning away from everyday things', a motivation for achievement in the advancement of knowledge and a unique single-mindedness even in the context of another's distress. Indeed those with Asperger's Syndrome typically have excellent abilities at understanding largely predictable systems such as engineering or computers, or the weather (Hermelin 2002, Baron-Cohen et al 2000) and often show an extraordinarily sophisticated understanding of complex predictable systems (Myers et al. 2004, O'Riordan et al 2001, Plaisted et al 1998). Their abilities to identify laws or patterns in complex data also give capacities for much original insight (Baron-Cohen 2006b: 4). Those with Asperger's Syndrome may be playing an important role within society.

The prevalence of autistic conditions in populations

The prevalence of autistic conditions has recently been appreciated more clearly. Of course given the different definitions and understandings of the condition the rates of what is classed as 'autistic' vary. Some authors place figures of those with autistic conditions as around 1% (Wing 1981), in broad agreement with diagnosis rates based on strictly defined behavioural diagnostic criteria for autistic conditions in the UK from the Office of National Statistics figure of 0.9% (Williams, Higgins and Bryne 2005) and recent wide scale medical studies of 1.2% (Baird et al 2006). However research by Baron-Cohen based on differences in cognitive style would place the autistic extreme of 'mind' in the UK at around 2% (Baron-Cohen 2004, Baron-Cohen and Wheelwright 2004: 169). Different definitions of autism may give subtly different 'rates' (with rather higher rates if based on cognition rather than behaviour) but there is overall agreement on the persistent presence of numbers of autistic people within the population, and perhaps most significantly broad inter population agreements in rates across other populations (Wakabayashi et al 2006).

The cognitive basis of autism

Those with autistic conditions clearly 'think differently' from others. There are different theories as to the neurological basis of autism, such as deriving from under-functioning of mirror neurones (Williams et al 2001) or differences in higher level neural connections (Just et al 2007). However in functional terms, autism is traditionally associated with cognitively based deficiencies in 'Theory of Mind' (ToM). Theory of Mind is the ability to conceive of other's intentions and beliefs. People may have differing abilities at understanding others, reflected in their 'levels of intentionality' (the extent to which they can understand the beliefs of others about the beliefs of others etc) (Dunbar 2003; 2007, Mithen 1996). However whilst autism is associated with low levels of Theory of Mind abilities (Dunbar 2003, Baron-Cohen and Belmont 2005, Burns 2004, 2006), and understanding of intentionality, those with Asperger's Syndrome may often pass Theory of Mind tests by using rules and logic about other's beliefs (Baron-Cohen 2000; Molley and Vasil 2002). Indeed such 'rules' appear to be sufficient to allow them to cope in most social interactions. However autistic conditions are nonetheless a disadvantage in certain areas of social relationships. Indeed attention has focused recently on inabilities of those with autistic conditions to empathise with others (feel a feeling appropriate to another's feeling, Baron-Cohen and Wheelwright 2004) and so to conceive of other's emotional states (Salani et al 2007). Whilst Theory of Mind (other's beliefs) abilities are reduced, it is the abilities to understand other's emotions which are most significant in affecting the social relationships of those within autism.

Autism in social relationships

Despite advantages in certain domains, conditions such as Asperger's Syndrome are generally a disadvantage in intimate social relationships. The 'something' missing in autism is the empathetic ability to relate to others emotions, to develop emotional rapport, and to compassionately invest in another's wellbeing and feelings (Baron-Cohen and Wheelwright 2004, Baron-Cohen 2002, 2004, Salani et al 2007). Empathy and emotional rapport are key to social relationships. Indeed it is empathy, largely missing in those with autistic conditions, which 'provides the glue which holds society together' (Baron-Cohen and Wheelwright 2004: 163). Emotional rapport, and reciprocal emotional exchanges form a crucial component of almost all areas of intimate social life. Emotional rapport is essential to child development, forming the basis for cognitive development and secure relationships in later life (Evans 2001, Greenspan and Shanker 2004, Parkinson, Fischer and Manstead 2005, Gross 2006, Goleman 2006, Grieser and Kuhl 1998; Jaffe *et al* 2001, Falk 2005). Emotional rapport and the emotions based on interpersonal emotional reactions (or social or socio-moral emotions, Damasio 2000, Parkinson, Fischer and Manstead 2005) are also the basis for strong social bonds in adulthood. It is socio-moral emotions based on empathising such as love, remorse and compassion which provide the close social ties that link people together (Batson 1991, Berg, Dickhait and McCabe 1995, Frank 1998; 2001, Nesse 2001, Fiske 2002, Gintis et al 2003, Tuckler, Luu and Derryberry 2005) and form the basis for altruistic acts. Through empathising with others, or the group, and integrating these emotions with rational thought we routinely act on behalf of others even at our own cost (Frank 2001, Nesse 2001, Mukulincer and Shaver 2005, deWaal 2008), something alien to the predominantly self-regarding social relationships of our nearest relatives the chimpanzees (Jenson et al 2006). Indeed, an emotional investment in other's wellbeing originating in the fleeting compassion of higher primates (deWaal 2008) appears to have a long history, from around 1.5 million years ago with the 'care' of debilitated KNM-ER 1808 for several weeks (Cameron and Groves 2004) to much larger scale investments, even extending over many years in caring for the injured and infirm in Neanderthals (Spikins and Rutherford in prep).

Those with Asperger's Syndrome function significantly differently within social relationships on two counts. Firstly they fail to interpret complex dynamic emotional signals, the rapid and empathetic chit-chat, gossip and humour of everyday life. Temple Grandin, illustrates this relationship particularly well. Temple is someone with an autistic mind who plays an important role in 'society' but remains outside, though nonetheless able to glimpse, the complex web of dynamic and rhythmic interpersonal emotions. She remarks

*During the last couple of years I have become more aware of a kind of electricity that goes on between people. I have observed that when several people are together and having a good time their speech and laughter follow a rhythm. They will all laugh together then talk quietly until the next laughing cycle. I have always had a hard time fitting in with this rhythm, and I usually interrupt conversations without realising my mistake. The problem is that I can't follow the rhythm* (Grandin 1995: 91-91).

Secondly those with Asperger's Syndrome can be motivated by different goals than others, and Fitzgerald and O'Brien (2007: 5) note that they 'get their psychological highs on their breakthroughs in creative understanding'. Like those which attachment insecurities (Mukilincer and Shaver 2005) they don't form part of the web of emotional commitment and 'caring' for others, which 'feels good' for those who act compassionately (Tuckler, Luu and Derryberry 2005). Indeed, one of the key characteristics for diagnosing historical figures with Asperger's Syndrome has been a failure to take action to care for or protect ill or infirm spouses of children where no clear 'rules' exist to proscribe this (Fitzgerald 2005) and Gernsbacher, Dawson and Mottron (2006: 414) illustrate the differing emotional motivations and drive for achievement of those with autism with a quote from the famous inventor Nikola Tesla.

*I do not think that there is any thrill that can go through the human heart like that felt by the inventor as he sees some creation of the brain unfolding to success… Such emotions make a man forget food, sleep, friends, love, everything… I do not think you can name many great inventions made by married men.* (Pickover 1999: 35).

Life as a 'high functioning' autistic person within society can appear as if living in a different culture, which Sacks (1995) describes as being 'An Anthropologist on Mars'.

The social roles of those with autistic conditions

It is not only the talents of those with Asperger's Syndrome, but also their motivations which tend to lead them towards particular social roles. We can easily imagine how a unique focus and ‘turning away’ from social relationships towards a particular focused special interest for example can be the basis for significant advances in the arts and sciences (Fitzgerald 2003; 2005, Baron-Cohen 2006a; 2006b). Indeed, the social roles developed by those with autistic conditions are becoming an important subject of debate (Fitzgerald 2003; 2005, Griffin 2006, Baron-Cohen et al 1997; 1998, Baron-Cohen 2002, 2004, Baron-Cohen and Wheelwright 2004, James 2006, Fitzgerald and O’Brien 2007). Unsurprisingly those with autism seem to naturally be drawn to certain social spheres or positions such as in academia, engineering and computer scientists (Baron-Cohen et al 1997; 1998)and politics (Griffin 2006, Fitzgerald and Walker 2006, Fitzgerald and O’Brien 2007). Many individuals associated with key political roles or significant scientific, artistic or philosophical achievement have been interpreted as having Asperger’s Syndrome (Attwood 1998, Fitzgerald 1999, 2003, 2005, Fitzgerald and Walker 2006, Fitzgerald and O’Brien 2007, Grandin 1995, Snyder 2004, Sacks 2004, James 2003, 2006, Bottomer 2007), including key historical figures such as Charles Richter, Albert Einstein, Charles Darwin, Isaac Newton, Hans Christian Andersen, Lewis Carroll, Wolfgang Amadeus Mozart, Vincent Van Gogh, Eamon de Valera and Sir Keith Joseph (Fitzgerald 2002, 2003, 2005, Fitzgerald and Walker 2006, Fitzgerald and O’Brien 2007, Hough 2007). Hans Asperger commented that *‘It seems for success in science or art, a dash of autism is essential. For success the necessary ingredient may be to turn away from the everyday world, from the simply practical, an ability to re-think a subject with originality so as to create new untrodden ways, with all abilities canalised into the one speciality’* (Asperger 1979: 49) cited in Attwood (1998: 27).

We can reasonably speculate that analogous social roles for those who were ‘different’ also existed in the past. Though there have not been any explicit studies of autism in ethnographically documented societies it is not difficult to see how such people might play a role in early small scale societies. ‘Difference’ in mind is often accepted and may generate particular social roles in small scale communities (Porr and Alt 2006). In ethnographically documented hunter-gatherers status and respect may be aided by autistic traits such as a unique understanding of technology and natural systems and unique focus (such as a particular proficiency in hunting or in creating precision or complex technology). Amongst the Selk’nam for example a solitary hunter, particularly specialised in hunting cormorants achieved a certain notable status (Bridges 1948). Social roles for difficult or controlling people also exist, for example amongst the !Kung who use such individuals to negotiate with other groups (Lee 1979). At points of stress where it may not be useful to empathise with others distress humble leaders (who are normally preferred in egalitarian societies, Boehm 1993) may be replaced by dominant or controlling ‘war leaders’ perhaps more suited to organising behaviour forcibly (Van Vugt and De Cremer 2002; Van Vugt 2006: 363, Boehm 1993: 233). Clear difference in mind in itself may also generate particular spiritual status (Carod-Artal and Vásquez Cabrera 2007, Porr and Alt 2006).

Selection of those with autistic traits

The situational success of autistic conditions also provide an explanation for their maintenance in populations. Autistic conditions are highly heritable (Folstein and Rutter 1977; Bolton and Rutter 1990; Bailey et al 1995; Bailey et al 1998; Folstein and Rutter 1988; Gillberg 1991; Baron-Cohen 1997; 1998, Lamb et al 2000, Molden and Rubenstein 2006, Alarcón et al 2008) and Baron-Cohen (2006a; 2006b) for example suggests that preferential mating between 'like minded' peoples with expressions of Aspergers's Syndrome may be maintaining autism and generating more extreme forms in their children. Baron-Cohen's 'assortative mating' theory is supported by evidence of high rates of autism amongst engineers and within families of engineers and those working in information technology (Baron-Cohen et al 1997; 1998) and geographic 'hotspots' of diagnosed severe autism at Cambridge, MIT and Stamford. Alternatively particularly nurturing individuals may be attracted by autistic differences (Attwood 2003, Rodman 2003). Relatively common conditions such as attachment insecurities in development which can constrain abilities to make emotional commitments to others in later life (Mukuliner and Shaver 2005) can make the 'fairness' of those with autism attractive partners for some (Rodman 2003), plus the potential arenas for success and achievement for those people those with 'a dash of autism' may also make their social status attractive. Autism, as a condition which is common, heritable and not necessarily harmful, even sometimes advantageous (Gernsbacher, Dawson and Mottron 2006) may be being maintained in populations through diverse means.

Autistic conditions in evolutionary perspective

From an evolutionary perspective there may be something particularly significant about autistic individuals. Rejman (2005) sees autism as key to human societies, and in reference to the potential role of autism in human evolution quotes G. B. Shaw as saying *'The reasonable man adapts himself to the world. The unreasonable man tries to adapt the world to himself. Therefore all progress depends upon the unreasonable man.'* Fitzgerald even boldy remarks that *'All human evolution was driven by slightly autistic Asperger's and autistic people. The human race would still be sitting around in caves chattering to each other if it were not for them'* (quoted in Griffin 2006: 27). Autism, and indeed other genetically based cognitive differences, might not be as peripheral to the origins and maintenance of 'modern human behaviour' as we might traditionally expect. Although our conscious concept of our own mind as a model for other's (Humphrey 1984 can make conceiving of widespread autistic conditions in society challenging, 'mild' autistic conditions such as Asperger's Syndrome are clearly something we as archaeologists need to take into account in interpretation of prehistoric societies.

## Autism in Prehistory

A knowledge of the situational advantages of autistic conditions and roles of individuals with these conditions can shed insight on key features of the archaeological record, and developments around the Middle-Upper Palaeolithic transition in particular.

One area of early Prehistory which has attracted particular attention within discussions of autism is that of the Upper Paleolithic cave art of south-west Europe. Humphrey (1998) highlights key similarities between such art and the drawings of Nadia, an autistic 'savant' who had virtually no command of language but exceptional drawing ability, and Kellman (1998) draws similar analogies between such art and 'Jamie' a similarly talented autistic 'savant' (Kellman 1998). The similarities are apparently significant, with both art forms showing unusual attention to precise details, exceptional memory abilities and a very literal (rather than metaphorical) rendition of the world. Humphrey concludes that the only explanation may be that the Upper Palaeolithic artists indeed shared cognitive similarities with Nadia, such as a literal view of the world, and may not have had in that case truly 'modern' minds. This explanation for the similarities is seen as problematic (Bahn 1998) and certainly is difficult to reconcile with other elements of the archaeological record, such as symbolic burial and personal ornamentation which occur much earlier and are generally interpreted in terms of complex symbolic thought (Mithen 1998b, Tattersall 1998). A further argument against such an interpretation is that even much earlier 'art' such as a Blombos Cave (Henshilwood et al 2002a, 2002b, 2004) is not in the precisely realistic style found in south-west Europe but demonstrates an understanding of symbolic, rather than purely literal, thought.

Trehin (2002, 2003) in contrast concludes that the similarities in such Palaeolithic art to that of austistic savants provides evidence that the art was made my autistic savants themselves and stresses the role of such individuals in human evolution. This is equally problematic as an interpretation however and fails to explain the ubiquitousness of this art form, particularly given similarities between parietal and mobiliary art (Bahn and Vertut 1997) and the continuity of art despite apparent rareness of savants with artistic genius, particularly within small scale Palaeolithic populations .

An understanding of the characteristics, prevalence and social roles of those with Asperger's Syndrome however illustrates that there is no need to recourse to either explanation. Those with Asperger's Syndrome share cognitive tendencies such as an attention to detail, exceptional memory and precise replication with those with more 'severe' (socially debilitating) forms of autism. Not only is Asperger's Syndrome more common, but we know that these linguistic competent individuals are very influential in the spread of their ideas. Few would doubt the influence of figures such as Einstein, Darwin, Newton, Van Gogh or Mozart, apparently with Asperger's Syndrome, on science or the arts, and indeed Temple Grandin has had significant influence within the field of animal husbandry and abbatoir design

(Grandin and Johnson 2006). Those with Asperger's Syndrome clearly have an influence on ideas and ways of seeing things. Indeed people living in close relationships with those with Asperger's Syndrome are also known to develop 'autistic thinking' (Aston 2001) and it is not difficult to see that influential people with Asperger's can be the hub of a spread not only of ideas, inventions, concepts but more profoundly of ways of thought. We are after all in modern society able to think 'autistically' or in purely rule based and analytical terms, and are explicitly thought such thinking styles through our system of education. That is not to say the influence of those with Asperger's Syndrome worked in the same manner in early prehistoric societies as in our own nonetheless. The nature of Upper Palaeolithic art may indeed provide evidence for the form of transmission of visual ideas, with Haworth (1998) suggesting that Upper Palaeolithic language was more visually based, powerfully focusing and disseminating thought on visual representation.

Upper Palaeolithic art in south-west Europe may have drawn particular attention in relation to traits of autism but it is not unique in demonstrating 'autistic' thinking. Indeed other elements of the archaeological record might display similarly surprising attention to detail, and absolute replication as Palaeolithic art – most notably precise, detailed and standardised technology such as microblade industries at Howiesoon's Poort (Wurtz 1999, Henshilwood et al 2001, Mellars 2006b, 2007). Rather than evidence for a lack of modern minds these developments are perhaps rather more evidence of the *emergence* of cognitive modernity as cognitive differences in mind within populations. Indeed if, like many researchers, we view modern human cognitive differences as a spectrum of difference of which the autistic spectrum is only one element (Baron-Cohen 2002, 2004, 2006b, Crespi 2006, Nettle 2005, 2006b), we can see the technological innovations of the Middle-Upper Palaeolithic transition as evidence for the rise of this characteristic 'spectrum' and the activities and influence of the 'technologically minded' on society.

Viewed with an understanding of the social role of autistic conditions it is difficult to escape the relationship between the 'package of developments' (Mellars 2007: 5) in Africa associated with the emergence of modern humans, and the focus on systems, precision and technological order seen in Asperger's Syndrome and in those with a more 'technologically minded' personality. From some of the earliest industries associated with this transition we the emergence of precision working, particularly within microlithic industries such as those of Howiesoon's Poort (Wurtz 1999, Henshilwood et al 2001), as well as clear attention to detail and adherence to strict rules in the new levels of standardisation of artefact forms (Mellars 2006b, 2007). In terms of rigidly analytical thinking we also see the emergence of a new efficiency in tools, and the use of 'engineered' solutions such as projectile weapons (Shea 2003) and more efficient use of blade technology (Mellars 2006, Shea 2003). Such improved efficiencies contribute to reductions in resource stress (Kaufman 2001, Underdown 2006). Rigidly ordered analytical thinking is also illustrated in the emergence of calendrical or rigidly structured notation systems (Marshack 1991, Robinson 1992). Moreover, perhaps most tellingly evidence for a range of ‘different thinking’ comes from the emergence of the applications of significant insights, and a new rapidity in innovation and willingness to ‘break with the norm’ (Hovers and Belfer-Cohen 2006). The significance of the ‘human revolution’ may be as a revolution captured in differences within society, rather than primarily a revolution between any single mind and what came before.

Can we therefore accredit the technological changes, and the ‘success’ of modern humans to the rise of autistic thinking? This would perhaps be simplistic. It might rather be argued that social changes allowed those who were ‘different’ to be incorporated into society, and their talents exploited rather than leaving the ‘different’ outside in the cold.

Autism and the social integration of difference

The key to the role of autism in the emergence of modern human behaviour may be argued to lie, not in autistic individuals themselves, but in the cultural mechanisms which allow their integration. It is, after all, ‘culture’ and most particularly the structure of language, which dictates that Einstein is merely talented and ‘eccentric’ whereas Nadia, unable to communicate effectively with language was talented but ‘disordered’. Indeed from this perspective we can begin to at least speculate that several social mechanisms within cultures could have developed in a form and structure which allows the ‘integration of difference’ and formed a bridge between different minds.

Language.

Language appears to be particularly important in integrating those with Asperger’s Syndrome in society. Language provides the ‘codification’ which both structures and ‘codes’ meaning, and gives a permanence to understandings which have a commonality across different minds. As Baron-Cohen illustrates language ability is the key threshold dividing socially functioning individuals with ‘Asperger’s Syndrome’ from those with ‘autism’ (Baron-Cohen 2006a, see also Attwood 1998, 2006), as shown in the diagnostic criteria (table 2 & 3). In this context, whilst Temple Grandin cannot understand dynamic empathetic social interactions she is more than capable of communicating her ideas and opinions (including on her inability to understand complex emotional exchanges) through our common understanding of structured language. Language is by no means perfect in communicating between different minds, and misunderstandings of meaning (particularly in relation to subtle emotional expression) often occur with those with Asperger’s Syndrome. These misunderstandings can normally be explained nonetheless (a dictionary providing Asperger interpretations of common phrases even exists, Stuart-Hamilton 2006). Language can, in a sense, solves even the misunderstanding created through its use.

Symbolic material culture

‘Language’ of course extends beyond spoken words and text. As archaeologists are acutely aware, material culture and material symbolism works in a way which is analogous to language (Hodder 1989, Tilley 1991). In all cultures ‘codes’ of dress and adornment exist and rule based systems of material culture ‘code’ meaning in material objects in similar ways to spoken language or text. Clear material symbols (such as wedding rings) function to explicitly codify emotional relationships and in doing so make them understandable and readable to autistic minds. Subtle material meanings may be lost on certain minds (or their ambiguity exploited by others, Tilley 1991) but nonetheless the key communication and facility for collaboration is made. Language and material symbolism both clearly ‘work’ in making collaboration and communication across different minds possible. As Attwood (2003) illustrates in his discussion of the very different meaning of ‘love’ between those with

Asperger's Syndrome and their neurotypical partners, different meanings can and do work to ensure communication and collaboration.

Rules to govern relationships outside of emotional attachments

There may also be social mechanisms which help those with autism navigate social relationships. Fiske also points to the role of universal structures to social relationships and rules of social contracts shared by both modern societies and ethnographically documented groups (Fiske 1991, 2002). Beyond close altruistic relationships for example he points to a sphere of 'tit-for-tat' relationships which characterise less close social connections, and potentially provide a structure for relating to autistic 'fairness' (Fiske 1991, 2002). Further research might clarify other rule based social mechanisms which forge effective communication and collaborations between the analytical and the emotional world of different minds.

**Social facilities to accommodate difference and social tensions**

Whatever the advantages of integrating autistic minds, the behavioural traits associated with autism (table 2 & 3), such as single mindedness, a lack of concern with social norms, egocentricity, or obsessive concerns with detail also create social tensions. Other social mechanisms identified as 'modern human behaviour' might also exist to promote social cohesion within groups pressurised by the integration of 'different minds'. Mithen (2005) illustrates how performance and music provide a context in modern humans for collaboration, stemming from earlier origins, based on group and herd emotions and a feeling of well being through boundary loss. Involvement in communal dance and music clearly forges a sense of emotional wellbeing and trust which is also important for group cohesion. Equally individuals such as shaman, found universally in hunter-gatherer groups (Aldhouse-Green and Aldhouse-Green 2005) and perhaps with a particularly empathetic or socially orientated personality, may arise to perform a key role in fostering social cohesion. Evidence for music, collaborative ritual (particularly with burial) and shamanic practices have been associated with 'modern human behaviour' (table 5).

Certain spheres of social life may also provide a level of lawfulness and predictability which allows extreme systemisers to function 'sheltered' from the confusing intensity of dynamic empathetic interactions. It has been suggested that such spheres within modern society provide an environment in which those with Asperger's Syndrome can thrive – with certain modern environments having high predictability, clear rules, little change and a low intensity or high rule base to social interaction, and in these spheres the areas of ability of extreme systemisers may make a valuable contribution. Griffin (2007) points to the legal system and academia, with Rodman commenting that 'universities provide a sheltered workshop for autistic thinking' (Rodman 2003). Certain individuals can also live rather sheltered and focused lives in ethnographically documented groups (such as Talimeot amongst the

Selk'nam, Briggs 1948). A study of social dynamics in Mesolithic Europe supports the separation of different spheres, showing that while in the 'emotional and social' arena burial rites are intensely changeable, so changeable in fact that 'anything goes' and methods of burial defy any overall generalisation (Schulting 1998), in contrast technology (the area of mechanics and physical systems) remains remarkably constant in this period (Spikins in press). The more clearly structured living spaces characteristic of 'modern human behaviour' may provide one example of the rise of spatially differentiated spheres of social relationships, and the possibilities for certain individuals to isolate themselves from intense emotional or unpredictable activities whilst remaining within society (see table 5).

**Social controls on potentially antisocial behaviour**

Being 'unreasonable' may go beyond tolerance and accommodation and difficulties with social norms, an egocentric focus, and controlling or dominant behaviour may also present more serious threats to group autonomy. The 'different' and often difficult individual is always present in ethnographic accounts, not matter how strong an ideologically focus exists on collective wellbeing. Amongst the Inuit Briggs notes that tempestuous *Niqi* and dominant, egocentric dominating *Inuttiaq* were tolerated whilst their behaviour remained within certain limits for example (Briggs 1980). Tolerance of very different behaviour in small scale societies is typically broad (Carod-Artal and Vásquez Cabrera 2007), but never unlimited where antisocial behaviour is concerned, and ethnographic accounts also provide evidence of the type of mechanism which limit antisocial behaviour. Boehm (1993) studies in detail social dynamics which prevent dominance in hunter-gatherer societies and illustrates that group action motivated by moralistic stances frequently motivates the expulsion or assassination of dominant individuals, Failure to abide by social rules may lead to exclusions for example and Bird-David illustrates that the Nyaka only tolerated a certain amount of egocentric exploitation of the sharing rules by one individual before she was conscientiously avoided (Bird-David 1990; 1992). We can also document the development of social controls in the archaeological record of modern human behaviour (table 5) and document social controls on dominance within the burial record of Mesolithic Europe (Spikins 2008).

## A 'society of difference'

A society made up of 'different minds', held together by social processes, is very different from one made up of very similar cognitions (fig. 1), and it is argued that it is the development of a 'society of difference' which marked the emergence of modern human behaviour.

Though autistic minds present their challenges to others, their incorporation into society would clearly lead to certain advantages. We might imagine a gradual and progressive adoption of social mechanisms to incorporate differences allowing the talents of autistic individuals to be exploited in technological/economic changes, with consequences for population dynamics (fig. 2). Autistic individuals with a focus on technical or natural systems might be valued 'specialists' in technological or natural realms, able to design new technology, analyse distributions of resources or patterns of animal behaviour. Rigidly analytical thinking (both by autistic individuals and through their influence) might improve technology and foraging efficiency, leading to reduced foraging stress and greater longevity, and an expansion of the resource base carrying the potential for population increase. Autistic and other ‘different’ thinking might also play an important role in challenging and expanding the cognitive capacities, creativity and innovation of modern human populations. A set of ‘different minds’ for example would also give substantial adaptability to environmental changes, with potential for important creativity and innovation from those whose ‘difference’ challenged ‘normal’ thinking. The development of social mechanisms for integrating ‘different minds’ might also have had further effects, perhaps allowing rule based structures to be used in communication with distant unrelated groups of people and even with other species of humans met through expansion, or allowing other differences to be promoted within society. Incorporation of autistic difference might also have other social effects, such as social tensions between ‘different minds’ and potential leadership roles in extreme stress situations which might have played a large role in geographic expansions.

Outside of any potential long term value to society, it may also be possible that changes in emotional commitment (Spikins and Rutherford in prep), and a widespread desire to support those who might not contribute emotionally to the group, perhaps coupled with cognitive abilities through orders of intentionality to believe in common goals (Dunbar 2007) allowed the support of autistic people. Whatever the motivations for their adoption the rise of social mechanisms for integrating the ‘different mind’ may provide an explanation for the coincidence of technological and subsistence innovations with social changes in the archaeological record.

## Different minds and the emergence of modern human behaviour in the archaeological record

Whilst we might view the archaeological evidence for the 'human revolution' through the lens of autism and conclude that 'autistic thinking' played a singularly important role, there is good reason to consider the social context in which such thinking might be incorporated. Given the dependence of those with autistic conditions on social mechanisms which foster inclusion in the present, a more contextualised perspective would be that social changes, allowing greater inclusion of those who are 'different', allowed the integration of autistic thinking into society at the 'human revolution'.

It is certainly notable that on a global level the suite of changes associated with modern human behaviour 'map onto' the development of social mechanisms for inclusion, resultant technological and economic changes and population expansion (table 5). Thus we see new 'rule based' means of communication being developed in the form of personal ornamentation (explicitly symbolising emotional ties and affiliations). We see potentially early evidence of beads in the Near East in the form of two perforated marine shells at Skhul dated to 100-135kbp (Vanhaeren et al. 2006, D'Errico and Vanhaeren 2007) and selection of shells with natural perforations at Quafzeh dated to 100kbp (McBrearty and Brooks 2000, D'Errico and Vanhaeren 2007) with the clearest evidence (41 marine shell beads) from Blombos Cave, amongst the Still Bay assemblage dated to 75kbp (Henshilwood et al 2004, D'Errico et al 2005, Zilhao 2007). We also see evidence for the means of cementing social ties across communities, such as with the emergence of communal music (Mithen 2005) (with clear evidence for musical instruments restricted to a modern human context), and commonly understood abstract symbols (such abstract art at Blombos cave dated to 75kbp, D'Errico, Henshilwood and Nilssen 2001, Henshilwood et al 2001, 2002). Symbolic communication systems also begin to reflect a sense of shared cohesive community with regional styles (D'Errico and Vanhaeren 2007).

Such capacities for inclusion not only of autistic individuals, but through their influence capacities for analytical 'autistic thinking', also match up with resulting technological change with modern human behaviour illustrated by precise, standardised and innovative technology (such as bladelet technology), engineered to specific needs. Technological innovations also include the use of novel materials (eg bone artefacts at Blombos Cave, Henshilwood et al 2002), the rise of multi-component tools (eg hafted inserts at Klasies River Mouth, Deacon and Deacon 1999) and the more elaborate and technological use of fire in hearths (Bar-Yosef 2002). Economic innovations entailing the use of complex 'engineered' technology include the emerging exploitation of new marine resources, such as in South Africa at Pinnacle Point (Marean et al 2007) and more difficult terrestrial resources such as cape buffalo or bushpig

(Klein 1999). Rigidly structured systems of depiction and notation emerge in Palaeolithic notational systems (Marshack 1991, Robinson 1992).

In terms of dealing with the difficulties encountered with 'difference' in mind we also see emerging spatial differentiation of spheres of activity (in the form of structured differentiated domestic deposits at sites, Mellars 1996, Pettit 1997) and in means dealing with serious conflicts forcibly (such as the development of projectile technology, Shea 2003: 183, Knecht 1997, Larsen-Peterken 1993, Bar-Yosef 2002). We also see result of the potential exploitation of analytical spatial and memory skills, improved efficiencies in technology and resource exploitation and potentially responses to social tensions in corresponding population expansion, both geographically and into new habitats (Mellars 2006b, 2007).

The sequence of such changes with the emergence of expansion of modern humans 'out of Africa' also provides support for the theory. In this context, the earliest evidence for social mechanisms for integration in the form of rule based symbolic communication comes from South Africa. Here we see early sporadic evidence for symbolism such as with the evidence for use of pigment in the Middle Stone Age (Clark et al 2003). At 165,000 (broadly contemporary with emerging modern humans) we see use of red ochre which we presume carried and codified a clear 'meaning' at Pinnacle Point, and in association with this technological and subsistence changes in the adoption of marine exploitation patterns and exploitation of shellfish (Marean et al 2007). Somewhat later at Blombos Cave at 75,000 – 80,000 bp, we see more explicitly structured evidence for symbolism, and regular notational marks, associated with subsistence changes (Henshilwood et al 2002a, 2002b, 2004) and precise, standardised, efficient technology with Howiesons Poort (Wurtz 1999, Henshilwood et al 2001). We might interpret this evidence in terms of early signs of social mechanisms for integration which might emerge gradually and perhaps sporadically, possibly until pressure to formalise such mechanisms leads to sustained adoption.

The spread of modern humans and the sequence of emergence of 'modern human behaviour' in the Levant supports the scenario of a progressive adoption of social mechanisms and the incorporation of different minds. Here social mechanisms for integration in the form of evidence for a symbolic burial also occurs early but very sporadically at 130-80kbp associated with biologically modern humans and with subtle evidence for more efficient technology (Shea 2003). However these modern humans with 'incipient methods of integration' are displaced by Neanderthals in this region at 80kbp (Shea suggests due to Neanderthals advantages in their rugged physique and abilities in confrontational hunting). Modern humans only return to displace Neanderthals with the formalisation of social mechanisms for integration at 43-30kbp. At this date we see widespread symbolic communication, (with the use of red ochre, and personal ornamentation) and elaborate burial ritual associated with detailed, efficient, standardised technology (in the form of prismatic blades, projectile technology). It appears that social mechanisms may reach a ‘point of no return’ where rigidly analytical thinking (cemented into society through intuitive and emotional support) becomes part and parcel of adaptations and ‘autistic thinking’ provides a key role in supporting and maintaining technological and subsistence efficiency.

Indeed, following from developments in the Levant, in Europe, modern human behaviour appears to be a ‘complete package’. Here we see clear social mechanisms arriving alongside the spread of biologically modern humans, particularly in long distance communication and exchange (Gamble 1999, Mellars 1996, 2000, 2004, 2005, 2006), the use of symbolism in art (Mellars 1996, 2000, Stringer and Gamble 1993, Connard and Bolus 2003, Zilhão 2007) and structured occupation (Mellars 1996, Pettitt 1997, Bar Yosef 2002, though see also Vaquero 1999, Vaquero and Pastó 2001, Speth 2006) associated again with evidence for technological and subsistence innovations, such as the widespread use of bone and antler technology (Stringer and Gamble 1993, Mellars 1996, 2006) and the use of standardised and precisely made bladelet technology (Stringer and Gamble 1993, Kuhn and Bietti 2000, Mellars 2006b,c, though see also Marks, Hietala and Williams 2001).

The distinctions between modern human and Neanderthal behaviour are however not always clear cut. The evidence for burial of the dead by Neanderthals (Harrold 1980, Belfer-Cohen 1992, Riel-Salvatore & Clark 2001, Pettitt 2002) and for their use of personal ornaments (Hublin et al 1996, Mellars 1999, 2004, Harrold and Otte 2001, Otte 2003) suggests a sophisticated social life and it can be hard to define a ‘threshold’ separating Neanderthals from modern humans. This might be what could be expected if Neanderthals showed some level of coding and structuring of meanings, or other social mechanisms which supported at least a certain level of ‘difference’. It seems likely that Neanderthals had complex language at least (Mithen 2005, Krause et al 2007). The existence of personal ornamentation, such as in the Chatelperronian at St Cesaire, might support this interpretation. Nonetheless as we have seen Neanderthal society appears to be ‘different’, socially, technologically, economically and on the level of population expansion to that of modern humans. It may be that the use of personal ornamentation was prompted by interaction with modern humans and demonstrates a ‘hi-jacking’ of mechanisms for within species communication in modern humans to that between two different species. Equally language and some level of symbolic thought might have existed which did not necessarily reach a level or be of a character which might forge communication across cognitive differences.

Undoubtedly various issues and questions remain in applying ‘different minds theory’ to the archaeological record. The development of social mechanisms including symbolism and the emergence of modern human behaviour is yet to be clear in Asia (James and Petraglia 2005) for example, and further research clearly remains to be carried out. Nonetheless whilst other explanations for the emergence of modern human behaviour exist (and are not necessarily mutually exclusive), the integration of different minds and the subsequent incorporation of particularly autistic talents in society provides a potential important explanation for the character, association and timing of the suite of traits associated with ‘modern human behaviour’ in the archaeological record.

## Further Issues

'Different minds theory' remains to be explored in depth. The model (fig. 1) suggests that cognitive differences existed prior to the emergence of modern humans, with those with autistic minds excluded from society. However in an alternative scenario the autistic spectrum of difference might be 'new' to the genetic and biological construction of modern humans as a species. Autistic talents might provide a new potential which is gradually exploited by modern humans. This alternative scenario is difficult to evaluate on the basis of current evidence. Theory of Mind is documented in chimpanzees (Dunbar 2003, Tomasello, Call and Hare 2003) and recent studies have focused on emotional empathy in other primates (deWaal 2008) however the realm of cognitive differences within other primates (and the extent to which this is integrated as any social advantage) remains to be explored. Autistic differences may be 'new' to the biology of emergent modern human populations and 'exploited' soon after their development, or may be an infrequent genetic difference observable in earlier species.

Whilst Baron-Cohen (2001, 2002, 2004, 2006a, 2006b, 2006b) and others (Nettle 2006a, 2006b, Crespi 2006) stress autism as a spectrum of differences displayed across the population, yet others might maintain that autism is a discrete disorder (Happé and Frith 2006). In the former case we might imagine that social mechanisms come into play to integrate substantially or marginally 'different' individuals depending on context. In the latter the 'disorder' of autism would be maintained through emotional commitments of others and social mechanisms for integration, and its elements of autistic genius and a rigid autistic approach both provide concrete innovations and an influence on the thinking of others. Whilst the author finds the former characterisation of 'autism' as a population cline in cognitive abilities the more likely, the latter would generate clearly similar behavioural products in the archaeological record. Further research might elucidate the issue.

There is also the issue of other differences in 'mind'. Autism was used as the illustration here, and provides a particularly interesting case as there is good evidence that autistic difference is a fundamental biological component of human populations. However 'difference' can constructed in different ways and other biological differences also exist in human populations which might have played an equally important role. Nettle and Clegg (2005) highlight the importance of schizophrenia which appears to follow a similar pattern of selection and maintenance in populations as autism. Whilst certain expressions of genes for schizophrenia can be very disadvantageous, at a lower expression they can confer positive advantages in terms of creativity. Schizophrenia, like autism, is also tempered or effected by environment and may only be expressed or diagnosed as 'disorder' under certain conditions. The selection and incorporation of schizophrenia/creativity might also have been an importance element of incorporated 'difference' in modern human behaviour.

Other biological differences might also be described or researched. Baron-Cohen and Dunbar both stress the emergence of a few potentially significant individuals with extraordinary social skills (and potentially limited technological capacities) in human evolution. Dunbar related those with 'higher order intentionality' to roles as ritual leaders, whilst Baron-Cohen relates those with 'extreme empathy' to roles in caring situations such as psychotherapists and nurses (Baron-Cohen 2004). These individuals might play a key role in facilitating group action non-coersively, as we know to be the norm in ethnographically documented small scale hunter-gatherer groups (Boehm 1993; 1999). We might consider that such individuals may have played an important role in social cohesion and the integration of different minds.

Difference may also have been important in modern human behaviour in ways that were almost exclusively social. Although there is evidence for modern sex differences in mind particularly in verbal and spatial reasoning (Halpern 1992, Connellan et al 2001, Baron-Cohen 2002, 2004, 2006c, Nettle 2006a) and some authors would see such differences as the 'middle ground' of the autistic spectrum (Baron-Cohen 2002, 2004, Baron-Cohen and Wheelwright 2004) gender based social roles seem to be largely culturally constructed. Gender roles and the sexual division of labour might have been a difference particular to modern humans and significant in their relative success and expansion nonetheless (Balme and Bowdler 2006), perhaps even exploiting concepts of specialised spheres and roles developed through integration of autism or other extremes of 'difference'.

Other 'differences' may also contribute to personalities, social roles and humans as a highly polymorphic, adaptable species and society in other ways. Depression (Murphy and Stich 2000), different attachment styles (Goleman 2006 Mikulincer and Shaver 2005, Mikulincer et al 2005) or other effects of childhood experiences (Bateson and Martin 2000) may also lead to the development of different social roles. Both the active construction, as well as the integration of cognitive 'difference' may have been a distinctive part of 'modern human behaviour'.  Further research into the genetic and social construction, incorporation and exploitation of cognitive 'difference' in ethnographic populations might contribute to this question.

## Conclusions

'Difference' in mind may have been particularly significant in the emergence of modern human behaviour. Yet 'difference' can also be difficult to discuss or approach. Our attitudes to 'difference' pervade our understanding of who we are, and of where we come from, including our understanding of our own evolution and early prehistory. Differences between ourselves and others can seem threatening to our sense of self, or even dangerous in their unpredictability.

It is notable that one of the most enduring images in discussions of early humans has been Carleton Coon's depiction of a Neanderthal wearing a suit and hat (fig. 3), supposedly unnoticeable in a New York subway (Coon 1939, Stringer and Gamble 1993: 28). On one level this depiction simply illustrates that morphological differences between modern humans and Neanderthals, particularly the pronounced brow ridge of Neanderthals, could easily be disguised. On another however the image implies that if Neanderthals could wield the social mechanisms of society to allow their integration even marked differences, physically or cognitively, might be unproblematic. The image stands well beyond Coon's interpretations of races, to mean something quite different – it reminds us quite profoundly that as long as the social rules are followed even a Neanderthal might find a place in society. Often it is these rules and structures to relationships with others which allay our fears of what difference might engender and support our sympathies and tendencies to social inclusion. In showing a Neanderthal as suited and 'social', that is aware of the social rules and norms of interaction, Coon makes even a different species of human, separated by hundreds of thousands of years of evolution, familiar and approachable.

Cognitive differences within our own species, particularly those which characterise the 'autistic spectrum', are far from insignificant. Yet, whatever our own place on the autistic spectrum, we all use and find familiar such social mechanisms to communicate with those around us who may be cognitively very different from ourselves. It is argued here that the existence and incorporation of such difference (and potentially others) may have been a crucial part of modern human success. Indeed, it may not have been one 'modern human mind' but this integration of different minds which created what has been dubbed the 'human revolution'.

## Acknowledgements

I would like to thank Terry O'Connor, Steve Roskams, Geoff Bailey, Don Brothwell, Mark Edmonds, Daniel Nettle, Bruce Charlton and Wendy Romer for valuable comments, support, advice and suggestions on earlier drafts of this paper and/or the ideas within it, and also my seminar groups of 2006-7 and 2007-8 for lively discussion and ideas about cognition and Neanderthals. I would also like to thank four anonymous referees for their helpful comments and advice, and various individuals who are cognitively different from myself for welcome inspiration, discussion, support and comments on the concepts in this paper.

## References

Aiello, L. & Dunbar, R. 1993. Neocortex size, group size, and the evolution of language. *Current Anthropology* 34, 184-193.

Alarcón, M., Abrahams B.S., Stone J. L., Duvall J. A., Perederiy J. V., Bomar J. M., Sebat J., Wigler M., Martin C. L., Ledbetter D. H., Nelson S. F., Cantor R. M., & Geschwind D. H. 2008. Linkage, Association, and Gene-Expression Analyses Identify CNTNAP2 as an Autism-Susceptibility Gene, *American Journal of Human Genetics* 82, 1, 150-159.

Aldhouse-Green, M & Aldhouse-Green, S., 2005. *The Quest for the Shaman*, Thames and Hudson.

American Psychiatric Association. 1994. *Diagnostic and Statistical Manual of Mental Disorders.* 4th edn. American Psychiatric Association, Washington, DC.

Andreason, N. C. 2005. *The Creating Mind: The Neuroscience of Genius*. New York:Dana Press,

Arsuaga, J. L. 2003. The Neanderthal's Necklace: in search of the first thinkers. Chichester: Wiley.

Asperger, H., 1979. Problems of Infantile Autism, *Journal of the National Autistic Society Communication* 13, 45-52.

Aston, M. 2001. *The Other Half of Asperger's Syndrome*. The National Autistic Society.

Attwood, T., 1998. *Asperger's Syndrome: A Guide for Parents and Professionals*, London: Jessica Kingsley.

Attwood, T. 2003. Afterword, in *Asperger's Syndrome and Adults… Is Anyone Listening?* K.E. Rodman (ed) (FAAAS Inc) London: Jessica Kingsley. 173-186 .

Attwood, T., 2006. *The Complete Guide to Asperger's Syndrome*, London: Jessica Kingsley.

Bahn, P., and Vertut, J. 1997. Journey through the Ice Age. University of California Press.

Bahn, P. 1998. Comments to N. Humphrey Cave Art, Autism, and the Evolution of the Human Mind. *Cambridge Archaeological Journal* 8(2), 165-191.

Bailey, A., Hervas, N., Matthews, S., Palferman, S. 1998. A full genome screen for autism with evidence for a linkage to a region on chromosome 7q. *Human Molecular Genetics* 7. 571-8.

Bailey, T., Le Couteur, A., Gottesman, I., Bolton, P., Simonoff, E., Yuzda, E., & Rutter, M. 1995. Autism as a strongly genetic disorder: Evidence from a British twin study. *Psychological Medicine* 25, 63-77.

Baird, G., Simonoff, E, Pickles, A., Chandler, S., Loucas, T., Meldrum., D., Charman, T., 2006. Prevalence of disorders of the autistic spectrum in a population cohort of childrenin South Thames: the Special Needs and Autism Project. *The Lancet* 368, 210-5.

Balme, J., & Bowdler, S., 2006. Spear and Digging Stick: The origin of gender and its implications for the colonisation of new continents. *Journal of Social Archaeology* 10 (6), 302-24.

Baron-Cohen, S. 2000. Is Asperger syndrome/high-functioning autism necessarily a disability? *Development and Psychopathology*, 12**,** 489–500.

Baron-Cohen, S., 2001. *Feeling Our Way*, Review of Evans, D., Emotion: the Science of Sentiment, Nature 410, 520.

Baron-Cohen, S., 2002. The extreme male brain theory of autism, *Trends in Cognitive Sciences* 6 (6), 248-254.

Baron-Cohen, S., 2004. *The Essential Difference: Men, Women and the Extreme Male Brain*, London: Penguin.

Baron-Cohen, S. 2006a. Two new theories of autism: hyper-systemizing and assortative mating, *Archives of Disease in Childhood* 91, 2-5

Baron-Cohen, S. 2006b. The hyper-sytemizing, assortative mating theory of autism, *Progress in Neuro-psychopharmacology and Biological Psychiatry* 30, 865-872

Baron-Cohen, S. 2006c. Sex differences in mind, M. Jones and A. C. Fabian (eds.) *Conflict: The Darwin College Lectures.* Cambridge: Cambridge University Press. 23-42.

Baron-Cohen, S & Wheelwright, S. 2004. The Empathy Quotient: An Investigation of Adults with Asperger Syndrome or High Functioning Autism, and Normal Sex Differences, *Journal of Autism and Developmental Disorders* 34, 2, 163-175

Baron-Cohen, S, Wheelwright, S., Skinner, R., Martin, J., & Clubley, E., 2000. 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.

Baron-Cohen, S. & Hammer, J. 1997. Parents of children with Asperger Syndrome: what is the broader phenotype? *Journal of Cognitive Neuroscience* 9, 548-54.

Baron-Cohen, S. Bolton, P, Wheelwright, S., Scahill, V., Short, L., Mead, G. & Smith, A., 1998. Autism occurs more often in families of physicists, engineers and mathematicians. *Autism* 2, 296-301.

Baron-Cohen, S. Wheelwright, S., Stott, C., Bolton, P. & Goodyer, I., 1997. Is there a link between engineering and autism? *Autism* 1,101-108.

Baron-Cohen, S., Richler, J., Bisarya, D., Gurunathan, N., Wheelwright, S., 2003. The Systemising Quotient (SQ): An investigation of adults with Asperger Syndrome or high functioning autism and normal sex differences. *Philosophical Transactions of the Royal Society of London B Biological Sciences* 358 (1430): 371-74.

Bar-Yosef, O. 2002. The Upper Palaeolithic Revolution, *Annual Review of Anthropology* 31, 363-393

Bateson, P. & Martin, P., 2000. *Design for a Life: How behaviour develops.* London: Vintage Paperbacks/

Batson, C. D. 1991. *The altruism question: Towards a social-psychological answer.* Hillsdale, (NJ): Lawrence Erlbaum Associates.

Belfer-Cohen, A. 1992. In the Eye of the Beholder: Mousterian and Natufian Burials in the Levant. *Current Anthropology* 33(4): 463-471

Bentley, K., 2007. *Alone Together: Making an Asperger Marriage Work*. London: Jessica Kingsley Publishers.

Berg, J., Dickhaut, J & McCabe, K. 1995. Trust, reciprocity and social history. *Games and Economic Behaviour* 10. 122-142.

Bertrand, J., A. Mars, C. Boyle, F. Bove, M. Yeargin-Allsopp, & P. Decoufle, 2001. Prevalence of autism in a United States population: The Brick Township, New Jersey, investigation. *Paediatrics* 108: 1155-1161.

Bird-David, N. 1990. The giving environment: another perspective on the economic system of gatherer-hunters, *Current Anthropology* 31 (2): 189–96.

Bird-David, N. 1992. Beyond 'The Original Affluent Society': A culturalist reformation. *Current Anthropology* 33(1): 25–47.

Bocherens, H., Drucker, D. E., Billou, D., Patrou-Mathis, M. & Vandermeersch, B. 2005. Isotopic evidence for diet and subsistence pattern of the Saint-Cesaire I Neanderthal: review and use of a multi-source mixing model, *Journal of Human Evolution* 49 (1), 71-87.

Boehm, C. 1993. Egalitarian Behaviour and Reverse Dominance Hierarchy, *Current Anthropology* 34, 3, 227-240

Boehm, C. 1999. *Hierarchy in the Forest*. London: Harvard University Press.

Bolton, P. & Rutter, M 1990 Genetic Influences on Autism. *International Review of Psychiatry* 2, 67-80

Bottomer, P. F. 2007. *So Odd a Mixture: Along the Autistic Spectrum in Pride and Prejudice*, London: Jessica Kingsley Publishers

Bridges, E.L. 1948. *Uttermost part of the Earth*. London: Hodder & Stoughton.

Briggs, J. L. 1970. *Never in Anger: Portrait of an Eskimo Family.* Cambridge (MA): Harvard University Press.

Burke, A. 2004. The Ecology of Neanderthals: Preface, *International Journal of Osteoarchaeology*, 14: 155-161

Carod-Artal, F. J., & Vásquez-Cabrera, 2007, An anthropological study about Epilepsy in Native Tribes from Central and South America, *Epilepsia* 48: 5, 886-893.

Cameron, D. W., and Groves, C. P. 2004. Bones, Stones and Molecules, Elsevier: California and London.

Caspari, R. & Lee, S-H 2006. Is Human longevity a consequence of cultural change or modern biology? *American Journal of Physical Anthropology* 129: 512-517.

Chase, P. G. 2007. The significance of 'acculturation' depends on the meaning of 'culture', in P. Mellars, K. Boyle, O. Bar-Yosef and C. Stringer (eds.) Rethinking the human revolution, McDonald Insitute Monographs: Cambridge, p 55-66.

Clark, J. D., Beyene Y., WoldeGabriel, G., Hart, W. K., Renne, P. R., Gilbert, H., Defleur A., Suwa G., Katoh, S., Ludwig, K. R., Boisserie, J-R., Asfaw, B. & White, T. D. 2003. Stratigraphic, chronological and behavioural contexts of Pleistocene Homo sapiens from Middle Awash, Ethiopia, *Nature* 423, 747-752.

Cobb, H. 2005. Straight Down the Line? A queer consideration of hunter-gatherer studies in north-west Europe, *World Archaeology* 37 (4) p 630-636.

Connard, N. & Bolus, M. 2003. Radiocarbon dating the appearance of modern humans and the timing of cultural innovations in Europe: new results and new challenges, Journal of Human Evolution 44, 331-371.

Connellan, J., Baron-Cohen, S., Wheelwright, S, Bakti, A., & Aluwahlia, J., 2001.Sex differences in human neonatal social perception. *Infant Behaviour and Development* 23. 113-118.

Coolidge, F. L. & Wynn, T., 2004. A cognitive and neurophysical perspective on the Chatelperronian. *Journal of Anthropological Research* 60. 55-73.

Coon, C., 1939. *The Races of Europe*. New York: Macmillan

Crespi, B. 2006. The natural selection of psychosis, *Behavioural and Brain Sciences 29 (4) 410-411.*

D' Errico, F., Zilhão, J., Julien, M., Baffier, D., & Pelegrin, J., 1998. Neanderthal Acculturation in Western Europe?: A Critical Review of the Evidence and Its Interpretation, *Current Anthropology* 39 (2) 1-44

D'Errico, F., Henshilwood, C. & Nilssen, P., 2001. An engraved bone fragment from c. 70,000-year-old Middle Stone Age levels at Blombos Cave, South Africa: implications for the origin of symbolism and language *Antiquity* 75 (288) 309 – 318.

D'Errico, F. and Vanhaeren, M. 2007. Evolution or Revolution?: New evidence for the origin of symbolic behaviour in and out of Africa, in P. Mellars, K. Boyle, O. Bar-Yosef and C. Stringers (eds.) Re-thinking the human revolution, McDonald Institute Monographs. Cambridge. 275-286

Damasio, A., 2000. *The Feeling of What Happens: body, emotion and the making of consciousness*, London: Vintage.

Davies, R., & Underdown, S., 2006. The Neanderthals: a social synthesis, *Cambridge Archaeological Journal* 16 (2), 145-64

Deacon, H.J., & Deacon, J., 1999. *Human beginnings in south Africa: uncovering the secrets of the Stone Age.* Cape Town: David Phillip

DeMarrais, E., Gosden, C & Renfrew, C. 2004, *Rethinking Materiality: the engagement of mind with the material world.* Cambridge: McDonald Institute Mongraphs

DeWaal, F. 2008. Putting the Altrusim back into Altruism: The Evolution of Empathy. *Annual Review of Pyschology* 59, 279-300

DeWaal, F., 1998. *Chimpanzee Politics: Power and Sex amongst Apes.* Baltimore Maryland: Hopkins University Press

Dunbar, R. I. M. 1993. Co-evolution of neocortex size, group size and language in humans. *Behavioral and Brain Sciences* 16 (4): 681-735.

Dunbar, R. I.M., 2003. The Social brain: mind, language and society in an evolutionary perspective, *Annual Review of Anthropology* 32: 163-181

Dunbar, R. I. M., 2007. The social brain and the cultural explosion of the human revolution, , in P. Mellars, K. Boyle, O. Bar-Yosef and C. Stringer (eds.) Rethinking the human revolution, McDonald Insitute Monographs: Cambridge, p 91-98.

Eagly, A. H. 1987. *Sex Differences in Social Behaviour: A social-role interpretation*. Hillsdale (NJ): Lawrence Erlbaum Associates.

Ehlers, S., and Gillberg, C. 1993. The Epidemiology of Asperger Syndrome, Journal of Child Psychology and Psychiatry 34: 1327-50

Evans, D. 2001. *Emotion: The Science of Sentiment.* Oxford: Oxford University Press.

Fauze, J, Carles, L. F., Orlando, L., Enard, W, Green, R. E., Burbano, H. A., Hublin, J-J., Hänni, C., Fortea, J., de la Rasilla, M., Bertranpetit, J., Rosas, A. & Pääbo, S., 2007. The Derived FOXP2 Variant of Modern Humans Was Shared with Neandertals. *Current Biology* 17 (21), 1908-12

Falk, D. 2005. Prelinguistic evolution in early hominins: Whence Motherese? *Brain and Behavioural Sciences* 27, 491-503.

Finlayson, C. 2004. Comparative behaviour and ecology of Neanderthals and Modern Humans' in C. Finlayson (eds.) *Neanderthals and Modern Humans: An Ecological and Evolutionary Perspective*, Cambridge: Cambridge University Press. 94-135.

Fiske, A. P. 1990. Relativity within Moose 'Mossi' Culture: Four incommensurable models for Social Relationships. *Ethos* 18 (2) :180-204.

Fiske, A. P. 1991. *Structures of Social Life: The Four Elementary Forms of Human Relations*, New York: Maxwell Macmillan International.

Fiske, A. P. 2002. Socio-moral emotions motivate action to sustain relationships. *Self and Identity* 1 (2), 169-175.

Fitzgerald, M. 1999. Did Isaac Newton have Asperger's Syndrome disorder? *European Child and Adolescent Psychiatry Journal* 8: 204.

Fitzgerald, M. 2003. *Autism and Creativity: is there a link between autism in men and exceptional ability?* London: Brunner-Routledge.

Fitzgerald, M. 2005. *The Genesis of Artistic Creativity: Asperger Sydrome and the Arts.* London: Jessica Kingsley.

Fitzgerald, M. & Walker, A. 2006. *Unstoppable Brilliance: Irish Geniuses and Asperger's Syndrome.* Liberties Press

Fitzgerald, M., & O'Brien, B., 2007. *Genius Genes: How Asperger Talents Changed the World*. Shawnee Mission. Kansas: Autism-Asperger Publishing Company

Foley, R. & Lahr, M.M. 2003. On Stony Ground: Lithic Technology, Human Evolution and the emergence of culture. Evolutionary Anthropology Issues News and Reviews 12 (3). 109-22.

Folstein, S. & Rutter, M. 1988, Autism: Familial aggregation and genetic implications. *Journal of Autism and Developmental Disorders* 18 (1), 3-30.

Folstein, S., & Rutter, M. 1977. Infantile autism: A genetic study of 21 twin pairs. *Journal of Child Pyschology and Psychiatry* 18. 297-321

Fowler, C. 2004. *The Archaeology of Personhood: An anthropological approach.* London: Routledge.

Frank, R. H. 1988. *Passions Within Reason: The Strategic Role of the Emotions.* New York: W. W. Norton and Co.

Frank, R. H. 2001. Cooperation through Emotional Commitment, in R. Nesse, *Evolution and the Capacity for Commitment*, New York: Russell Sage Foundation Series on Trust, p57-76

Frith, U. 1991. *Autism and Asperger's Syndrome*. Cambridge: Cambridge University Press.

Frith, U., and Happé, F. 1994. Autism: Beyond 'Theory of Mind', *Cognition* 50, 115-132

Gamble, C., 1999. The Palaeolithic societies of Europe, Cambridge. Cambridge University Press.

Gamble, C. 2007. *Origins and Revolutions: Human Identity in Earliest Prehistory*, Cambridge. Cambridge University Press.

Geary, D. C. & Flinn, M. V. 2001. Evolution of Human Parental Behaviour and the Human Family, *Parenting* 2001, 1, 5-61

Gemsbacher, M. A., Dowson, M ., and Goldsmith, H. H., 2005. Three reasons not to believe in an autism epidemic, Current Directions in Psychological Science 14: 55-58.

Gemsbacher, M. A., Dawson, M., and Mottron, L. 2006. Autism: common, heritable, but not harmful, Brain and Behavioural Sciences 29 (4), 413-414.

Gilberg, C. 1991. Clinical and neurological aspects of Asperger Syndrome in six family studies. In U. Frith (Ed.) *Autism and Asperger Syndrome*. Cambridge. Cambridge University Press.

Gillberg, I. C., and Gillberg, C. 1989. Asperger Syndrome: Some epidemiological considerations: A research note, Journal of Child Psychology and Psychiatry 30, 631-638

Gintis, H., Bowles, S., Boyd, R. & Fehr, E. 2003. Explaining altruistic behaviour in humans. *Evolution and Human Behaviour* 24, 153-172.

Goleman, D. 2006. *Social Intelligence*. New York: Hutchinson.

Gosden . C. 2004. Aesthetics, intelligence and emotions: Implications for archaeology in E. DeMarrais, C. Gosden, and C, Renfrew (eds.) *Rethinking Materiality: the engagement of mind with the material world.* Cambridge: MacDonald Institute for Archaeological Research. p 33-40.

Gouchie, C. & Kimura, D. 1991. The relationship between testosterone levels and cognitive ability patterns. *Psychoneuroendocrinology* 16, 323-334.

Grandin, T. 1995. *Thinking in Pictures*. New York: Vintage Books.

Grandin, T., & Johnson, C., 2006. *Animals in Translation: Using the mysteries of autism to decode animal behaviour.* New York: City

Greenspan, S. I. & Shanker, S. G .2004. *The first idea: how symbols, language, and intelligence evolved from our primate ancestors to modern humans*. Cambridge: Da Capo Press (Perseus Books Group).

Griezer, D. L., & Kuhl, P. K. 1988. Maternal speech to infants in a tonal language: support for universal prosodic features in motherese. *Developmental Psychology* 24: 14-20

Griffin, J. 2006. Autistic tendencies: the consequences for our culture, *Human Givens* 13 (4), 14-19

Griffin, J., & Tyrell, I., 2003. *The Human Givens: A new approach to emotional health and clear thinking*, Human Givens Publishing.

Grinker, R. R. 2007. *Unstrange Minds: Remapping the world of autism*. New York: Basic Books.

Gross, D. 2006. *The Secret History of Emotion.* Chicago: University of Chicago Press

Halpern, D. 1992. *Sex Differences in Cognitive Abilities*, 2nd ed. New Jersey: L. Erlbaum.

Happé, F. & Frith, U. 2006. The weak coherence account: detail-focused cognitive style in autism spectrum disorders. *Journal of Autism and Developmental Disorders* 36 (1): 5–25.

Harrison, M. J., O'Hare, A. E., Campbell, H., Adamson, A. & McNeillage, J. 2005. Prevalence of autistic spectrum disorders in Lothian Scotland: and estimate using the 'capture-recapture' technique. *Archives of Disease in Childhood*. 90: 16-19.

Harrold, F. 1980. A Comparative Analysis of Eurasian Palaeolithic Burials. *World Archaeology* 12(2), 195-211.

Harrold, F. 1989. Mousterian, Chậtelperronian and Early Aurignacian in Western Europe: Continuity or Discontinuity? In P Mellars and C Stringer (eds.) *The Human Revolution.* Edinburgh: University Press. p677-714.

Harrold, F., & Otte, M. 2001. Time, Space and Cultural Process in the European Middle-Upper Palaeolithic transition. In M. A. Hays and P.T. Thacker (eds) *Questioning the answers: re-solving the fundamental problems of the early upper Palaeolithic*. Oxford: Archaeopress (British Archaeological Reports International Series 1005).

Hawcroft, J. & Dennell, R. 2000. Neanderthal cognitive life history and its implications for material culture. In Derevenski, J S. (ed.) *Children and Material Culture*. London: Routledge. p 89-99.

Hawkes, K, O'Connell, J. F., Blurton Jones, N.G., Alvarez, H, & Charnov, E. L., 1998, Grandmothering, menopause and the evolution of human life histories, *Proceedings of the National Academy of Sciences of the United States of America*, 95 (3), 1336-1339.

Hawkes, K. 2006. Life History Theory and Human evolution. In *the Evolution of Human Life History*, K. Hawkes and R. Paine, eds. Santa Fe and Oxford: SAR Press, 45-93.

Haworth, K. 1998. Autism and the origins of language, paper presented at the Language Origins Society Meeting, Florida, June 24-28 1998.

Henshilwood, C. S., D'Errico, F., Marean, C., Milo, R., & Yates, 2002a., An early bone tool industry from the Middle Stone Age at Blombos Cave, south Africa: implications for the origins of modern human behaviour, symbolism and language. *Journal of Human Evolution* 41: 631-678.

Henshilwood, C. S., D'Errico, F., Yates, R., Jacobs, Z., Tribolo, C., Duller, G.A.T., Mercier, N., Sealy, J. C., Valladas, H., Watts, I.& Wintle, A. G., 2002b. Emergence of modern human behaviour: Middle Stone Age engravings from South Africa *Science* 295: 1278-1280.

Hensilwood, C. S. & Maraen, C. S., 2003. The Origin of Modern Human Behaviour: Critique of the models and their test implications. *Current Anthropology* 44, 5, 627-651.

Hensilwood, C. S., Sealy, J. C., Yates, R., Cruz-Uribe, K., Goldberg, P., Grine, F. E., Klein, R. G. Poggenpol, C van Niekirk, K. & Watts, I. 2001. Blombos Cave, southern Cape, South Africa: preliminary report on the 1992-1999 excavations of the Middle Stone Age levels, *Journal of Archaeological Science* 28: 421-448.

D'Errico, F., Henshilwood, C., Vanhaeren, M and K. Van Niekerk, 2005. Nassarius kraussianus shell beads from Blombos Cave: evidence for symbolic behaviour in the Middle Stone Age. Journal of Human Evolution 48, 3-24.

Henshilwood, C., D'Errico, F., Vanhaeren, M., Van Niekirk, K., Jacobs, Z., 2004. Middle Stone Age beads from south Africa. *Science* 304: 404.

Hermelin, B. 2002. *Bright splinters of the mind: a personal story of research with autistic savants*. London: Jessica Kingsley.

Hobson, P., 2002. *The Cradle of Thought: Exploring the Origins of Thinking.* Oxford: Macmillan

Hodder, I. 1989. This is not an article about material culture as text, *Journal of Anthropological Archaeology* 8: 250-69

Hoffecker, J. F. and Cleghorn, N. 2000. Mousterian hunting patterns in the Northwestern Caucasus and the ecology of the Neanderthals *International Journal of Osteoarchaeology* 10, 368-378.

Hough, S. H. 2007. *Richter's Scale: Measure of an Earthquake, Measure of a Man*. Princeton (NJ): Princeton University Press.

Hovers, E. & Belfer-Cohen, A. 2006. Now you see it, now you don't – modern human behaviour in the Middle Palaeolithic, in E. Hovers and S. L. Kuhn (eds.), *Transitions before the transition. Interdisciplinary Contributions to Archaeology*. New York: Springer. p295-304

Hublin, J., Spoor, F., Braun, M., Zonneveld, F. & Condemi, S. 1996. A late Neanderthal associated with Upper Paleolithic artifacts. *Nature* 381 p224.

Humphrey, N. 1984. *Consiousness Regained.* Oxford: Oxford University Press.

Humphrey, N. 1998. Cave Art, Autism, and the Evolution of the Human Mind. *Cambridge Archaeological Journal* 8(2), 165-191.

Iacoboni, M., 2006. Failure to deactivate in autism: the co-constitution of self and other, *Trends in Cognitive Science* 10 (10), 431-3

Jacobs, B. 2006. *Loving Mr Spock: Understanding an Aloof Lover – Could it be Asperger's Syndrome?* London: Jessica Kingsley Publishers.

Jaffe, J., B Beebe, S. Feldstein, C. L. Crown and M. D. Jasnow. 2001. Rhythms of dialogue in infancy. *Monographs of the Society for Research in Child Development* 66, no 2, serial no. 265. With commentaries by Phillipe Rochat and Daniel N. Stern. Boston: Blackwell.

James, H. V. A. & Petraglia, M. D., 2005. Modern Human Origins and the evolution of behaviour in the Late Pleistocene Record of South Asia. *Current Anthropology* 46, s3-27

James, I. 2003. Singular Scientists. *Journal of the Royal Society of Medicine* 96: 36-9

James, I. M., 2006. *Asperger's Syndrome and High Achievement: Some Very Remarkable People*, London: Jessica Kingsley

Jensen, K., Hare, B., Call, J., and Tomasello, M., 2006. What's in it for me? Self-regard precludes altruism and spite in chimpanzees, Proceedings of the Royal Society B 273, 1013-1021

Just, M.A., Cherkassky, V.L., Keller, T.A., Kana, R.K., Minshew, N. J. 2007. Functional and anatomical cortical underconnectivity in autism: evidence from an FMRI study of an executive function task and corpus callosum morphometry. *Cerebral Cortex* 17 (4), 951-61.

Kaufman, D., 2001. Comparisons and the case for interaction among Neanderthals and early modern humans in the Levant. *Oxford Journal of Archaeology* 20 (3) 219-240.

Kellman, J. 1998. Ice Age Art, Autism and Vision: How we see/how we draw, Studies in Art Education, 39 (2), 117-131.

Klein, R., 1999. *The Human Career: Human Biological and Cultural Origins*, Chicago: University of Chicago Press.

Klin, A., Schultz, R., & Cohen, D. J., 1999. Theory of Mind in Action: developmental perspectives on social neuroscience. In S. Baron-Cohen, Tager-Flusberg, H. and Cohen, D. J. (ed.) *Understanding Other Minds: Perspectives from developmental cognitive neuroscience*. Oxford: Oxford University Press.

Knauft, B. M., Abler, T. S., Betzig, L., Boehm, C., Dentan, R. K., Kiefer, T. M., Otterbein, K. F., Paddock, J. & Rodseth, L. 1991. Violence and Sociality in Human evolution, *Current Anthropology* 32, 391-428.

Knecht, H., 1997. Projectile points of bone, antler and stone: experimental explorations of manufacture and use. in Knecht, H., (ed). *Projectile Technology*. New York: Plenum Press, p191-212.

Knickmeyer, R., Baron-Cohen, S., Raggatt, P. & Taylor, K., 2005, Foetal testosterone, social relationships, and restricted interests in children, *Journal of Child Psychology and Psychiatry* 46 (2). 198-210.

Krevelen, A. C., and Kuipers, C. 1962. The psychopathology of autistic psychopathy, Acta Paedopsychiatricia 29: 22-31

Kuhn, S. L. & Bietti, A. 2000. The Late Middle and Early Upper Palaeolithic in Italy, in O. Bar-Yosef and D. Pilbeam (eds.) *The Geography of Neanderthals and Modern Humans in Europe and the Greater Mediterranean*, Cambridge (MA): Peabody Museum Harvard. 49-76

Kuhn, S. L. & Hovers, E., 2006. General Introduction. in E. Hovers and S. L. Kuhn, *Transitions before the transition*. Interdisciplinary Contributions to Archaeology. New York: Springer. p 1-11.

Kuhn, S. L., Stiner, M. C., Reese, D. S. & Gulec, E. 2001. Ornaments of the earliest Upper Palaeolithic: New Insights from the Levant. *Proceedings of the National Academy of Sciences USA* 98: 7641-46.

Lamb J. A., Moore, J., Bailey, A. & Monaco, A. P. 2000. Autism: recent molecular genetic advances. *Human Molecular Genetics.* 9(6), 861-868.

Larsen-Peterkin, G., 1993. Lithic and organic hunting technology in Peterkin, G. L. Bricker, H., Mellars, P. A. (editors) *Hunting and animal exploitation in the Late Paleolithic and Mesolithic of Eurasia.* Washington D. C. American Anthropological Association, p 49-68

Lathe, R. 2006, *Autism, Brain and Environment*. London: Jessica Kingsley

Lawrence, D. H., 1913. *Sons and Lovers*. London: Penguin.

Lee, R. B. 1979. *The !Kung San: men, women and work in a foraging society.* Cambridge: Cambridge University Press.

Lieberman D. E., and Shea J. J. 1994. Behavioural differences between archaic and modern humans in the Levantine Mousterian, *American Anthropologist* 96, 300-322.

Lutchmaya, S. & Baron-Cohen, S. 2002. Human sex differences in social and non-social looking preference at 12 months of age, *Infant Behaviour and Development* 25, 319-25.

Lutchmaya, S. Baron-Cohen, S., & Raggart, P. 2002. Foetal testosterone and eye contact in 12-month-old infants. *Infant Behaviour and Development* 25 (3), 327-35.

Lutchmaya, S., Baron-Cohen, S., Raggart, P., Knickmeyer, R., and Manning, J. T., 2004. $2^{nd}$ to $4^{th}$ digit ratios, fetal testosterone and estradiol, *Early Human Development* 77, 1-2. 23-28.

Malafouris, L. 2004. The cognitive basis of material engagement: where brain, body and culture conflate, in E. DeMarrais, C. Gosden, and C, Renfrew (eds.) *Rethinking Materiality: the engagement of mind with the material world.* Cambridge: MacDonald Institute for Archaeological Research. p53-62.

Manning, J. T., Baron-Cohen, S., Wheelwright, S., & Sanders, G. 2001. The $2^{nd}$ to $4^{th}$ digit ratio and autism, *Developmental Medicine and Child Neurology* 43, 160-164.

Marean, C. W., Bar-Matthews, M., Bernatchez, J., Fischer, E., Goldberg, P., Herries, A. I. R., Jacobs, Z., Jerardino, A, Karkanas, P., Minichillo, T., Nilssen, P. J., Thompson, E., Watts, I., & Williams, H. M. 2007. Early Use of Marine resources and pigment in south Africa during the Middle Pleistocene. *Nature* 449, 905-908.

Marks, A. E., Hietala, H. J. & Williams, J. K., 2001. Tool standardisation in the Middle and Upper Palaeolithic: a closer look. *Cambridge Archaeological Journal* 11: 17-44.

Marshack, A. 1991. The Taï plaque and calendrical notation in the Upper Paleolithic. *Cambridge Archaeological Journal* 1, 25-61.

Marwick, B., 2003. Pleistocene Exchange Networks as Evidence for the evolution of language, *Cambridge Archaeological Journal* 13: 67-81.

Maynard Smith, J. 1982. Evolution and the Theory of Games*. American Scientist* 64 (1), 41-45.

Mc Brearty, S & Brooks, A. S. 2000. The Revolution that wasn't: a new interpretation of the origin of modern human behaviour. *Journal of Human Evolution* 39, 453-563.

McBrearty, S. & Stringer, C. 2007. The coast in colour. *Nature* 449: 793-908.

Mellars, P. 1989a. Major issues in the origin of modern humans. *Current Anthropology* 30: 349-85.

Mellars, P. 1989b. Technological changes across the middle-upper Palaeolithic transition: Economic, social and cognitive perspectives. In P. Mellars and C. Stringer (eds.) *The Human Revolution: Behavioural and Biological perspectives on the emergence of modern humans.* Edinburgh and Princeton: University Press. p 338-65.

Mellars, P. 1999. The Neanderthal Problem Continued. *Current Anthropology* 40 (3), 341-364.

Mellars, P. & Stringer, C. (eds.) 1999. *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*. Edinburgh: Edinburgh University Press.

Mellars, P. 1996. *The Neanderthal Legacy: an archaeological perspective from Western Europe*. Princeton: Princeton University Press.

Mellars, P. 2000. The Chatelperronian Chronology and the case for Neanderthal/Modern human' acculturation' in Western Europe. In: C. B. Stringer, R. N. E. Barton and J. C. Finlayson *Neanderthals on the Edge*. Oxford: Oxbow Books.

Mellars, P. 2004. Neanderthals and the modern human colonisation of Europe. *Nature* 432, 461-465.

Mellars, P. 2005., The impossible coincidence. A single-species model for the origins of modern human behavior in Europe, *Evolutionary Anthropology* 14 (1), 12–27.

Mellars, P. 2006a. Foreword. Challenges and Approaches in the study of Middle Palaeolithic Behavioural Change, in E. Hovers and S. L. Kuhn, *Transitions before the transition*. Interdisciplinary Contributions to Archaeology. New York: Springer. P vii-xvii.

Mellars, P. 2006b. A new radio-carbon revolution and the dispersal of modern humans in Eurasia. *Nature* 439: 931-935.

Mellars, P., 2006c, Archaeology and the Dispersal of Modern Humans in Europe: Deconstructing the 'Aurignacian'. *Evolutionary Anthropology* 15, 167-183.

Mellars, P. 2007. Rethinking the Human Revolution: Eurasian and African Perspectives, in P. Mellars, K. Boyle, O. Bar-Yosef and C. Stringer (eds.) Rethinking the human revolution, McDonald Insitute Monographs: Cambridge, p 1-14

Mikulincer, M, Shaver, P. R., Gillath, O. & Nitzberg, R. A. 2005. Attachment, Caregiving and Altrusim: Boosting Attachment security increases attachment and helping. *Journal of Personal and Social Psychology* 89 (5), 817-39.

Mikulincer, M., Shaver, P. R. 2005. Attachment Security, Compassion and Altruism, Current Directions in Pyschology 14 (1), 34-38.

Mithen, S. 1995. Palaeolithic archaeology and the evolution of mind, *Journal of Archaeological Research* 3 (4) 305-332.

Mithen, S. 1996. *The Prehistory of the Mind*. London: Thames and Hudson.

Mithen, S., 1998a. *Creativity in Human Evolution and Prehistory*. London: Routledge.

Mithen, S. 1998b. Comments to N. Humphrey Cave Art, Autism, and the Evolution of the Human Mind. *Cambridge Archaeological Journal* 8(2), 165-191.

Mithen, S. 2000. Paleoanthropological perspectives on the theory of mind. In S. Baron-Cohen, H. Tager-Flusberg, & D. Cohen (Eds.), *Understanding other minds* Oxford, UK: Oxford University Press. 488-502.

Mithen, S. 2005. *The singing Neanderthals: the origins of music, language, mind and body.* London: Weidenfeld and Nicolson.

Moldin, S.O. & Rubenstein, J. L. R. 2006. *Understanding Autism: From Basic neuroscience to treatment.* New York: CRC Press.

Molley, H. & Vasil, L. 2002. The Social Construction of Asperger Syndrome: the pathologising of difference? *Disability and Society* 17(6), 659-69.

Mikulincer, M and Shaver, P. R.,2005. Attachment Security, compassion and altruism, *American Psychological Society* 14, 1, 34-38

Murphy, D. & Stich, S. 2000. Darwin in the Madhouse: evolutionary psychology and the classification of mental disorders. In Carruthers, P and Chamberlain, A. (eds) *Evolution and the human mind, Modularity, Language and meta-cognition*. Cambridge: Cambridge University Press. 62-92.

Myers, P., Baron-Cohen, S. & Wheelwright, S., 2004. *An exact mind*. London: Jessica Kingsley.

Nesse, R. M. 2001. *Evolution and the Capacity for Commitment*. New York: Russell Sage Foundation Series on Trust.

Nettle, D. & Clegg, H. 2005. Schizotypy, creativity and mating success in humans, *Proceedings of the Royal Society* B, 1-5.

Nettle, D., 2006a. Empathising and systemizing: What are they, and what do they contribute to our understanding of psychological sex differences? *British Journal of Psychology* 00, 1-20.

Nettle, D., 2006b. The evolution of personality variation in humans and other animals, *American Psychologist* 61, 6, 622-631.

O'Riordan, M. Plaisted,K., Driver, J. & Baron-Cohen, S. 2001. Superior visual search in autism. *Journal of Experimental Psychology and Human Perceptual Performance* 27: 719-30.

Oswaldt, P. & Zegans, L. S., 1993. *The Pleasures and Perils of Genius: Mostly Mozart*, Mental Health Library series monograph 2. Madison CT: University Press.

Ortiz, . M. 2008. The Myriad Gifts of Asperger's Syndrome, Jessica Kingsley Publishers.

Otte, M., 2003. Reserches sur le Palaeolithique Superieur. Oxford: Archaeopress. *British Archaeological Reports International Series* 1107.

Parkinson, B., Fischer, A. H. & Manstead, A. S. R. 2005. *Emotion in Social Relations*, New York: Psychology Press.

Pettitt, P. B. 1997. High-resolution Neanderthals. *World Archaeology* 29 (2), 208-24.

Pettitt, P. 2002. The Neanderthal dead: exploring mortuary variability in Middle Palaeolithic Eurasia. *Before Farming* 1 (4), 6-19

Pettitt, P., (2007) Trajectories before the transition, and revolutions that were or were not, *Journal of Human Evolution* 53 (6), p755-759.

Plaisted, K., O'Riordan, M. & Baron-Cohen S.1998. Enhanced visual search for a conjunctive target in autism: a research note. *Journal of Child Psychology and Psychiatry* 39: 777-83.

Porr, M. & Alt, K. W., 2006. The Burial of Bad Dürrenberg, Central Germany: Osteopathology and Osteoarchaeology of a Late Mesolithic shaman's grave, *International Journal of Osteoarchaeology* 16, 395-406.

Rejman, D. 2005. *Cognitive deviance as a catalyst for human evolution -- cave art, autistic savant syndrome, and beyond*, Londond School of Economics and Political Science. http://www.lse.ac.uk/collections/CPNSS/projects/ConsciousnessSelfandSocietyEvolutionaryPerspectives/Cognitivedeviance.htm

Renfrew, C., 2007. *Prehistory: Making of the Human Mind*. London: Orion.

Renfrew, C. & Scarre, C. (eds). 1998. *Cognition and Material Culture: the archaeology of symbolic storage.* Mc Donald Institute Monographs. Cambridge: McDonald Institute for Archaeological Research.

Riel-Salvatore, J. & Clark, G. A. 2001. Grave Markers. *Current Anthropology* 42(4): 449-479.

Robinson, J. 1992. Not counting on Marshack: a reassessment of the work of Alexander Marshack on notation in the Upper Palaeolithic. *Journal of Mediterranean Studies* 2(1): 1-16

Rodman, K. E. 2003. *Asperger's Syndrome and Adults… Is Anyone Listening?* FAAAS Inc. Jessica Kingsley. London.

Sacks, O. 1995. *An Anthropologist on Mars*, United States: Knopf.

Sacks, R., 1994. *Autism as Illness; Autism as Hope, two narratives*, Ottawa: National Library of Canada

Salani, G., Bird, G., Brindley, R., Singer, T., Frith, C., Frith, U. 2007. Levels of Emotional awareness and autism: an fMRI study, Social Neuroscience 99999 (1), 1-16

Szatmari, P., Brenner, R., ad Nagy, J. 1989. Asperger Syndrome: A review of clinical features, *Canadian Journal of Psychiatry* 34: 554-60

Schmitt, D. & Churchill, S. E. 2003. Experimental Evidence Concerning Spear Use in Neanderthals and Early Modern Humans', *Journal of Archaeological Science 30* (1), 103-114.

Schulting, R. J. 1998. Creativity's coffin: innovation in the burial record of Mesolithic Europe. In S. Mithen (ed.) *Creativity in human evolution and prehistory*. London. Routledge, pp. 203–26.

Selfe, L. 1977. Nadia: A case of extraordinary drawing in an autistic child. London: Academic Press.

Shea, J. J. 1998. Neanderthals and Early Modern Human behavioural variability: A regional-scale approach to lithic evidence for hunting in the Levantine Mousterian', *Current Anthropology*, 39 (supplementary issue), s45-s78.

Shea, J. J. 2003. Neanderthals, competition and the origins of modern human behaviour in the Levant. *Evolutionary Anthropology* 12, 173-187

Shah, A. 1998. Visuo-spatial islets of abilities and intellectual functioning in autism, Unpublished PhD thesis, University of London

Shennan, S., 2001. Demography and Cultural Innovation: a model and its implications for the emergence of modern human culture *Cambridge Archaeological Journal* 11 (1), 5-16.

Singer, R. & Wymer, J. 1982. *The Middle Stone Age at Klasies River Mouth in South Africa.* Chicago: University of Chicago Press.

Slater-Walker, G., & Slater-Walker, C. 2002. *An Asperger Marriage*. London: Jessica Kingsley Publishers.

Smirnov, Y. 1989. Intentional Human Burial: Middle Palaeolithic (Late Glaciation) beginnings. *Journal of World Prehistory* 3: 199-233

Soffer, O. 1994. Ancestral Lifeways in Eurasia: The Middle and Upper Palaeolithic records. In M. H. Nitecki and D. V. Nitecki (eds) *Origin of Anatomically Modern Humans.* New York. Plenum Press, pp101-19

Spencer, B. & Gillen, F. J. (1976). The Avenging Party in Central Australia, in J. Poggie., Jr., G. H. Pelto and P. J. Pelto, eds. *The Evolution of Human Adaptations: Readings in Anthropology*. New York: MacMillan. p 262-264

Speth, J. D. 2006. House-keeping, Neanderthal style, Hearth placement and midden formation in Kebara Cave, Israel, In E. Hovers and S. L. Kuhn, *Transitions before the transition*. Interdisciplinary Contributions to Archaeology. New York: Springer. P171-188

Spikins, P. A.. 2007. Letters to the Editor, *Human Givens* 14 (1)

Spikins, P. A. and Rutherford, H., in prep. *The Prehistory of Compassion*.

Spikins, P. A. *The Bashful and the Boastful: Approaches to authorities in Mesolithic Europe*, submitted to Journal of World Prehistory

Spikins, P. A. 2008. Introduction, in G. N. Bailey and P.A. Spikins (eds.) *Mesolithic Europe*, Cambridge University Press: Cambridge. p 1-17.

Stanton, M., 2000. *Learning to Live with High Functioning Autism: A Parent's Guide for Professionals* London: Jessica Kingsley Publications.

Stewart, J. R. 2004. Neanderthal - Modern Human Competition? A Comparison between the Mammals Associated with Middle and Upper Palaeolithic Industries in Europe during OIS 3, *International Journal of Osteoarchaeology*, 14: 178-189.

Stringer, C., 2002, Modern human origins: progress and prospects. *Philosophical Transactions of the Royal Society of London B* 357, 563-579.

Stringer, C., and Gamble, C., 1993. *In Search of the Neanderthals.* New York: Thames and Hudson.

Stuart-Hamilton, I. 2006. *An Asperger Dictionary of Everyday Expressions*, London: Jessica Kingsley Publishers.

Synder, A. 2004. Autistic Genius? Review of Autism and Creativity: Is There a Link between Autism in Men and Exceptional Ability? by Michael Fitzgerald, *Nature* 428, 470-471.

Tantam, D. 1988. Asperger's Syndrome, *Journal of Child Psychology and Psychiatry* 29: 245-55

Tattersall, I. 1998. Comments to N. Humphrey Cave Art, Autism, and the Evolution of the Human Mind. *Cambridge Archaeological Journal* 8(2), 165-191.

Tarlow, S. 2000. Emotion in Archaeology*. Current Anthropology* 41, 13-46.

Tilley, C. Y. 1991. *Material Culture and Text: The Art of Ambiguity*. London: Routledge.

Tomasello, M., Call, J., and Hare, B. 2003. Chimpanzees understand psychological states – the questions is which ones and to what extent. *Trends in Cognitive Sciences* 7, 153-6.

Treffert, D. A. 1989. Extraordinary People: Understanding Savant Syndrome, Balatine Books, New York.

Trehin, P. 2002. *Palaeolithic art and autistic savant syndrome: Have people with autism played an essential role in mankind's progress ?* Preliminary research analysis. World Autism Congress Melbourne November 2002.

Trehin, P. 2003. Palaeolithic Art and Autistic Savant Syndrome, Presentation at Autism Europe 7th International Congres, Lisbon.

Trinkaus, E., 1993. Femoral neck-shaft angles of the Qafzeh-Skhul early modern humans, and activity levels among immature Near Eastern Middle Palaeolithic hominids. *Journal of Human Evolution* 25, 393-416.

Tucker, D. M. Luu, P. Derryberry, D., 2005. Love hurts: The evolution of empathic concerní through the encephalisation of nociceptive capacity, *Development and Psychopathology* 17, 699-713.

Underdown, S., 2006. A comparative approach to understanding Neanderthal trauma, *Periodicum Biologorum* 108 (4), 485-493

Valoch, K. 2000. More on the question of Neanderthal Acculturation in Central Europe. *Antiquity* 45, 625-6

Van der Leeuw, S. E., & Torrence, R., (eds.) 1989. *What's New? A closer look at the process of innovation*. London: Hyman.

Van Vugt, M. & De Cremer, D. 2002. Leadership and cooperation in groups: Integrating the social dilemma and social identity perspectives, *European Review of Social Psychology* 13, 155-184.

Van Vugt, M. 2006. Evolutionary Origins of Leadership and Followership, *Personality and Social Psychology Review* 10, 4, 353-371.

Vanhaeren, M.,D'Errico, F., Stringer, C., James, S. L., Todd, J., and Mienis, H. K., 2006. Middle Palaeolithic shell beads in Israel and Algeria.

Vaquero, M. & Pastó, I. 2001. The Definition of Spatial Units in Middle Palaeolithic Sites: The Hearth-related assemblages. *Journal of Archaeological Science* 28 (11), 1209-1220.

Vaquero, M. 1999. Intra-site spatial organisation of lithic production in the Middle Palaeolithic, The evidence of Abri Romani (the Capellades, Spain). *Antiquity* 73, 493-504.

Villa, P., Soto, E., Santonja, M., Pérez-González, A., Mora, R., Parcerisas, J. & Sesé, C. 2005. New data from Ambrona: closing the hunting versu*s* scavenging debate', *Quaternary International* 126-128, 223-250.

Wakabayashi, A., Baron-Cohen, S., Wheelwright, S., and Tojo, Y., 2006. The Autism-Spectrum Quotient (AQ) in Japan: A Cross-Cultural Comparison *Journal of Autism and Developmental Disorders* 36 (2), 263-270.

Weibull, J. W. 1995. *Evolutionary game theory*, Michigan: MIT Press.

Weiss, K. M. 2007. Finding Hippocampus Minor: What makes us uniquely human? *Evolutionary Anthropology* 16: 88-93

White, R. 1997. Substantial acts: from materials to meaning in Upper Palaeolithic representation. In M. Conkey, O. Soffer, D. Stratmann, and N. G. Jablonski (eds.) *Beyond Art: Pleistocene Image and Symbol*. San Francisco: California Academy of Science.

White, R. 1993. Technological and social dimensions of 'aurignacian age' body ornaments across Europe, in H. Knecht, A. Pike-Tay, and R. White, (eds). *Before Lascaux: the complete record of the early upper Palaeolithic.* Boca Raton: CRC press. 277-300.

Willey, L. H. 1999. *Pretending to be Normal: Living with Asperger's Syndrome.* London: Jessica Kingsley Publishing.

Williams, J. H. G., Whiten, A., Suddendorf, T. & Perrett, D. I. 2001. Imitation, mirror neurons and autism. *Neuroscience Biobehavioral Review* 25 (4): 287–95.

Williams, J. O. , Higgins, J. P. T., & Brayne, C. 2005. Systematic review of prevalence studies of autistic spectrum disorders. *Archives of Disorders in Childhood* 90, 8-15.

Wing, L. 1981, Asperger's Syndrome: A clinical account, *Psychological Medicine* 11; 115-29

Wright, K. I. 1992. A classification system for ground stone tools from the prehistoric Levant. *Paléorient* 18: 53-81

Wurtz, S. 1999. The Howieson's Poort backed artefacts from Klasies River: An argument for symbolic behaviour, *South African Archaeological Bulletin* 54, 38-50.

Wynn, T. 2001. The Role of Archaeology in Cognitive Science, Nowell, A., (ed) *In the Minds' Eye: Multidisciplinary Approaches to the Evolution of Human Cognition*, International Monographs in Prehistory, Archaeological Series 13, 9-19.

Wynn, T. 2003. Archaeology and Cognitive Evolution, *Behavioural and Brain Sciences* 25, 389-402

Wynn, T., and Coolidge, F. 2004. The Expert Neanderthal Mind, *Journal of Human Evolution* 46, 467-487.

Zilhao, J., 2006. Neanderthals and moderns mixed, and it matters. *Evolutionary Anthropology* 15, 183-195.

Zilhao, J., 2007. The Emergence of Ornaments and Art: An Archaeological Perspective on the Origins of "Behavioral Modernity". *Journal of Archaeological Research* 15, 1-54.

**Table 1. Archaeological traits of 'modern human behaviour'** (after Hensilwood and Marean 2003, McBrearty and Brooks 2000, Bar-Yosef 2002, Mellars, 2005; 2006)

**Social structures and communication mechanisms**
Long-distance exchange networks
Personal ornamentation
Symbolic expression and use of pigment
Notched and incised objects (bone, egg shell, ochre, stone)
Burials with grave goods, ochre, ritual objects

**Technological changes in terms of adoption of innovative technology, standardisation, and precision in technical artefacts**
New lithic technologies
'Improved' (more efficient) technology
Standardisation with formal tool categories
Complex tool designs eg Hafting and composite tools
Tools in novel materials eg bone, antler
Special purpose tools eg projectiles, geometrics
Increased number of tool categories

**Subsistence changes, particularly with innovative and structured/standardised exploitation patterns**
Increased diet breadth
Specialised hunting of large, dangerous animals
Scheduling and seasonality in resource exploitation
More efficient foraging strategies
Intensification of resource extraction (aquatic and vegetable)

**Population dynamics**
Increased population densities
Range of previously unoccupied regions
Geographic variation in formal categories
Temporal variation in formal categories
Long distance procurement and exchange of raw materials
Curation of exotic raw materials
Site reoccupation or longer occupation
Structured use of domestic space
Regional artefact styles

**Table 2. Diagnostic Criteria for 299.80 Asperger's Disorder**

[The following is from American Psychiatric Association *Diagnostic and Statistical Manual of Mental Disorders: DSM IV*]

(I) Qualitative impairment in social interaction, as manifested by at least two of the following:

> (A) marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction
> (B) failure to develop peer relationships appropriate to developmental level
> (C) a lack of spontaneous seeking to share enjoyment, interest 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

(II) Restricted repetitive & stereotyped patterns of behavior, interests and activities, as manifested by at least one of the following:

> (A) 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, nonfunctional routines or rituals
> (C) stereotyped and repetitive motor mannerisms (e.g. hand or finger flapping or twisting, or complex whole-body movements)
> (D) persistent preoccupation with parts of objects

(III) The disturbance causes clinically significant impairments in social, occupational, or other important areas of functioning.

(IV) There is no clinically significant general delay in language (E.G. single words used by age 2 years, communicative phrases used by age 3 years)

(V) There is no clinically significant delay in cognitive development or in the development of age-appropriate self help skills, adaptive behavior (other than in social interaction) and curiosity about the environment in childhood.

(VI) Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia.

**Table 3. Diagnostic Criteria for 299.00 Autistic Disorder**

[The following is from American Psychiatric Association *Diagnostic and Statistical Manual of Mental Disorders: DSM IV*]
(I) A total of six (or more) items from (A), (B), and (C), with at least two from (A), and one each from (B) and (C)

(A) qualitative impairment in social interaction, as manifested by at least two of the following:

1. marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction
2. failure to develop peer relationships appropriate to developmental level
3. 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)
4. lack of social or emotional reciprocity ( note: in the description, it gives the following as examples: not actively participating in simple social play or games, preferring solitary activities, or involving others in activities only as tools or "mechanical" aids )

(B) qualitative impairments in communication as manifested by at least one of the following:

1. delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
2. in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
3. stereotyped and repetitive use of language or idiosyncratic language
4. lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

(C) restricted repetitive and stereotyped patterns of behavior, interests and activities, as manifested by at least two of the following:

1. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
2. apparently inflexible adherence to specific, nonfunctional routines or rituals
3. stereotyped and repetitive motor mannerisms (e.g hand or finger flapping or twisting, or complex whole-body movements)
4. persistent preoccupation with parts of objects

(II) Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years:

(A) social interaction
(B) language as used in social communication
(C) symbolic or imaginative play

(III) The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder

**Table 4. Characteristics of autistic conditions of particular significance for social roles of individuals on the autistic spectrum**

**Perception/Understanding**

A particular focus on detail (O'Riordan et al 2001, Plaisted et al 1998, Baron Cohen 2006a, 2006b) and abilities to differentiate details within large patterns ('weak central coherence' Frith and Happe 1994, Shah 1988)

Sometimes exceptional memory capacities (Attwood 1998)

Literal, rule based understanding (Selfe 1983; Humphrey 1998; Myers et al 2004) of the world, ability to isolate rules and pattern within complex systems (eg engineering or weather patterns, Hermelin 2002, Baron-Cohen et al 2000)

'Obsessive' focus on their area of interest (Attwood 1998:15; Ehlers and Gillberg 1993; Gillberg and Gillberg 1989; Tantam 1988)

**Motivation**

Due to deficits in empathy (Attwood 1998:15), particular focus on psychological rewards in other realms than social relationships (Wing 1981; Fitzgerald 2004))

Focus on acquiring knowledge about the natural and physical world (Krevelen and Kuipers 1962; Fitzgerald 2004)

Tendency to social isolation, lack of desire to interact with others (Szatmari et al 1989; Attwood 1998: 25)

**Effects on Others**

Lack of concern/understanding of social norms (Wing 1981; Attwood 1998; Fitzgerald 2004)

Abilities to develop unique insights (Baron-Cohen 2006b: 4)

Desire to create predictable environments and controllable systems (extending to people) (Baron-Cohen and Wheelwright 2004: 253; Attwood 1998)

Misreading of emotional messages, challenges with understanding and communication (Attwood 1998: 25)

Lack of self-doubt, tendency to attempt to force own viewpoint and so create social tensions or be controlling or emotionally damaging (Attwood 1998:25; Fitzgerald 2004: 31; Baron-Cohen 2006c)

Lack of concern for or action on behalf of others, particularly where there are no rules to proscribe this (Ehlers and Gillberg 1993; Gillberg and Gillberg 1989; Fitzgerald 2004).

**Table 5: Archaeological evidence corresponding to key traits illustrating the integration of autistic minds within society**

| **Integration of autistic individuals and autistic thinking into society** | **Archaeological expression (in 'modern human behaviour')** | **Archaeological examples** |
|---|---|---|
| | | |
| *Mechanisms for integrating 'different minds':* | | |
| Material symbolism of complex emotional ties | Rise of personal ornamentation<br><br>Elaborate burial | Appearance of body decorations such as shell beads (eg in the Levant, Kuhn et al 2001, or at Blombos Cave, Henshilwood 2004, or in the European Aurignacian White 1993, 1997)<br><br>Burials with grave goods, ochre and ritual objects (eg in the Levant at Quafzeh Cave, 90,000 years ago, Hovers et al. 2003) |
| Clear material clues of meanings | Use of symbolism | Use of red ochre (eg at Blombos cave, Hensilwood 2002 or at Pinnacle Point, Marean et al 2007) |
| Mechanisms for clear communication/collaboration across different understandings and perceptions (eg 'tit-for-tat' social structures) | Long distance communication with other groups | Exchange of Venus figurines (eg of Venus figures in Europe, Gamble 1999)<br>Long distance raw material movement (eg in South West Europe, Gamble 1999. Marwick 2003) |
| Mechanisms for dealing with social tensions | Evidence for social rituals and collaborative practices (music, dance, shamanism)<br><br>Organised use of space | Evidence for music (eg Mithen 2005) and shamanic practices (eg Lewis Williams 2002)<br><br>Widespread distinct spatial organisation (Pettitt 1997, Mellars 1996, though see also Vaquero 1999, Vaquero and Pastó 2001, Speth 2006), widespread structured hearths (Bar-Yosef 2002) |
| Mechanisms for dealing with controlling, emotionally damaging or dominant behaviour | Mechanisms to counteract dominance | projectile technology such as spear throwers (Bar-Yosef 2002, with long- |

| | | |
|---|---|---|
| | | distance combat possibilities, Shea 2003)<br><br>group unity, moral emotions and group expulsions or assassinations (Boehm 1993, 1999) |
| | | |
| *Social roles for individuals with autistic talents* | | |
| Inclusion of individuals with unique capacities for understanding physical and mechanical systems | Rise of more efficient technology<br><br>Development of new technological methods/innovations<br><br>More complex technological designs | Bladelets, microliths and backing (eg Howiesons Poort technology, Mellars 2005: 17, Aurignacian bladelets in Europe Mellars 2006c)<br>More efficient blade technology (eg 75,00-80,000 in the Levant, Shea 2003)<br><br>Diversified projectile points (eg in the Levant and Europe, Shea 2003: 183, Knecht 1997, Larsen-Peterken 1993, Bar-Yosef 2002)<br><br>Use of novel materials (eg bone artefacts at Blombos Cave, Henshilwood et al 2002)<br><br>Rise of multi-component tools (eg hafted inserts at Klasies River Mouth, Deacon and Deacon 1999)<br><br>More elaborate and technological use of fire in hearths (Bar-Yosef 2002 )<br><br>Use of grinding and pounding stones (Wright 1992, Bar-Yosef 2002) |
| Inclusion of individuals with unique capacities for understanding natural systems | More efficient exploitation patterns | More efficient scheduling of exploitation (eg circulating vs logistical mobility |

| | | |
|---|---|---|
| | | patterns in the Levant, Lieberman and Shea 1994) |
| | Understanding of behaviourally complex or difficult prey | Regular exploitation of more dangerous species (eg Cape buffalo and bushpigs at MSA sites in south Africa, Klein 1999) |
| | Exploitation of new ecological niches | Development of marine exploitation (eg of shellfish at Pinnacle Point, Marean et al 2007) |
| | Exploitation of new environments | Population regional expansion (eg into Europe, Mellars 2006b) and into more inhospitable environments (Finlayson 2004) |
| Inclusion of individuals with concern with small precise details | Precise and detailed technological innovations | Precise, detailed designs (eg Howiesons Poort industry, Mellars 2005, Aurignacian bladelets Mellars 2006c) |
| Inclusion of individuals with concern for 'rules' | Standardisation of tool technology | Formalised tool types (eg formalised end scrapers at Klasies River Mouth, Singer and Wymer 1983) |
| | Special purpose tools | Eg defined, specific forms (eg new end scraper forms, Klasies River Mouth, Singer and Wymer 1983, Mellars 2005) |
| Individuals with lack of understanding of social norms | Innovative technological or subsistence methods | Innovative categories of subsistence resources (eg of shellfish at Pinnacle Point, Marean et al 2007) |
| | | |
| *Population consequences of integrating autistic minds* | | |
| Individuals often desiring isolation, and with unique memory capacities | Population expansion, as new lands can be mapped by exploration (refs Mellars 2006) | Genetic evidence for population expansion (Mellars 2006b) |
| Social conflicts | Splits in populations | Regionally differentiated tools (eg in the European aurignacian and Gravettian, |

| | | |
|---|---|---|
| | | Mellars 1989, Gamble 1999, appearances of differences in style, Bar-Yosef 2002) |
| Biological consequences of increased efficiency in resource exploitation | Increased longevity<br><br>Reduced trauma through foraging stress on limbs | Caspari and Lee (2006)<br><br>Davies and Underdown (2006)<br>Underdown (2006) |