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The Stone Age Origins of Autism

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‘Their strengths and deficits do not deny them humanity but, rather, shape their humanity’

Grinker 2010: 173 [in [1]]



1. Introduction

1.1. Minds from a stone age past

Our modern societies have been said to house ‘stone age minds’ (see [2]). That is to say that despite all the influences of modern culture our hard wired neurological make-up, instinctive responses and emotional capacities evolved in the vast depths of time which make up our evolutionary past. Much of what makes us ‘human’ thus rests on the nature of societies in the depths of prehistory thousands or even millions of years ago.

Looking back on the archaeological record of the early stone age there is much to be proud of in our ancestry. Not only our remarkable intelligence but also our deep capacities to care about others and work together for a common good come from evolutionary selection on early humans throughout millions of years of the stone age. As far back as 1.6 million years ago we have archaeological evidence from survival of illnesses and trauma that those who were ill were looked after by others, and by the time of Neanderthals extensive care of the ill, infirm and elderly was common, see [3,4]. From at least one million years ago we see evidence for widespread collaboration in hunting, in sharing food and in looking after increasingly vulnerable young. Stone age societies, much as recent hunter-gatherers such as the Selk’nam of Tierra del Fuego (figure 1), lived in small groups who cared deeply about each other, and worked together to survive.

Nonetheless our evolved minds also have a darker side. For most of our early existence, at least until only around 100,000 years ago, human groups were relatively isolated, and much of our common drive to identify ‘us’ and ‘them’ probably has its roots in a suspicion of ‘others’ which dates to this time. Studies of the remains of a group of *Homo antecessor* dating to around 900,000 years ago at Atapuerca in northern Spain for example have revealed that these people probably hunted and ate neighbouring groups to defend their territories (see [5]). Small wonder that as a result we find ourselves far too often being afraid of those who we feel are different from ourselves. Our neurological response to the pain of others for example can be tempered by whether we see them as belonging to the same group as ourselves or not (see [6]) and if we see people as different to ourselves we can even feel a sense of pleasure at their pain (see [7]).

Thanks to our capacities for self-awareness and moral judgement we can make balanced decisions about how we treat others. Undoubtedly we must also be influenced by our more recent evolutionary history of a remarkably widespread collaboration. Indeed from 100,000 years ago onwards we begin to see evidence for widespread links across different stone age groups in many different parts of the world. In ice age Europe for example around 35-10,000 years ago marine shells travel over 2000km through exchange networks which helped provide a social buffer to withstand shortfalls in resources (see [8]). Somehow these groups overcame their tendencies to distrust outsiders and worked out ways of working together.



Figure 1. Selk'nam hunter-gatherers from Tierra de Fuego on the move. Hunter-gatherer societies such as the Selk'nam depend on high levels of collaboration for their survival. But do all minds need to be the same for collaboration to work, or are different minds a better recipe for success?

Our remarkable abilities to extend ourselves to care about others' wellbeing can sometimes be rather fragile. As the same time as being able to care about global issues or the wellbeing of those we have never met, we can work hard to set up divisions which set us above others. One can't help but wonder if future societies may well look in disbelief at the plethora of ways in which the twentieth and twenty-first centuries have found more detailed and elaborate ways to define a mentally 'normal' mind in contrast with a mentally different (and by implication 'wrong') other. Whilst our abilities to deal with mental health issues have become ever more sophisticated, our 'labelling' of many conditions as disorders can fly in the face of the more obvious reality that the human condition involves a great deal of suffering, and not all of that suffering can be seen as 'unnatural'.

Many so-called 'disorders' may be a natural part of humanity. Conditions such as anxiety or depression are unwelcome but far from unnatural for example. Equally, genetically linked conditions such as schizophrenia or bipolar disorder appear to have a long history, with good evidence to suggest a role for those less grounded in reality in hunter-gatherer societies as shaman (see [9]). Though a shaman's apparent difference, and connection to another world, may give them power, the trances experienced by shaman, and seen as providing a link to the spirit world are more commonly painful than pleasurable. Their experience and behaviour may have at times given them a certain social role in the past, but the same experience is more typically seen as a disorder today.

It is within the context of a fashionable drive to label and classify 'disorder' that the label of autism has emerged. Yet are autistic minds really 'abnormal' or 'wrong'? We would be well advised to be cautious of media warnings of an autism 'epidemic', wording which easily conjures up a picture of a growing disease threatening society. There is every reason to suggest in contrast that what makes 'us' human is not a single 'normal' mind but a complex interdependency between different minds in which autism plays a key role (see [10, 11, 12]). As Grinker (see [1]) illustrates autism should not deprive

someone of humanity, but rather shape their (and our) humanity. Whilst the 'story' of autism is nearly always told as beginning with its labelling in diagnosis by Kanner and Asperger in the early 19th century (see [13]) autism may have much older roots, and a more significant role to play in the emergence of our species. This much earlier 'story' of the role of autism is an important one which accords a key role to autism in the emergence of humanity.

This chapter explores the potential stone age origins of autism, considering the contribution which those with autism may have made to small scale prehistoric societies and the archaeological evidence for a long time depth to the influence of autism.

2. Autism and society

Is autism part of what makes us 'human' today? Autism has traditionally been seen as a condition of people somehow *outside* society. However recent research has challenged this view, suggesting in contrast that autism is part of the processes that allow societies work together.

Various authors have questioned whether autism, particularly high functioning autism or aspergers syndrome, should always be seen as *a disability* (see [14, 15, 11, 12]). That is not to say that life with aspergers syndrome is not often difficult or challenging or that coping with having such a condition in a social world is not often distressing but that at least *at times* it can sometimes be an advantage to have an 'exact mind' (see [16]). Aspergers syndrome often brings with it particular talents in a focus on detail, understanding of systems or abilities to concentrate on a particular problem (see [11]) and is associated with heightened awareness of details, including musical pitch as well as sensory sensitivity (see [17]). High rates of those with aspergers syndrome characterise occupations such as engineering and mathematics (see [18]) as well in universities and the legal system (see [19]). There may be many situations in which having aspergers syndrome makes life difficult, but many of those with aspergers syndrome have a place in society, making a valuable contribution.

Are people with autism motivated to be part of a greater social good? One of the key misconceptions of autism is that a 'lack of empathy' carries with it a tendency to care far less about others wellbeing than the 'neurotypical' might. However empathy comprises a cognitive and an affective component (understanding others feelings and caring about others feelings). The affective component, how much someone will care about others, has been shown to be intact in autism (see [20]). People with autistic spectrum conditions 'care' about others wellbeing as much as anyone else might (even if their abilities to intuitively sense others feelings are impaired), often channelling such concerns into wider social endeavours such as a drive for fairness and justice (see [11]) or scientific progress. Autism implies that people care about others *in a different way*.

Are people with autism really part of human social life? A further misconception is that those with asperger's syndrome are unsocial. Anthropological studies of autism have made a significant impact on our understanding of what it is to be autistic and social and shown that whilst 'autistic sociality' is notably *different* those with autism are not less social. Autistic sociality may often be focused on exchanging knowledge rather than sharing feelings or extended narratives, and is often mediated through the material world (today made up of books or computers). Autism means that people are social *in a different way* (see [13]).

Even those with severe autism can share a sociality which binds them to others. Solomon (in [21]) for example describes Sacks account of two severely autistic twins, John and Michael, who were institutionalised from childhood. In their early twenties and delighted in sharing mathematical concepts and 'conversing' in prime numbers.

Sacks writes:

They were seated in a corner together, with a mysterious secret smile on their faces, [...] enjoying the strange pleasure and peace they now seemed to have.[...] They seemed to be locked in a singular, purely numerical, converse. John would say a number—a six-figure number. Michael would catch the number, nod, smile and seem to savour it. Then he, in turn, would say another six-figure number and now it was John who received and appreciated it richly. They looked, at first, like two connoisseurs wine-tasting, sharing rare tastes, rare appreciations. (Sacks 1970: 202, in [22])

The twins happily welcome Sacks to their conversation when he joins in with his own prime numbers. They provide an example of how apparently extremely autistic individuals can connect socially to others, and derive pleasure from their social contribution and connection, albeit in a non-typical manner. Sadly the different nature of their communication lead them to be separated to prevent them communicating in this 'non-normal' manner.

Whilst it is clear that for the twins pleasurable social life may be distinctive from the norm, in many ways this type of connection is not uncomparable to motivations and pleasures of scientific endeavour as described by Nikola Tesla (see [23]).

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. (see [24]).

Not only rare geniuses like Darwin or Einstein may have been autistic (see [25, 26, 27, 28]) but many more common and far less obviously distinctive members of society may have minds that are distinctively different from what we see as 'typical', and add something critical to what makes us 'human'.

2.1. Inherited gifts of insight and action?

'I feel sure that my way of being is only a disability of context, that what have been labelled symptoms of autism in the context of my culture are inherited gifts of insight and action'
Dawn Prince (in [29])

As Dawn Prince comments, autism can be seen as a disability of context. How we view expressions of autism, whether as laudable and productive (such as an extreme focus on scientific discovery to the exclusion of other concerns for example) or as unproductive and threatening (in the case of the mathematical communication of the twins studies above) is greatly dependant on our culture. Whereas all cultures will have some limits to the nature of unusual behaviours that could be readily supported by others (and severe autism may never be an advantage), some may have been more accommodating of autistic difference than others, and in turn benefitted from what autism may have brought to society (figure 2).

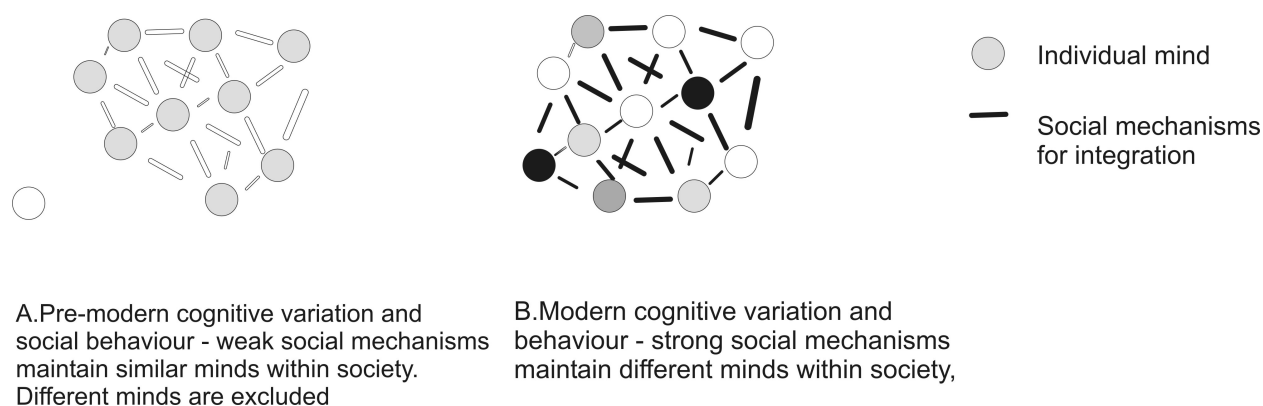


Figure 2. Social means of accommodating autism (or other differences in mind) and the resulting nature of cognitive differences.

Dawn Prince's observation that autism brings with it inherited gifts of unique *insight* and *action* itself gives us a unique insight into the potential contribution which *in certain contexts* autism may have made societies in the far distant past as well as the present.

2.1.1. Unique insight

Baron-Cohen (in [30]) describes the main areas of talents in autism. These talents derive from a drive to understand systems, and illustrate the domains in which unique insights often lie.

The major kinds of system focused on by those with autism include:

- *collectible systems* (e.g. distinguishing between types of stones or wood);
- *mechanical systems* (e.g. a video recorder or a window lock);
- *numerical systems* (e.g. a train timetable or a calendar);

- *abstract systems* (e.g. the syntax of a language or musical notation);
- *natural systems* (e.g. the weather patterns or tidal wave patterns);
- *social systems* (e.g. a management hierarchy or a dance routine with a dance partner);
- *motoric systems* (e.g. throwing a Frisbee or bouncing on a trampoline).

Restricted or circumscribed interests shown by children with autism (figure 3), and which tend to fall into these domains may be difficult for parents to manage, but are often also seen as related to unique strengths or talents (see [31, 32]). An obsession with weather patterns as a child for example may in some lead to a particular strength and an academic focus on meteorology as an adult. Many famous scientists appear to show autistic traits. Isaac Newton's unique insights into astronomy for example derive from a particularly focused motivation to understand the systems behind the movements of astronomical features (figure 4).



Figure 3. An eight month old boy with autism obsessively stacking cans (source: Wikimedia commons)

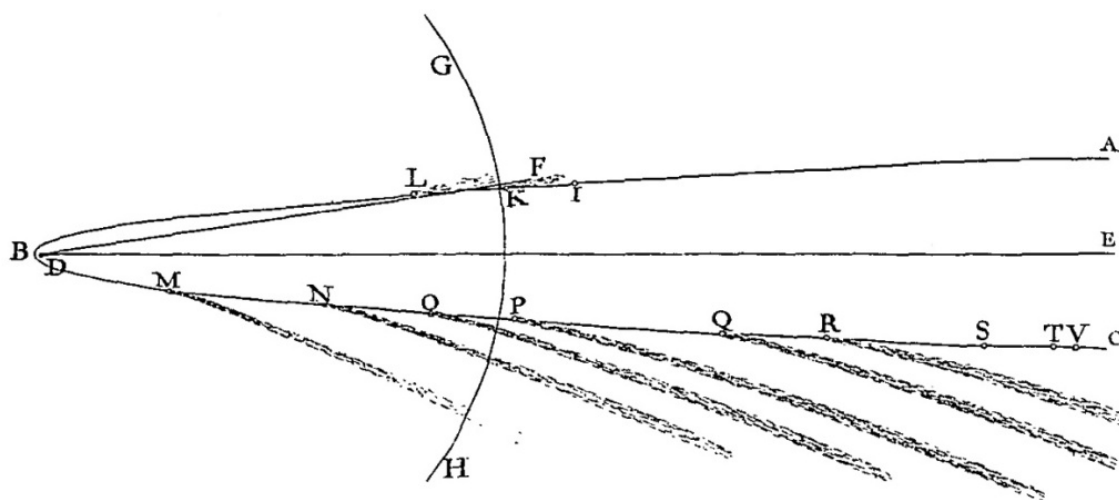


Figure 4. Sir Isaac Newton's depiction of the orbit of the Comet of 1680, fit to a parabola. *The Mathematical Principles of Natural Philosophy*. London: Benjamin Motte, 1729: 358. (Wikimedia Commons)

In a stone age context a focus on fine scale technological prowess or understanding and prediction of nature has an obvious contribution, particularly in harsh and risky high latitude environments such as the Arctic where survival depends on technology occupation depends on highly technological systems. The Inuit for example use complex multi-component harpoons to fish for seal, finely engineered dog sleds and highly efficient hunting equipment.

2.2. Autism and material culture

Though subtle, certain differences in the material culture selected and created by those with autism reflect their different minds. Thus we can argue that it ought to be possible to discriminate the material record of a society which includes or even encourages autistic traits from those where autism is unsupported.

Children and adults with autism use and create the world around them in subtly different ways, though it is children who have been studied most intensively. Children diagnosed with autistic spectrum disorder tend to engage differently with toys, for example focusing on spinning objects or lining up toys, and seem to derive comfort from *precise ordering* or regular patterning (see [33]) as seen above. Adults in turn, even if high functioning and not usually detectable as 'different', relate differently to the material world around them, tending to find comfort in ordered patterns. A focus on understanding systems leads to *detailed record keeping and scientific insights*. Baron-Cohen (in [30]) for example notes the precise recordings of weather patterns in the notebooks of Kevin Phelps and equivalent focus often drives scientific genius. A drive to understand and experiment is related to the creation of *inventions or technological innovation* (with aspergers syndrome being associated with families of engineers, see [18]).

Differences in perception also influence the creation and use of objects. Children with autism notice the numbers on telegraph poles, and differences in perception lead to adults *noticing and dealing with finer details* than others might. *Autistic art* is thus notably distinct. The art of Nadia, an autistic 'savant' for example is typical in being extraordinarily detailed, in common terms a representation of 'the parts' rather than 'the whole' (or the trees rather than the wood), figure 5, and in contrast to figure 6 (in [34]). The same pattern is seen in the art of Peter Myers (see [16]), who also shows remarkable talent in embedding illusions within his work. Kellman (in [35]) argues that differences in visual perception creates the distinctive features of autistic art, alongside the unique focus that a lack of perception of some other areas of external environment can bring.



Figure 5. Horse and rider completed at approximately 5 years 6 months by Nadia. Selfe 2011: figure 2.7: p32 (with kind permission Lorna Selfe).



Figure 6. Two riders drawn by non-autistic children aged 6 years. Selfe: 2011 (figure 2.10, p35). With kind permission Lorna Selfe.

2.2.1. Action

As well as driving detailed recording, fine scale understanding and new innovations of the natural world, autism may also be related to *particular types of action* in other more social ways. Whilst empathising leads to tendencies to follow allegiances (see [36]) autism leads to a focus on strict fairness in social relationships regardless of any particular allies (see [11]). An autistic creation of rigidly clear rules and obsessively fair social behaviour may thus play a key role in defining the 'rules' or legal systems which allow cooperation between unfamiliar people and constrain exploitation, explaining an association in the present between asperger's syndrome and the legal profession (see [19]). Those with autism appear to play a key role in the creation and enforcement of rigid social rules.

Clues to the significance of defined rules of social behaviour for stone age societies can be found in modern hunter-gatherers. Amongst the Inuit for example, as with most hunter-gatherers, connections to external groups and collaborations at times of crisis work through rigid systems of defined behaviour, rather than being driven by a far messier suite of complex allegiances or personal favours.

In the northern Canada the Netsilik Inuit for example had a highly rule based system called *niqaiturasuaktut* which is used to ensure 'fair' sharing during collaborative winter seal hunts (see [37]). After a hunter kills a seal sharing partners are defined by a combination of inheritance and naming and decided by the males of the family. A particular woman divides the carcass and actually shares it with the other partners. The division must follow specific rules. The seal meat and blubber is divided amongst 14 partners, with the first 7 being the most important. The hunter himself only keeps the flippers, so relying on a repeat of the system in future hunts to provide him with meat for himself. These elaborate and rigidly defined rules prevent emotionally driven personal allegiances from influencing the sharing of resources and provide a system by which those who might not usually work together can collaborate for a common good.

The incorporation of an autistic obsession with fairness and rules may have been key to providing highly systemised conventions to circumvent any tendencies to follow allegiances, or react emotionally to the unfamiliar and so may have been critical in promoting collaboration between different groups. It is not unreasonable to suggest that the widespread connections, exchange of materials and collaboration at times of need which we see after around 100,000 years ago may have been driven by the inclusion of autistic minds into societies. These types of systems may have been the key for example to allowing upper Palaeolithic groups to collaborate across large regions to survive local famines during the severe environments of ice age Heinrich events (see [38]).

Autism may often be a disadvantage where intuitive understanding of others is important, and can be unhelpful to the emotional wellbeing of others. Nonetheless where they could be integrated and supported, at a certain level a few individuals at the extreme of the spectrum of mind may have made an important contribution to past societies both in technological and social domains.

3. Autism and the archaeological record of the Palaeolithic

In the light of the potential value of autistic insight and action in certain contexts it is possible to view the archaeological record rather differently. Rather than a progressive sophistication of a single human 'mind', a more plausible explanation for much of the patterning in the archaeological record is as the marked emergence of autistic traits within a modern 'humanity' made up of complex interrelationship between *different minds*.

The earliest evidence for any autistic characteristics emerges well after the split between our own species and our nearest relatives the Neanderthals (occurring around 500,000 years ago), perhaps unsurprisingly as some of the key genes for autism have been found to be lacking in the Neanderthal genome (see [39]) and that of the other closely related species to modern humans, the Denisovans (see [40]).

However after 100,000 years ago various elements of the archaeological record document certain new traits which appear to be linked to autism – such as a unique focus on detail,

technological innovation, and understanding of complex systems (see [10]) as well as evidence for large scale collaborations in the exchange of materials between groups (see [41]). Many of these new elements can be associated with what has been termed the appearance of ‘modern human behaviour’.

After around 100,000 years ago we begin to relatively suddenly see the emergence of ‘inventions’ such as the spear thrower, multi-component harpoon and tiny microlithic stone tools (figure 7 & 8) which appear to have been essential for the colonisation of previously unoccupied regions such as the far north (see [42]).



Figure 7. A ‘microlith’, these tiny tools formed part of barbs in arrow shafts, as well as other uses, and were highly efficient ways of making effective hunting weapons as well as maximising the use of stone tools materials and the efficiency and maintainability of tools with individual microliths being replaceable. *With kind permission José-Manuel Benito Álvarez.*

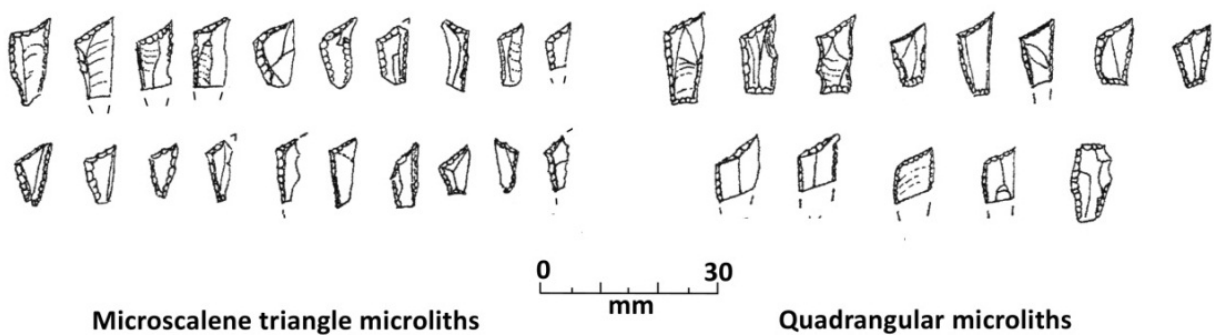


Figure 8. Microliths, forming part of highly engineering technologies, only appear after about 100,000 years ago. These microliths are from Red Rafter Late Mesolithic site in the Pennines (courtesy of Paul Preston).

For example changes in ‘modern human’ technology include the appearance of tiny microlithic points such as at Howieson’s Poort and Rose Cottage in South Africa at around 75,000 years ago. Other innovations in Africa at his time including finely made bifacial points made

on raw materials which may have been derived from structured exchange networks, bone tools, new symbolic art such as engraved patterns on ochre and ostrich eggshell and the formal ordering of space on sites (see [44]). Microliths and other elements of 'modern' behaviour are also later found at Patne in India, following the presumed colonisation of the southern corridor by fully modern humans (see [45]).

Somewhat later in Ice Age Europe, around 35-10,000 years ago, we see potential further evidence for a stone age context in which autism may have played an important social role.

Firstly, a number of artefacts found at European Upper Palaeolithic sites illustrate a unique focus on recording and understanding natural systems, particularly astronomical systems, which parallels with that seen in those with aspergers syndrome today. The Taiï plaque for example, a 9cm long engraved bone from the Grotte de Taiï, dated to around 10,000 years ago (see [43, 46]) is covered with many notches interpreted as a calendrical notation spanning over a year (figure 9).

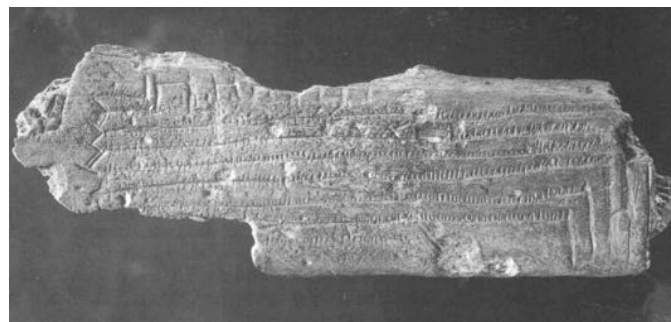


Figure 9. The Taiï plaque (Marshack 1991: figure 1, p26.[43])

The Abri Blanchard plaquette, dated from around 32,000 years ago is perhaps even more remarkable. The patterns on this bone record the phases of the moon and its position in the sky related to a notched co-ordinate system at the edge of the plaque (figure 10, see [47, 46, 48]).

As well as other artefacts which also appear to carry calendrical, astronomical or other notation there are also other hints of autistic influence. The Raymondén plaquette from around 12,000 bp for example illustrates an autistic like approach to social relationships. This bone features an extended bison skeleton, with figures sitting on either side of the spine, illustrating both a detailed anatomical knowledge of anatomy (showing individual vertebrae) and with a focus on equal or systematically defined sharing (figure 11).

The most famous example of a link between autism and the contemporary archaeological record of this period however comes from the famous art. Upper Palaeolithic art in south-western Europe is dominated by often extraordinarily realistic and naturalistic depictions of animals, both on cave walls (see front figure and figure 12) and in portable art (see figure 13). A number of elements of this art, such as highly realistic detailed figurative representation, a focus on parts (with drawings often overlapping) and a remarkable visual memory from what can only have been limited opportunities to note details of dynamic animals are found in common with autism (see [49, 35, 50, 10]). Whilst we might not necessarily suggest

that the ice age artists were autistic themselves, it would not be unreasonable to conclude that *autistic perception* and the influence of those with autism on society had a significant influence on the style of art.

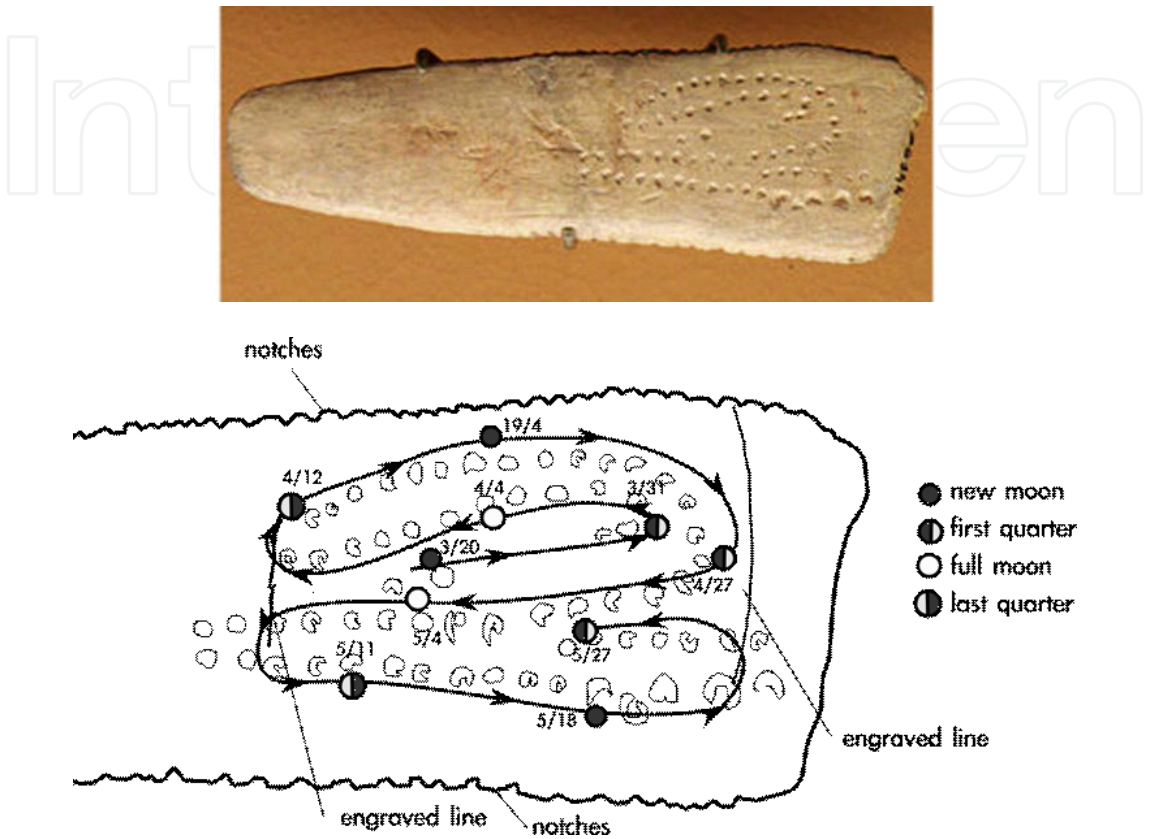


Figure 10. The Abri Blanchard plaquette (De Smedt and Cruz 2011: figure 1, with kind permission).



Figure 11. Raymonden plaque, c10,000 years old, Raymonden, Dordogne, southern France (image: museo de Altamira).



Figure 12. B. & G. Delluc viewing frieze of swimming reindeer in Lascaux cave, Dordogne c 20,000 years old.



Figure 13. Line of animal heads engraved on a rib from the cave of Courbet, Penne-Tarn, France, Late Magdalenian, about 12,500 years ago (source: Wikimedia Commons)

The patchy nature of the expression of autistic traits in post 100,000 bp archaeological evidence suggests that it may have been most particularly in certain times and places that the advantages of autism were particularly emphasised. The clearest context may be that of highly risky, cold climate environments such as Ice Age Europe. Here both the dependence on technology for survival is greatest, and technological efficiency and innovation much valued, and unstable climates place an emphasis on large scale collaborations to provide a social buffer against shortfalls in resources. The archaeological record of southernmost Africa provides another particularly interesting case where autistic traits appear to have been adopted early at Blombos and Rose Cottage, later declined around 65,000 years ago and then re-adopted many thousands of years later continuing into elements of modern San technology (see [51]). If those with autism were integrated into societies at different times and places it

is not surprising that there are multiple genes coding for autistic traits, and representing a geographically complex process of selection.

3.1. The cloud behind the silver lining?

Individuals with autism can create challenges for societies, whether small scale hunter-gatherers or large scale modern societies. Pronounced counter-dominance tactics in hunter-gatherers (see [52]) for example may have developed in part to prevent the dominance of those with autistic traits such as rigid rules and a lack of sensitivity to potential emotional consequences of their actions. Thus no matter how much someone is respected in small scale egalitarian groups, their rights to dictate the behaviour of others is heavily constrained by shared action to maintain equality. Indeed Boehm documents a progressive series of sanctions for dominating behaviour from ridicule to ostracism or assassination (see [53]). Such dynamics have also been recognised in Palaeolithic and Mesolithic contexts (see [52]). Whilst counter-dominance tactics work in a small scale setting, in modern societies a lack of such intuitively based social sanctions on behaviour may create problems where highly dominant individuals with autism are in positions of power. In this case such individuals may make decisions with emotionally damaging consequences for others which remain unchallenged.

Most individuals with autism are highly moral. However where autism is associated with disorders of *motivation*, as in the case of autistic psychopathology, a lack of intuitive feeling of others' suffering allied with a desire to harm can be a literally lethal combination (see [54]).

Whilst we tend to envisage a single typical Upper Palaeolithic society, such societies, like the human minds within them, were likely to have been highly variable. In a modern context small scale societies today tend to vary greatly in their level of social tolerance and tendencies towards or against violence, and a certain amount of self sorting takes place amongst hunter-gatherers with more collaborative or more competitive individuals tending to group together (see [55]). It is not difficult to envisage situations in prehistory where it was not the highly collaborative and moral personalities which were the most successful but in contrast where highly dominant, aggressive and even violent attitudes towards others might occasionally 'pay off' sufficiently to allow the genetic determinants of such traits to be selected for (see [54]).

3.2. The timing of incorporation of autism

Why might the incorporation of autism apparently occur relatively late in human evolution (at least after 100,000 years ago)? A capacity to integrate those who think differently, not only at the autistic end of the spectrum but also by implication other differences in mind, may depend on particular evolutionary changes taking place. Perhaps the most likely is that a particular cognitive threshold might need to be passed. A capacity to care about and support members of society is in evidence at much earlier dates. However we might speculate that only when early humans had the cognitive sophistication to appreciate that *behind different behaviour lies positive motivations towards others* as well as *the moral consciousness to promote inclusivity* could

autism bring the unique elements to make up 'humanity'. These unique elements may nonetheless have been a critical part of the remarkable global colonisation and modern human success which follows their appearance.

4. Conclusions

There is every reason to believe that autism, far from being outside society, is very much part of the story of the origins of 'humanity'. Those with autism may have played a unique role in technological spheres and understanding of natural systems, contributing calendrical knowledge, refined efficient technological practices and a unique perspective to art. They may also have been key to allowing larger scale societies to form with clear rules to define how sharing takes places.

Autism is sometimes portrayed as the 'other'. Not only is this a dangerous perspective to take on a difference of mind, but there is every reason to conclude that autism is a central part of what makes us 'human'. However difficult dealing with autism may be there may be much which we owe to the role of autism in our success. Moreover the solutions to allowing 'us' to work with 'others' in the Palaeolithic, and allowing a large scale society to be created might have depended on the inclusion of autism.

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