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Henry Cavendish and Asperger's syndrome: A new understanding of the scientist

Hugo Lidbetter

University of Oxford, Department of Experimental Psychology, South Parks Road, Oxford OX1 3UD, UK

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ABSTRACT

Although it has recently been suggested that Henry Cavendish (1731–1810) suffered from Asperger's syndrome (James, 2005; Sacks, 2001), there has yet to be a systematic exploration of this claim. For various reasons, Cavendish is considered here through the diagnostic framework described by Gillberg (1989), with further support from the DSM-IV (APA, 1994). The potential for such a retro-diagnosis is evident, given Cavendish's biographers' lament of Cavendish as the 'incomplete man': the oddly misanthropic man characterised by negations. Such an impression is evident in the memoirs of Cavendish's contemporaries but finds its best expression in Wilson's (1851) biography. With a new and cautious interpretation from an Asperger's syndrome perspective, this fragmented picture dissipates and Cavendish emerges as a man of remarkable intellect whose syndrome stunted his social development and expression, yet so crucially enabled his research into a paradoxically catholic taste of scientific study. Topics relevant to a 'retro-diagnosis' are first addressed, before Cavendish is compared to Gillberg's and the DSM-IV criteria.

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'It becomes obvious that their extreme intelligence in one or other area, coupled with rigidity, repetitiveness and social isolation has led them to the top of their field' (Gillberg, 2002, on Asperger's syndrome).

'He was like a deaf mute sitting apart from a circle, whose looks and gestures show they are uttering and listening to music and eloquence, in producing or welcoming which he can be no sharer' (Wilson, 1851, on Henry Cavendish).

1. Introduction

1.1. Henry Cavendish

Cavendish was born in 1731 in Nice, where his mother, Lady Anne Cavendish (fourth daughter of the Duke of Kent), was convalescing. Two years later she died, following the birth of Henry's younger brother, Fredrick. Lord Charles Cavendish (third son of the second Duke of Devonshire) and his two sons moved to Great Marlborough Street in London in 1738. In December 1749 Cavendish matriculated at Peterhouse College, Cambridge, leaving three years later without taking a degree. He thereafter lived with his father in Great Marlborough Street until the latter's death in 1783, where he spent his time on scientific (predominantly chemical and electrical) research. Cavendish continued to live in and around London after his father's death, first in Hampstead and then in Clapham. He also retained a town house in Great Marlborough Street and later in Dean Street, Soho. The latter was used exclu-

sively as a private library where his books were 'at the command of all men of letters' (Young, 1921).

Cavendish first attended the Royal Society in June 1758 as a guest of his father and was elected into the Society in May 1760. Six years later, his first paper on the composition of 'airs' was published. He was elected to the Council of the Royal Society in 1765. This appears to have been Cavendish's sole social outlet. He continued to live a life of seclusion and routine until his death at the age of 79.

Among Cavendish's most outstanding achievements were the discovery of hydrogen (after initially equating it with phlogiston), the description of the chemical composition of water and nitric acid, and a remarkably accurate calculation of the density of the earth. He also made many innovative and important discoveries in mechanical heat, thermometry and electricity, particularly in anticipating the theories now attributed to the later work of Coulomb (1736–1806) and Ohm (1789–1854).

1.2. Creativity and mental disorders

The fine line between creative genius and madness has historically been of great interest; noted among many others by the Roman Seneca ('*nullum magnum ingenium sine mixtura dementiæ*' – 'There is no great genius without a tincture of madness'), the empiricist Mill (1859), and Dryden in his classical statement, 'Great Wits are sure to Madness near ally'd; And thin Partitions do their Bounds divide' (Dryden, 1961). Frith noted that the idea has indeed been with us for centuries, but it is 'only now that we are considering that the madness in question may point to autism' (Frith, 1991). This is of course a generalised view, for autistic 'creation'

E-mail address: hugolidbetter@googlemail.com

as it is increasingly being understood is markedly different from the creativity found in artists and writers. Consequently, a more realistic view differentiates these, regarding artistic and scientific creativity as different phenomena. Consequently, there are various forms of ‘madness’ that characterise the distinction. Thus, a popular view holds that artistic creativity is often accompanied by depressive and mood disorders (e.g., bipolar disease), whereas schizotypal and autistic spectrum disorders have a higher incidence among scientists. Certainly, in science and particularly in Cavendish’s case, characteristics such as a single all consuming interest exclusively pursued, a concrete reasoning method, and total disinterest in social interaction combined to allow a successful research approach. This condition may well have provided Cavendish with exactly the dispositions that made his remarkable achievements possible.

1.3. The ‘psycho-graphical approach’ and retro-diagnostic issues

Frith (1989) made a basic but important observation when she wrote that ‘in view of the short history of psychiatry... we know that a disorder recently described is not necessarily a recent disorder.’ This refers in part to the lack of understanding of people with autism and Asperger’s syndrome (AS) in the past, individuals whom Aykroyd (1935) claimed were to be ‘found in any lunatic asylum.’ It specifically explains why Cavendish was misunderstood by his contemporaries and why he has continued to be misunderstood by his biographers. When examining the cases of Hugh Blair of Borgue and John Howard, Frith noted that these examples ‘allow us to see the helpful effects of a privileged social background on autism at a time when there was no awareness of the disorder.’ A privileged background is thus likely to allow the social exclusion that would be denied to other classes. Cavendish could live a life of research because he had the means to detach himself from society. However, those from less privileged backgrounds, who could not shun society so easily, may well have found themselves in the lunatic asylums Aykroyd mentioned.

Although there were missing details of Hugh Blair’s early life, Frith concluded that a ‘retrospective clinical diagnosis of autism’ was allowed because he showed ‘all the typical features of autism.’ Fitzgerald (2004) agreed with Frith and Houston’s (2000) claim that it is possible to come to a definite conclusion as to whether a deceased person had autism, declaring that, ‘I believe the psycho-historical approach shows that the diagnoses are not fanciful or speculative.’ They are, however, hypotheses relative to the information available. In contrast, Gillberg (2002) advised that ‘it is always speculative to examine case studies in retrospect, and there can be no ‘truth’ regarding who ‘had’; and did not ‘have’ AS in most cases not clinically examined.’ Gillberg’s caution has largely been ignored by an increasingly popular trend in the literature of ‘labeling’ historical figures with various syndromes. Although there is nothing inherently wrong with this endeavour, there is a tendency to apply the syndrome to cases where it is dubious that it actually pertains. In this sense, it is vital that a full argument together with the relevant diagnostic scheme is presented in each case. Given the very informative accounts that remain from Cavendish’s contemporaries, it certainly seems very likely that he had AS. This, however, remains a hypothesis relative to the strength of the arguments that can be made within Gillberg’s and the DSM-IV framework.

A related point of caution is the danger of simplistically thinking that one can split the field of psychological syndromes into those who ‘have’ and do ‘not have’ a particular syndrome. Instead, like many other psychological disorders, AS occurs within a spectrum (the autism spectrum) and so one can have some of the cognitive traits associated with AS whilst falling short of actually having the syndrome itself. Indeed, many researchers have claimed

that creativity can be best associated with cases where an individual has the cognitive traits of a psychosis but does not have the actual psychosis. This is particularly relevant of the personality construct, ‘schizotypy’ (e.g., Claridge, 1997, 1998).

In line with the preferences of many experts in the field, and because of its greater descriptive value, the diagnostic scheme employed here is that used by Gillberg (1991) and Gillberg and Gillberg (1989), further supplemented with reference to the DSM-IV (APA, 1994). Both Szatmari, Bartolucci, and Bremner (1989) and the World Health Organization (1993) offer important diagnostic schemes, but Gillberg’s and the DSM-IV are preferred here (both are included as Appendices).

1.4. The successful Asperger’s patient

There is a tendency when considering AS to adhere too much to a view of the classic autistic child: aloof, unimaginative, and disinterested. This creates the misleading impression that autistic disorders and creativity or social-vocational success are mutually exclusive. Many leading researchers in the field have commented on this mistaken view. Frith (1989) pointed out that, ‘as adults AS individuals can become, superficially at least, well-adapted and some are exceptionally successful.’ The capacity for success tends to arise both from their intelligence and their focused concrete thinking style. Thus, in support of the former, Frith noted that ‘in some cases of superior intelligence a brilliant academic career is possible.’ She further noted the adaptive function that high intelligence allows: ‘...the presence of high intelligence makes an enormous difference to the manifestation of a disorder, which can camouflage problems.’ Along with his privileged social position, Cavendish’s intelligence may therefore provide a second reason why he was regarded as more eccentric than mad. Gillberg (2002) similarly claimed that ‘high IQ is often the outstanding asset/strength in people with AS.’ So, as with normal variations in intelligence, there are considerable individual differences within the abilities of AS individuals: ‘...outcome in AS is very variable. Many with the disorder do well as adults and many attain status as leaders in their particular field’ (Gillberg, 2002).

As noted, potential for success derives not only from intelligence, but also from a characteristic style of thinking. Frith (1991) noted that ‘...fortunately, the ability to sustain strong interest in a particular area and to be absorbed and even enraptured by its pursuit can lead to outstanding achievement.’ Therefore intelligence and an ‘absorbed’ mentality are both important: ‘...the perseverance, drive for perfection, good concrete intelligence, ability to disregard social conventions, and not worry too much about other peoples’ opinions or critiques, could all be seen as advantages’ (Gillberg, 2002). So, it is quite possible that Cavendish could have achieved all that he did, whilst also having AS. Indeed the features of AS described by Gillberg look as though they were actually fundamental to Cavendish’s scientific discoveries.

2. Cavendish and negations

2.1. Cavendish the ‘incomplete man’

Jungnickel and McCormmach (1996) asked, with good reason, ‘what of Cavendish the complete man?’ This is similar to Berry’s (1960) earlier observation: ‘...yet all who knew him were agreed about his striking deficiencies as a human being.’ Aykroyd completed Cavendish’s biographers’ sense of wonder with the conclusion:

A great brain, and a very small man! A psychiatrist might find it interesting to guess at the early experiences which made full

human development impossible, allowing one small part of his being to hypertrophy, and the rest to waste away.
-Aykroyd (1935, p. 78).

Cavendish is invariably regarded negatively, lacking in empathy and socially deficient. This may be attributed to AS, but also to the analysis by Cavendish's original biographer, George Wilson – summarised by Jungnickel and McCormmach (1996) as 'a vivid portrait of Victorian negations, of a man lacking in piety, family, philanthropy and poetry.' Wilson was of course comparing Cavendish against a certain code, both in terms of the social expectations that were made of Cavendish's class and of the propagation of scientific knowledge that lay at the heart of the philosophy of the Royal Society. The negations that Wilson attributed to Cavendish thus come from his accentuated failure to both interact socially and publish more of his research. Wilson drew on many of Cavendish's contemporaries when forming his impression, though the testimonies generally concerned the older Cavendish. Nonetheless, after examining these sources Thorpe (1921) reported that Cavendish was 'not a man as other men are, but simply the personification and embodiment of a cold, unimpassioned intellectuality.' Blagden, perhaps the one man who was ever close to Cavendish (as his temporary assistant), recorded in his diary on 15 September 1794 – after having spoken with Aubert about Cavendish – that Cavendish had 'no affections, but always meant well.' On 27 August 1795 he also noted, 'made nothing of Cavendish, cannot understand him.'

Wilson's account of Cavendish's 'deficiencies' was apparently accentuated by a sense of frustration that he felt in 'devoting so much time and effort' to 'so small a matter' (Jungnickel & McCormmach, 1996). Nonetheless, Wilson's interpretation is worth outlining for it provides a valuable insight into Cavendish's peculiarities. AS provides a very compelling answer to the charges of a lack of empathy. Wilson's view is epitomised in his conclusion of Cavendish: 'he was not a Poet, a Priest, or a Prophet, but only a cold, clear intelligence, raying down pure white light, which brightened everything on which it fell, but warmed nothing' (Wilson, 1851). In fact, Wilson's estimate of Cavendish's character was essentially a negation of the Victorian model of man, 'morally it was a blank, and can be described only by a series of negations. He did not love; he did not hate; he did not hope; he did not fear; he did not worship as others do.' Indeed, 'There was nothing earnest, enthusiastic, heroic, or chivalrous in his nature, and as little was there anything mean, grovelling, or ignoble. He was almost passionless.' Quite clearly, a lack of any show of 'passion' indicated to Wilson that Cavendish must actually be 'passionless.' Of course, the major problem in autistic spectrum disorders is not so much about lacking any form of emotion, but being unable to demonstrate it in socially acceptable ways. So, the lack of any outward show of emotion created a picture, very understandably, in Wilson's and Cavendish's contemporaries' eyes, of a depersonalised, almost robotic being:

Anything requiring exercise of fancy, imagination, affection, or faith, was distasteful to Cavendish. An intellectual head thinking, a pair of wonderfully acute eyes observing, and a pair of very skilful hands experimenting or recording, are all that I realise in reading his memorials. His brain seems to have been but a calculating engine; his eyes inlets of vision, not fountains of tears; his hands instruments of manipulation which never trembled with emotion.
-Wilson (1851, p. 185).

In a post-Newtonian age that saw scientific enquiry as the means of elevating the condition of man, this sense of disappointment is understandable, even if it is misplaced. Cavendish contrasts with what was expected from those engaged in science at the time, both in his character and in his reticence to publish in

an enlightened age. The disappointment is reflected well by Bickley (1911): 'there is something pathetic about such an existence as Henry Cavendish's, so fruitful and yet so utterly barren.' Clearly though, being characterised by his peers in the Royal Society as a 'man without affections' is consistent with what one would expect from an AS individual. Furthermore, as well as showing no outward sign of emotion, Cavendish also apparently recorded no private thoughts, certainly none that have survived.

2.2. Negations and misunderstanding

Given that Cavendish has repeatedly been viewed in terms of negations, it is hardly surprising that this has created a great deal of confusion among his biographers. It is only when a hypothesis of AS is considered that Cavendish loses his apparent misanthropy and can be perceived more favourably. Such an interpretation would at least give McCormmach his much lamented conception of Cavendish the 'complete man.'

The influence of Wilson's account has to an extent been 'uncritically repeated' since, as Jungnickel and McCormmach objected. McCormmach (2004) importantly observed that the theory evident in Cavendish's *Heat* shows Cavendish was not solely a quantifier, as Wilson's account might suggest. This in no way challenges the argument that he had AS, as it is of course a distinguishing feature from low functioning or 'classical' autism that the 'quantifying' has extra meaning to it (rather than carried out by rote). Of course, it must be related to intelligence and Cavendish was of undisputed intelligence, as outlined below.

Rather unfortunately, whilst resisting exaggeration on this level, Jungnickel and McCormmach (1996) do not completely avoid hyperbole, claiming that 'on the subjects he cared to speak about, Cavendish spoke precisely and sparingly as a point of conscience.' It is by no means clear how this follows (as is claimed) from Davy's report that Cavendish, when he did 'choose' to speak, was always 'luminous and profound.' Jungnickel and McCormmach rather humbly came to their 'second consideration' as a result, that 'silence can be positive.' They seem to imply that Cavendish chose silence wherever possible due to his supposed views on the inadequacy of language in portraying ideas:

...and in part, we think, Cavendish's silence was an acknowledgement of the inadequacy of customary spoken language to represent the world. The pains he took always to define his quantitative terms before beginning to reason with them is an indication of what we mean here.

-Jungnickel and McCormmach (1996, p. 370).

Cavendish made no such choice but was predisposed towards silence by his syndrome. So, because they do not realise that Cavendish's behaviour was characteristic of AS, Jungnickel and McCormmach are forced into conceding that 'the person of Cavendish remains in large part in shadow. At the heart of the problem of Cavendish lies the mystery of human communication.' More accurately of course, at the heart of the problem of Cavendish lies the mystery of *autistic* communication.

It is only with the knowledge that Cavendish very probably had AS that we can get anywhere near attempting to understand Cavendish 'the complete man.' It certainly at least explains those peculiarities of his character which so perplexed his contemporaries and biographers. Jungnickel and McCormmach got very close to suggesting this: they certainly at least emphasised Cavendish's extreme shyness, and also assumed he suffered from depression. Wing (1981) observed that 'quietness, social withdrawal and lack of facial expression in AS might suggest a depressive illness' and that this is only clarified by a 'full clinical picture.' This explains why Jungnickel and McCormmach might have assumed a deep

depression in Cavendish, but his having AS gives us a much better impression of his character.

3. All-absorbing narrow interest: a paradox

The second of Gillberg's six diagnostic criteria is the presence of a narrow interest which is either to the exclusion of all other activities, has repetitive adherence, or has more rote quality than meaning. Certainly, for Cavendish this narrow interest was to the exclusion of all other activities. The DSM-IV similarly postulates an 'encompassing preoccupation with one or more stereotyped and restricted patterns of interest' under the broader 'restricted or repetitive stereotyped patterns of behaviour, interests and activities', as a key component of an AS diagnosis.

However, a paradox arises from the nature of Cavendish's research, as made explicit by Wilson:

Few of our men of science have been so catholic in their tastes as Cavendish, so far at least as physics is concerned. He was an excellent mathematician, electrician, astronomer, meteorologist, and geologist, and a chemist equally learned and original. -Wilson (1851, p. 19).

The broad nature of Cavendish's scientific research is confirmed by almost all of his contemporaries; for example Lord Brougham wrote, 'he was a most complete and accomplished mathematician. . . his papers relate to various branches of optics, of physical and practical astronomy to pure mathematics in all its branches, geometry, the integral and differential calculus' (Brougham, 1845). And the opinion is echoed by his modern biographers:

Among the men who cultivated natural philosophy in its widest sense during the 18th century, it would be difficult to determine whose work was of more far reaching importance than that of Cavendish, having regard to the diversity of the subjects he investigated, and to the care and exactness which characterised all his experimental work. -Berry (1960, p. 9).

Objectively the range of Cavendish's work is demonstrated in the papers he published in the Philosophical Transactions. Ten of these were chemical, two concerned electricity, two meteorology, three were related to astronomy, and one gave Cavendish's method of dividing astronomical instruments. His approach was certainly 'abnormal either in intensity or focus' (DSM-IV, criterion 2.a) for Cavendish 'prosecuted zealously and successfully so many branches of knowledge, that the students of nearly all the physical sciences may consider him an illustrious brother' (Wilson, 1851). The intensity of Cavendish's focus is particularly striking and the adjective 'industrious' often occurs in recollections of him: 'Mr. Cavendish examined this important point with his usual patient industry and acute discernment' (Thomson, 1830). The paradox is not, however, inextricable. All the references are solely to Cavendish's interests in science, as varied as those might be. Outside science, Cavendish apparently had no interests whatsoever. Thus on the face of it, Cavendish had a varied taste of research interest. However, all were strictly scientific and pursued with absolute rigour. As such, the paradox dissolves.

4. Narrow interest: science

Jungnickel and McCormmach (1999) claimed that 'Cavendish's life was his science', and they seem right to have done so. Indeed, it was not a major exaggeration for Aykroyd (1935) to have written 'revolutions might come and pass, a new era dawn, a great conqueror shake the foundations of Europe, but Cavendish had no concerns in such matters.' His life was 'a single minded dedication to

comprehending the universe' (McCormmach, 2004). As Blagden (1810) recollected, 'The love of truth was sufficient to fill his mind.' Cavendish's research efforts were thus fuelled by a dual pronged attack on the pursuit of truth and the elimination of error, and the dogmatic execution of this explains why Cavendish's work cannot be separated from his life.

Perhaps the best example of this 'encompassing preoccupation' is in reference to his houses. Aykroyd (1935) captured Cavendish's domestic position well: 'he owned three houses, in Soho, in Montague Place, and in Clapham, the first of which was devoted towards a library, the other two being fitted out as laboratories and workshops rather than as dwelling places.' It is certainly not unusual, given Cavendish's social position, to have part of his house devoted towards research, but for 'books and apparatus' to form the 'chief furniture' is certainly strange. Cavendish's favourite house was in Clapham where 'the whole of the house. . . was occupied as workshops and laboratory' and even the upper rooms 'constituted an astronomical observatory' (Wilson, 1851). This indicates the level to which Cavendish's 'love of truth' dominated his life.

Evidence for this encompassing preoccupation arises generally in two forms. First, Cavendish's love of science and enigmatic pursuit of 'truth' (as outlined above) and, secondly, his apparent lack of any aesthetic sense or interest. Wilson emphasised the latter point:

To the other objects of common regard which excite and gratify the fancy, the imagination, the emotions, and the higher affections, he was equally indifferent. The Beautiful, the Sublime, and the spiritual seem to have lain altogether beyond his horizon.

-Wilson (1851, p. 178).

Wilson dwelt some time on this deficiency, noting that only perfect accuracy was of interest to Cavendish:

Many of our natural philosophers have had a strong and cultivated aesthetical sense; and have taken great delight in one or another or all of the fine arts. For none of these does Cavendish seem to have cared. Unlike Black, he was constructed, might be clumsy in shape and of rude materials. He insisted, however, on its perfect accuracy.

-Wilson (1851, p. 173).

The same point was later reflected by Berry (1960): 'the appreciation of any sense of beauty or elegance, which was so lacking in Cavendish as regards natural scenery, extended even to his apparatus.'

Regardless of their level of involvement with work, the vast majority of people at least retain a considerable interest in at least one other thing, perhaps their family or the opposite sex. However, Aykroyd (1935) observed that 'one may add that Henry Cavendish remained all his life quite uninterested in his ducal relations and singularly indifferent to the glories of his family history.' Other accounts reveal he rarely communicated with his brother and that his heir, Lord George Cavendish, only visited him for half an hour every year. And Aykroyd reported an anecdote when members of the Royal Society Club were looking out of the window at a pretty girl: 'Cavendish, on joining the group, shrank away in disgust when he saw the object of their attention. He had thought, poor fellow, that they were observing the moon.'

Travel is also often considered to be of interest to many. Cavendish, though, 'crossed the country like a railway surveyor; turning neither to the right nor to the left, or deviating from his route' (Wilson, 1851). In Cavendish's journal of travels, Wilson found no reference to the 'grandeur of natural scenery' nor any observation of the historical association of certain locations, as apparently

found in all other 'scientific pilgrims.' Berry (1960) noted that these tours of England and Wales occurred in 1785–1787 and 1793, and that their purpose was inevitably 'wholly scientific' and 'primarily concerned with geology.'

Even in conversation 'a cold indifference of nature returned if conversation relapsed into general topics' (Wilson, 1851). It seems, therefore, that Cavendish really was only interested in scientific research, and demonstrated absolutely no significant interest in any other matter whatsoever.

5. Social impairment

5.1. Interaction

All anecdotes relating to Cavendish's social interactions strongly suggest that he had AS. Jungnickel and McCormmach (1999) capture this well: 'his features were strained, his speech excited, his demeanour that of a creature poised for flight. He was reticent, inhibited, awkward, and embarrassed in the presence of strangers.' Cavendish corresponds to nearly all of the classical diagnostic criteria in this regard.

Gillberg's first social impairment criterion 1.a relates to 'difficulties interacting with peers.' This was, in short, Cavendish's position with respect to his social life. It is perfectly caught in the following anecdote, recorded by Wilson and told by a 'senior member of the Royal Society' when Cavendish was standing outside the door of Sir Joseph Banks (The Society's President at the time):

I have myself seen him stand a long time on the landing, evidently wanting courage to open the door and face the people assembled, nor would he open the door until he heard some one coming up the stairs, and then he was forced to go in.
-Wilson (1851, p. 169).

Wilson, commenting on the striking unanimity of all reports of Cavendish attempting to mix in society wrote: 'we picture him to ourselves an excessively shy, silent, awkward, and embarrassed person, barely enduring the looks of man, and fleeing from the gaze of women.' Sir Humphrey Davy's account is typical: 'Cavendish was a great man, with extraordinary singularities. His voice was squeaking, his manner nervous, he was afraid of strangers, and seemed, when embarrassed, even to articulate with difficulty' (Davy, 1839). Dr. Thomas Thomson's report lends further support: 'he was shy and bashful to a degree bordering on disease; he could not bear to have any person introduced to him, or to be pointed out in any way as a remarkable man' (Thomson, 1830). The reference to 'bordering on disease' clearly suggests a major impairment in social interaction; Cavendish certainly did not mix with others easily.

Evidence for an 'indifference to peer contacts' (criterion 1.b) can be seen in Cavendish's general social indifference and seclusion. Such indifference led Wilson (1851) to characterise Cavendish as 'the coldest and most indifferent of mortals', even if his selfishness 'was entirely passive.' Davy (1839) also noted that Cavendish 'encouraged no intimacy with any one... He lived latterly the life of a solitary, came to the club dinner, and to the Royal Society, but received nobody at his own house.' Cavendish's awkwardness in contact and desire to avoid it is clear from these accounts.

AS is often distinguished from autism by the person's attempt to interact socially at some level, but it is marked by an inability to monitor this interaction appropriately. This was certainly true for Cavendish, for he is noted in several places for his clumsy approach to social interaction. This corresponds to the socially inappropriate behaviour of Gillberg's fourth interaction criterion 1.d. For example, Pepys recorded that during a social meeting of the Royal Society, he noticed 'an old gentleman in a complete (faded

violet) suit of clothes... very attentive to what I was describing. When I caught his eye he retired in great haste, but I soon found he was again listening near me' (Pepys cited in Wilson (1851)). Lord Brougham recollected the 'shrill cry [Cavendish] uttered as he shuffled quickly from room to room, seeming to be annoyed if looked at, but sometimes approaching to hear what was passing among others.' He further remembered that Cavendish would often 'leave the place where he was addressed, and leave it quickly, with a kind of cry or ejaculation, as if scared and disturbed' (Brougham, 1845). The oddity of Cavendish's behaviour explains why it struck his contemporaries in the Club. Perhaps the most remarkable of these anecdotes is reported by Thomson, who remembered Cavendish fleeing from a Dutch doctor: 'to all these high-flown speeches Mr. Cavendish answered not a word, but stood with his eyes cast down, quite abashed and confounded. At last, spying an opening in the crowd, he darted through it with all the speed of which he was master, nor did he stop till he reached his carriage, which drove him directly home' (Thomson, 1830).

5.2. Isolation

Interestingly, it is only Szatmari et al.'s (1989) scheme that emphasises social isolation as a diagnostic criterion. Otherwise it is explained by reference to impaired social interaction, the assumption being that unsuccessful interaction attempts, coupled with a natural tendency towards it, leads to seclusion.

Again, there is an abundance of evidence testifying to Cavendish's shy and reserved character. Jungnickel and McCormmach (1999) consequently decided that 'taciturnity, solitariness, and shyness' were Cavendish's predominant characteristics. His contemporaries commented particularly on his shyness, with Barrow (1849) particularly observing an 'extreme shyness in all his habits' and that Cavendish apparently 'consider[ed] himself as a solitary being in the world, and to feel himself unfit for society.' Brougham (1845) also noted that Cavendish was of 'a most reserved disposition and peculiarly shy habits.' After considering all of the sources available to him, Wilson (1851) pointed to Cavendish's 'dislike of publicity, and reserve and love of retirement which strongly characterised him.' Therefore, a preference for isolation was certainly a predominant characteristic of Cavendish. As a result, he did all he could to curtail social contact and, 'bidding the world farewell... and, like the Monks of old, shut himself up within his cell' (Wilson, 1851).

Cavendish's social isolation is particularly consistent with AS, especially when it is occasionally breached by rather unsuccessful attempts to mix in society (usually only in the context of the 'special interest'). This explains most satisfactorily why Cavendish only ever broke from his 'cell' to attend meetings of the Royal Society. He was certainly not known to mix socially anywhere else (apart from very occasional family christenings). His having AS is certainly a more likely reason for this than Jungnickel and McCormmach's (1996) rather odd claim that there was 'something chosen' about Cavendish's silence and reserve, 'like the trappists vow.'

Cavendish's extreme reserve extended even to his domestic staff. He left notes on the hall table at a designated hour so as not to have to communicate his meal requirements to his housekeeper, and he reputedly had a back staircase built in his Clapham house after an apparently distressing encounter with a housemaid on the stairs. It is further reflected by his refusal to have his portrait taken, hence William Alexander's sole surreptitious sketch whilst Cavendish was sitting at a dinner at the Royal Society (adding the coat and hat, which were hung up on a peg, to the sketch later). Certainly Cavendish's behaviour was marked enough to attract embellished comments both from those who knew him and those who had only just met him. For example, Brougham (1845)

claimed Cavendish ‘uttered fewer words in the course of his life than any man who ever lived to fourscore years, not at all excepting the monks of La Trappe’, and an Italian foreign visitor apparently described Cavendish as ‘a man so unsociable and cynical that he could stand honourably in the same tub with Diogenes.’¹ Unlike Cavendish, there was certainly something ‘chosen’ about Diogenes’ social curtailment, but it does at least convey the extreme unsociability that characterised Cavendish.

6. Regularity and routine

Gillberg stipulated a ‘compulsive need for introducing routines and interests’, which either affects every aspect of the individual’s life or which affects others, as his third criterion. Similarly, the second criterion of DSM-IV is a ‘restricted or repetitive and stereotyped pattern of behaviour, interests and activities.’ It has already been argued that Cavendish had an ‘encompassing preoccupation with one or more stereotyped and restricted patterns of interest.’ Although this is sufficient to meet the DSM-IV requirement, there is also evidence for the second option, the presence of ‘apparently inflexible adherence to specific, non-functional routines or rituals.’ In relation to the third and fourth options, there is little evidence for ‘stereotyped and repetitive motor mannerisms’ (although of course they could have been likely). But for the fourth it seems feasible that, given Cavendish’s intelligence and scientific interest, he is unlikely to have had a ‘persistent preoccupation with parts of objects.’ The last criterion relates to the weaker central coherence of autistic individuals, and a channeled concentration on particulars would no doubt have been helpful in a scientific context. However, without perceiving the problem in its wider context, Cavendish’s discoveries would have been far more limited than they actually were, suggesting his intelligence would have overcome a predisposition towards a weak central coherence.

It would certainly seem Cavendish lived his life by routine. After studying what relatively little information there is on Cavendish, Jungnickel and McCormmach (1996) concluded that Cavendish’s world was inhabited by ‘demons’ which he could only ‘subdue by imposing a vigilant orderliness on all phases of his life.’ They earlier referred to a ‘clock-wise regularity in all his transactions with life.’ This certainly seems an accurate reflection of Cavendish’s life. According to Wilson (1851), Cavendish took up residence in Cambridge in November 1749 and thereafter resided ‘very regularly and constantly until 23 February 1853.’ He then lived in strict accordance with routine until his death at 79, the age at which his father had died, and the age at which his younger brother was to die two years later. Wilson encapsulated Cavendish’s life as follows:

He insisted on the trivial routine of outward life, following a law as inflexible and imperative as that which rules the motions of the stars. He wore the same dress from year to year, taking no heed of the change in fashions. He calculated the advent of his tailor to make a new suit, as he would have done that of a comet, and consulted the almanac to discover when the artist should appear.

–Wilson (1851, p. 188).

If this adherence to routine arose as a result of AS, then it must be expected to influence all aspects of Cavendish’s life, rather than simply a slightly eccentric work pattern. This certainly seems to have been the case, with examples being seen in his domestic management, research style, dietary preference and exercise habits.

Jungnickel and McCormmach (1996) note that at Cambridge Cavendish would eat mutton five times a week. He also tended

to eat mutton at home in later life (he could afford much grander fare) and served mutton on the very rare occasions that he entertained. On one such occasion, when his housekeeper suggested a leg of mutton might not be sufficient to feed the four guests, he replied ‘then get two’. The choice of mutton reflects a continuation of his early preferences, rather than any indifference to hospitality or to miserliness.² Jungnickel and McCormmach (1996) note the changing composition of English meals under French influence from 1760, yet Cavendish ‘continued what he had known as the usual hospitality from his early years.’ As Wilson (1851) wrote, ‘The little peculiarities of his domestic affairs’ give ‘a singular consistency and unity to all the proceeding of its possessor.’ This consistency is very characteristic of AS. Even Cavendish’s daily walk around Clapham (deviating in neither the hour nor the route) attracted the attention of mystified locals. On becoming aware of this undesired attention, Cavendish was forced to take to walking at dusk, always down the middle of the road to avoid salutations, and on one report, 50 yards behind a girl instructed to light the way ahead and not to pay attention to Cavendish.

The rule of routine is further revealed in the trivialities of Cavendish’s life. When attending meetings at the Royal Society Club, Cavendish ‘hung up his hat invariably on the same peg’ and at his house Cavendish’s housekeeper told Wilson that Cavendish always placed his walking stick ‘in one of his boots, and always in the same one’ and that the boot itself would always be in the same place by the dining room door (Wilson, 1851). As indicated above, he even ordered new suits (always the same outdated style) in accordance with a regular time system, rather than according to their state. Even in acts of generosity Cavendish stuck to routine, dispensing ‘charity by a singular numerical rule’ (Wilson, 1851). In his research, Cavendish always reported every quantity of substance related to the experiment, even though they were often not of relevance. It would, according to Wilson, ‘apparently, have been painful to him to have experimented otherwise.’

Needless to say, Cavendish was not a man who changed residences easily. Unsurprisingly, the move from Hampstead to Clapham was ‘a particularly upsetting event in Cavendish’s well-ordered life’ (Jungnickel & McCormmach, 1996). It would appear that Blagden, acting as ‘the soul of order’, relieved Cavendish of many of the details and stresses of the upheaval. Even so, it still ‘left his scientific work in disarray.’ Clearly Cavendish was unable to disengage himself from the routine; most likely because of the calming influence routine imposes on the more detached mental life of the autistic person.

7. Speech and language peculiarities

An obvious point of departure from Gillberg’s criteria in the DSM-IV is the emphasis of *no* significant delay in language development (DSM-IV 4), whereas Gillberg suggested speech development may be delayed (4.a). In either case, because of a lack of information about Cavendish’s childhood, it is impossible to comment on the normality of his verbal development. Cavendish clearly did, however, have ‘odd prosody, peculiar voice characteristics’ (Gillberg 4.d) and, on at least one occasion, ‘impairment of comprehension including misinterpretations of literal or implied meanings’ 4.e but, given the available information, one cannot be sure about 4.b or 4.c. No reference to voice characteristics is made in DSM-IV, the concern being, as stated, in ensuring that a delayed language development is not characteristic.

² Gillberg noted that this phenomenon is common to those with AS, ‘Many people with autism spectrum disorder refuse to eat other than a very small number of dishes’ (Gillberg, 2002, p. 53).

¹ Marsilio Landriani (1788) cited in Jungnickel and McCormmach (1999, p. 307).

Evidence for peculiar voice characteristics is found in the accounts of at least three of Cavendish's contemporaries:

His speech was hesitating and excited, but he was very quick of comprehension.³

Cavendish was a great man, with extraordinary singularities. His voice was squeaking, his manner nervous.

-Davy (1839, vol. ii, p. 139).

...a hesitation or difficulty of speech, and a thin shrill voice. He entered diffidently into any conversation, and seemed to dislike being spoken to.

-Brougham (1845, p. 446).

There is also at least one good example of Cavendish misinterpreting a 'literal or implied meaning' (c.f. Gillberg 4.e), that took place in the apartments of Sir Humphrey Davy:

It was just before the subscription was entered into for the extended voltaic battery, and upon Davy expressing regret that he feared he should not obtain sufficient for the object, he [Cavendish] joined most truly in deploring the want of liberality in the patrons of science to carry it into effect. He did not seem to think he was called upon to take any active set to forward the desired object.

-Wilson (1851, p. 174).

The hint from Davy, as socially restrained as it might have been, should have been quite clear, particularly given Cavendish's wealth. True to AS form, it appears Cavendish completely overlooked Davy's implied meaning. Because Cavendish had made a generous (albeit prompted) donation to his librarian and a nurse at a christening, as well as making regular charitable donations, it surely could not be Cavendish's ungenerosity that left Davy disappointed. In this respect, certainly at least two of Gillberg's language peculiarities can be met but it is unclear whether 4.a, 4.b or 4.c are relevant in Cavendish's case. Whether 4.a is even relevant to AS generally is disputed by the DSM-IV.

8. Nonverbal communication and appearance

In order to satisfy Gillberg's fifth criterion (nonverbal communication), at least one of five symptoms must be manifested relating to: limited gesture, gauche body language, limited or inappropriate facial expression, and odd gaze. These are roughly equivalent to criterion 1.a of the DSM-IV. Cavendish's peculiar facial expression was often remarked on, usually in reference to his 'nervous disposition.' For example, 'his face was intelligent and mild, though, from the nervous irritation which he seemed to feel, the expression could hardly be called calm' (Brougham, 1845). His odd gait was also noted, a trait that is immediately evident from the one portrait ever drawn of him. Wilson (1851) recorded an account from one of the 'most accomplished chemists' of that day (although he does not say who): 'he came slouching in, one hand behind his back, and taking off his hat (which by the bye he always hung up on one particular peg).' Horace Walpole also wrote that an awkward gait was characteristic of the Cavendish family (which is interesting given milder symptoms of AS are often observed in relatives) when noting that a 'peculiar awkwardness of gait is universally seen in them.'⁴ Cavendish was also often remarked on for his peculiar dress sense, wearing invariably the fashion of the last century and always of the same style:

His dress was that of the gentleman of the preceding half century. The frilled shirt-wrist, the high coat collar, the cocked

hat... His appearance was, apart from his dress, nowise distinguished: of fair complexion, small, and not marked features, a feeble and somewhat hesitating voice.⁵

This rather misleading appearance though did not shield an eccentric fool, for, as Davy further noted, 'his conversation and queries denoted quickness and acuteness, and undiminished vigour of mind.'

9. Intelligence and ability

A view of classical autism (particularly routines carried out for no reason and very focused interests) can often have an undue influence on what AS is thought to be. It is very likely that the more intelligent the person, the more complex the circumscribed interest, the more advanced the meaning behind it and the stranger the inability to interact socially is in contrast. Cavendish was remarkably intelligent and this may well explain why his particular interest happened to be advanced scientific research, which itself is not surprising given that simpler 'folk physics' is often manifested in less intelligent or more severely affected autists (Baron-Cohen, 2000).

From the point of view of modern scientists, Cavendish is often praised on three counts: his achievements given the limitations of the times; the reports from his contemporaries (all of which were based exclusively on his published works); and his uncanny knack of knowing what was worth studying.

Regarding the first, Maxwell (1921) (editor of Cavendish's unpublished Electrical Papers in 1879) commented that Cavendish 'had a wonderful power of making correct observations, and getting accurate results with these somewhat clumsy instruments.' Jungnickel and McCormmach (1996) similarly marveled at what Cavendish was able to achieve with the 'instruments and concepts available to him.' McCormmach (2004), in his consideration of Cavendish's *Heat*, claimed it to be the 'only developed mechanical theory of heat from the 18th century' and showed that Cavendish was a 'subtle theorist' as well as an 'exacting experimenter.' His meticulous methodology and utmost precision in all his quantifications meant Cavendish invested significant effort in achieving the best degree of accuracy, often having to develop better instruments in the process.

It is remarkable that the praise Cavendish received from his contemporaries was based exclusively on what he published, whereas he is now just as famous for what he did not publish. Even so, the praise was great, Sir Thomas Young and Cuvier both paid testimony to the style and importance of Cavendish's work.⁶ Cuvier also compared him to the 'most austere anchorites' in his dedication to science, who were not 'more faithful to their vows' (cited by Jungnickel & McCormmach 1996). In his preface to the edition of Cavendish's unpublished papers, Thorpe (1921) declared that 'the 22 years that Cavendish devoted to chemical enquiry constitute indeed one of the most brilliant periods in the history of that science' and that Cavendish's personal discoveries were often 'it need hardly be stated, epoch-making.'

Cavendish has also developed a rather peculiar reputation for having known what was worth studying and for anticipating the work of later physicists. Thorpe's (1902) conclusion on Cavendish's papers was that 'in most of his work his trend of thought seems to have been straight towards the course of the subsequent progress of science.' This had also previously been noted by William Snow Harris, who commented that 'Mr. Cavendish had really anticipated

⁵ In a letter from Dr. Davy, April 9th 1850. Cited by Wilson (1851, p. 168).

⁶ He 'continued for almost 50 years to contribute to the *Philosophical Transactions* some of the most interesting and important papers that have ever appeared in that collection.' Young (1921), included as an Appendix to Thorpe (1921, p. 436).

³ Written in a letter from Pepys to Lord Burlington. Cited by Wilson (1851, p. 168).

⁴ Written in a letter from Walpole to Horace Mann, 4 June 1749. Cited by Jungnickel and McCormmach (1996, p. 9).

all those great facts in common electricity which were subsequently made known to the scientific world through the investigations and writings of the celebrated Coulomb and other philosophers' (cited in Jungnickel and McCormmach (1999)). This obviously reiterates the fact that Cavendish's fame would have been substantially greater if he had published more of his work.

10. Publication

Wilson (1851) observed that Cavendish 'allowed the larger part of them [his discoveries] to lie unused in his repositories' – such that his published papers 'give but an imperfect notion of the great extent of ground over which he traveled in the course of his investigations, and of the success with which he explored it.' The same is noted by Sir Joseph Lamor, 'careless though Cavendish was of scientific reputation, intent on pressing on to new solitary achievement, to the neglect of publication.'⁷ Various reasons have been suggested for this apparent reticence to publish. Perhaps most relevantly, criterion 1.c of the DSM-IV is a 'lack of spontaneous seeking to share enjoyment, interests, or achievements with other people.' Cavendish's relative lack of publication could certainly be attributable to such an absence of interest in sharing one's achievements. The point is supported by Thorpe (1921): 'He cared little for the judgment and opinion of his fellows and was wholly indifferent to scientific fame.' This certainly seems more feasible than Jungnickel and McCormmach's suggestion that Cavendish held back from publishing because of his views on the inadequacy of language. Fitzgerald, when considering Wittgenstein's similar reluctance to publish offered two further reasons relating to Wittgenstein's AS: 'his reluctance to publish work was likely because of a fear of hostile criticism, which is characteristic of patients with depression' and, 'his perfectionism probably also meant that he could only publish one book in his life although he had written many' (Fitzgerald, 2004).

Thus, a lack of concern with sharing his discoveries, an autistic perfectionist streak and a desire to avoid criticism, which are all consistent with AS, might explain why Cavendish allowed this 'voluminous, embarrassment of riches' (Jungnickel & McCormmach, 1996) to remain hidden from the public eye. It also appears that Cavendish held little interest in the final literary preparations required prior to publication.

11. Cavendish the 'quantifier'

In line with what one would expect with AS, Cavendish has also typically been characterised as a 'quantifier':

Whenever we catch sight of him we find him with his measuring-rod and balance, his graduated jar, thermometer, barometer, and table of logarithms... [Cavendish] required that every phenomenon and physical force should be held to be governed by law and admit of expression in mathematical or arithmetical symbols...

... His theory of the universe seems to have been, that it consisted *solely* of a multitude of objects which could be weighed, numbered, and measured; and the vocation to which he considered himself called was, to weigh, number, and measure as many of these objects as his allotted three-score years and 10 would permit.

-Wilson (1851, p. 187).

This 'quantifying' tendency is particularly relevant as one of the prevailing theories of autism suggests that order (in this case through quantification) is imposed on the subject's life to establish

rule and routine, thus making an otherwise confused and detached mental life less distressing. This was certainly obvious to Wilson over a hundred and fifty years ago when he commented that Cavendish:

In the Microcosm of his own nature... tried to reflect and repeat the subjection to inflexible rule, and the necessitated harmony, which are the appointed conditions of the Macrocosm of God's Universe.

-Wilson (1851, p. 187).

However, as indicated above, Cavendish did not confine his keen eye for error to the 'general features'. In fact 'everything pertaining to it, to which a quantitative value could be attached, was set down in figures, before it went forth to the scientific world, with its passport signed and sealed' (Wilson, 1851). This certainly reflects an avowedly close adherence to quantification and discovering rule. Given what is outlined above regarding the importance of routine to Cavendish, and to AS sufferers in general, it is hardly surprising that this very concrete approach 'seemed to give him some deep psychological satisfaction' (Aykroyd, 1935), such that 'it seem[ed], indeed, to have been impossible for Cavendish to investigate any question otherwise than quantitatively' (Wilson, 1851). This is certainly very much in keeping with what one would expect in AS, and reflects well the DSM-IV's specification of an 'apparently inflexible adherence to specific, non-functional routines or rituals' (DSM-IV 2.b. See also Gillberg 2.b). It should be noted, however, that Cavendish would not have made the discoveries he had by rote experimentation alone, and he is thus often now praised for being both a subtle theorist and an exacting experimenter (e.g., McCormmach, 2004).

12. Cavendish and women

Cavendish never married; nor indeed does he appear to have had any (even remotely) close contact with women. It is certainly characteristic of males with AS that they find it difficult to mix with females – not unexpectedly considering the difficulty they have even with other males. It is clear that Cavendish could not abide being disturbed at home, especially by women. Lord Burlington and Lord Brougham both told Wilson that any maid who showed herself to Cavendish was to be dismissed. It is hardly surprising then that Cavendish was 'reported among his contemporaries, indeed, to have a positive dislike of women' (Wilson, 1851). This is certainly the impression Aykroyd (1935) seems to have formed, noting that that Cavendish 'shunned the female sex as circumspectly as a fourth century hermit.'

13. Conclusions

The information available on Cavendish appears to be consistent with AS. Perhaps it may be suggested that he had a more classical form of autism, but this seems unlikely given Cavendish's intelligence, language abilities, achievements, and attempts to interact in social situations. It might also be claimed that he simply had some of the cognitive traits of AS, without having the full syndrome (and therefore being disposed towards creativity without being hampered by the actual clinical disorder); but, again, the evidence points the other way. Nonetheless, it is worth stressing that the length of time since Cavendish's death and the limited information on him make this only a hypothesis, rather than a statement claimed with certainty.

In the absence of relevant information, Gillberg's criterion 6 (motor clumsiness) has been omitted. It is also interesting to consider the influence of variations in intelligence on this and the other diagnostic schemes, for certainly Cavendish's intelligence

⁷ Sir Joseph Lamor, cited in Thorpe (1921, p. vii).

make the more basic criteria (e.g., Gillberg 2.c) less relevant. Cavendish's social position also seems to have mitigated the consequences of his syndrome at a time when AS was not understood.

It seems likely that Cavendish having AS was a doubled edged sword. On the one hand, it allowed a blinkered, completely dedicated and successful life of research in natural philosophy. On the other hand, it stunted his social side, leaving him to follow a life of isolated seclusion. Certainly this was a problem for Wilson, interpreting Cavendish from a Victorian ideal of man and science. However, from a more tolerant perspective, that Cavendish was predisposed towards solitary work rather than social activity was by no means a bad thing, and one that modern science has much to thank him for.

Appendix A. Diagnostic criteria for Asperger's syndrome

A.1. Gillberg and Gillberg (1989) and Gillberg (1991)

- (1) *Social impairment* (extreme egocentricity) (at least two of the following):
 - (a) Difficulties interacting with peers
 - (b) Indifference to peer contacts
 - (c) Difficulties interpreting social cues
 - (d) Socially and emotionally inappropriate behaviour
- (2) *Narrow interest* (at least one of the following):
 - (a) Exclusion of other activities
 - (b) Repetitive adherence
 - (c) More rote than meaning
- (3) *Compulsive need for introducing routines and interests* (at least one of the following):
 - (a) Which affects the individual's every aspect of everyday life
 - (b) Which affects others
- (4) *Speech and language peculiarities* (at least three of the following):
 - (a) Delayed speech development
 - (b) Superficially perfect expressive language
 - (c) Formal pedantic language
 - (d) Odd prosody, peculiar voice characteristics
 - (e) Impairment of comprehension including misinterpretation of literal/implied meanings
- (5) *Nonverbal communication problems* (at least one of the following):
 - (a) Limited use of gestures
 - (b) Clumsy/gauche body language
 - (c) Limited facial expression
 - (d) Inappropriate expression
 - (e) Peculiar, stiff gaze
- (6) *Motor clumsiness*
Poor performance in neurodevelopmental test.

A.2. DSM-IV (source: APA, 1994)

299.80 Asperger's disorder

- (A) Qualitative impairment in social interaction, as manifested by at least two of the following:
 - (1) marked impairment in the use of multiple nonverbal behaviours, such as eye-to-eye gaze, facial expression, body postures, 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.
- (B) Restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities, as manifested by at least one 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, non-functional 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.
- (C) The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.
- (D) There is no clinically significant general delay in language (e.g., single words used by age two years, communicative phrases used by age three years).
- (E) There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behaviour (other than in social interaction), and curiosity about the environment in childhood.
- (F) Criteria are not met for another specific pervasive developmental disorder or schizophrenia.

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