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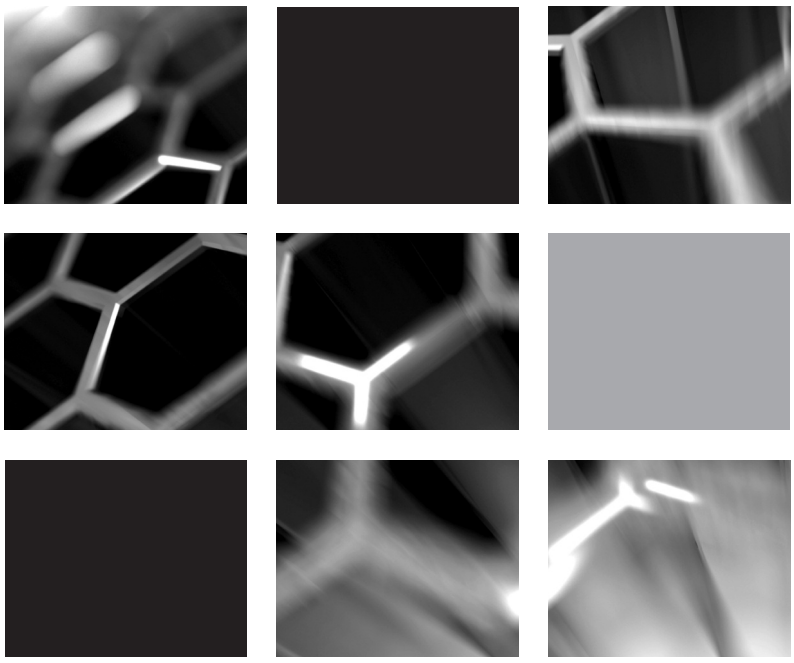

**Published in partnership with The University of Birmingham autism.west midlands and Autism Cymru**

# Designing learning spaces for children on the autism spectrum

**Iain Scott,** Edinburgh

**Editorial comment**
Iain Scott is an architect and in this paper he sets out the key criteria which need to be borne in mind when designing learning environments for children on the autism spectrum. He illustrates these points by looking in detail at four newly created units and schools. It is a very rich paper and will be a great asset to architects, designers, teaching staff and pupils involved in creating effective spaces where children feel comfortable and within which they enhance their learning potential.

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**Acknowledgements**
The author would like to thank all the staff and architects involved in the work at the New Struan School in Scotland, at Netley School in Camden, at the Mossbrook Unit in Sheffield and at Whitton Gateway in Richmond, for their permission to use the photos and for their comments on the environments they have designed.

## Introduction

When designing areas for children on the autism spectrum, it is important to have knowledge and understanding of how they experience the environment and the people and objects within it. Both Bogdashina (2003) and Hinder (2004) describe very well the potential sensory differences in perception, processing and responses. It is also important to know that not all children are affected in the same way or to the same extent. Whilst many children are capable of learning within mainstream environments, some children require a more bespoke and tailored setting (DfEE, 2005).

Increasing attention is being paid to the design of classrooms, units and schools and this, and so local authorities (LAs) and their appointed architects are being faced with the challenge of designing appropriate learning environments for these children.

This paper reports on a study undertaken by the author, into how architects research and respond to these challenges. In the first section, the paper examines the existing body of knowledge to ascertain what relevant criteria exist with respect to designing for autism. This includes published statutory guidance, books, research publications, journal articles, feasibility studies, web-based and anecdotal information. In the second section, the paper presents an analysis of four recently completed buildings for children on the autism spectrum in relation to the body of knowledge examined. Each of these units was visited and interviews were held with the architect and end users. The architects provided drawings, images, briefing notes and design analysis to allow a broad appreciation of the design and its specific response to autism.

Finally, the paper ends with key recommendations for professionals engaged in the provision and design of autism-specific learning environments.

The four units studied were as follows:

- New Struan, Alloa, Scotland
- Netley Primary School ASD Unit, Camden LA, London
- Whitton School ASD Unit, Twickenham, Richmond LA
- Mossbrook Special Primary School, Norton, Sheffield

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**Image: GA Architects**

**Image: Sarah Wigglesworh Architects**

## Review of the literature

A complete list of all of the material examined is listed in the references. In this section, each piece of design guidance in relation to the autism spectrum will be examined, establishing its source and its specificity and relevance in relation to autism. 'Autism specificity' is used here to identify issues in design which are specific to the autism spectrum. The key document in relation to published statutory guidance is Building Bulletin (BB) 77, *Designing for People with Special Educational Needs and Disabilities in Schools*, (updated 2005), published by the Department for Education and Employment.

It contains the following points in relation to designing educational spaces for children with autism:

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1 The building should have a simple layout which reflects order, calm, clarity and has good signage and way-finding.
2 Pupils may show different sensitivities to spaces: some will be frightened by large, open spaces and wish to withdraw to smaller spaces, whilst others will not like enclosed spaces. Providing a mix of larger spaces with smaller ones to withdraw to when anxious can help.
3 Designing low sensory-stimulus environments reduces sensory overload, stress and anxiety.
4 The provision of pleasant, well-proportioned space, with plain, bare walls decorated in muted soft colours will allow teachers to introduce stimulus, (such as wall displays of work or information), gradually to suit pupils needs.
5 Classrooms can be arranged so that teachers may employ different teaching methods, with spaces for individual work or screened personal work-spaces.
6 Use of indirect lighting and the avoidance of noise or other distractions, (blind cords, exposed pipes or dominant views out), need to be considered.
7 Containment in the class base for reasons of supervision, safety or security by the use of two door handles, at high and low-level, must neither compromise escape procedures, nor violate human rights, (in that children must not be locked up unless they are secured or detained legally in secure provision).
8 Robust materials should be used where there are pupils with severe disabilities and safety precautions for doors, windows, glass, plaster and piped or wired services will be required.
9 There is a need to balance security and independence and to find the right mix between tough materials and special equipment on the one hand and ordinary, everyday items on the other, in order to avoid an institutional appearance, whilst at the same time eliminating risks.
10 Simple or reduced detailing and changes of plane may reduce the opportunity for obsessiveness.'

(BB 77: DfEE, 2005 Section 2.3.2).

A further, practice-based source is Simon Humphreys, an architect with a wide range of experience in designing for autism, including designing a home for his brother who has autism. He produced a short paper in 2005 which relays the principles he feels are specific to designing for autism. He seems to accord with all of the points listed above, with one or two significant additions:

- Good levels of natural light and ventilation.
- Proxemics:

  *'Proxemics deals with the amount of space people feel it necessary to set between them-selves. Proximity is the condition of being near or close. Proxemics can also be termed as personal space around the body. A person with ASD can be more guarded about this space and any infringement is seen as a personal threat. They need more space.'* (Humphreys, 2005).

- Good Observation. Relates to BB 77, 9, above.

  *'It is useful to be able to observe the movements of people with ASD, without them feeling constantly*

*under surveillance … Good observation will put the carer at rest, which will help their well-being and can only benefit the person with ASD.'* (Humphreys, 2005).

Another source is *Designing for Special Needs*, (Harker and King, 2002) published by RIBA Enterprises, which contains a section on 'Autism and Design', which focused largely on service provision. In relaying autism-specific design features it quotes Humphreys.

Drawing from the body of knowledge, key issues in designing for autism seem to be:

## A The requirement to provide an ordered and comprehensible spatial structure

Whilst desirable for all school environments:

*'legible routes are especially important to those who are visually impaired or those SEN pupils for whom research shows that predictability is important. Circulation should make efficient use of available area and where appropriate there should be overlap between circulation and social or study space.'* (BB 95: Schools for the Future: DfEE, 2002).

This requirement to design circulation with a sense of place and function over and above that of movement is developed by Whitehurst (2006) in an analysis of GA Architects design for residential accommodation at Sunfield School.

*'Circulation space – This banishes the conventional corridor by turning it into a useable space in its own right with access through double doors to the central courtyard. This effectively 'breaks the mould' of the institutional approach to accommodation facilities and creates a space which can be utilised, especially for play,'* (Whitehurst, p 4)

It is thus important that all visual cues, colour schemes, different qualities of light, texture changes are used to support the spatial hierarchy rather than confuse it.

Humphreys (2005) makes the point that people on the autism spectrum require more personal space around them. Class sizes in relation to available space should reflect this.

## B The requirement to provide a mix of large and small spaces

*'Support spaces are small spaces for teachers and other professionals to work with individuals or small groups … This is particularly true for those with special needs for whom the crucial relationship between student and teacher – that inspires and nurtures learning – cannot always work in public or even in small groups. Pupils with special needs require assistance from a number of people in addition to their teachers including parents and health and social care professionals. Small spaces are also valuable for counselling and mentoring sessions.'*

Furthermore,

*'Quiet time needs to be a natural part of the educational environment and there are times when an open resource and work area are not appropriate. … Pupils need to be able to work undisturbed in a quiet place, but not feel separated from the main school.'* (BB 95: 2003, section 2.a4).

Much is made by educational psychologists of the requirement for a withdrawal space, which has a calming, therapeutic atmosphere for children on the autism spectrum. It is important that this space, whilst autonomous, remains within the social fabric of the classroom and can also function as an individualised teaching space.

Jim Taylor, the headteacher at Struan School, said:

*'At one point the architects had proposed a withdrawal room or 'snoozelin', where a child could withdraw and calm down if things got too much. We rejected that as we felt that would have been a failing in itself. We wanted the children to have the opportunity to withdraw, but still remain within the social fabric of the school and the building allows for that.'*

## C The requirement to provide greater control of the environmental conditions to the user

*'Designing low sensory stimulus environments reduces sensory overload, stress and anxiety.'* (BB 77: 2005, section 2.3.2)

This comment requires some debate. Haverstock Associates carried out an extensive feasibility study for Camden LEA prior to being commissioned to design Netley School's ASD unit. This is a non-site specific, but extremely comprehensive, document which includes records of meetings and consultations with educational psychologists, teachers and other education professionals from various education authorities.

John Jenkins, Principal with Haverstock Associates states:

> *'What we have found is that people take a very negative view in design terms about how you resolve some of the issues that autistic kids may have. We have had scenarios where consultants have raised the issue of the kid's distract-ability and proposed as a solution having only high level windows. Colour is potentially an issue, so do you take colour out and make a magnolia world? Glare is an issue. Do you reduce the number of windows? This all leads to a very negative approach to design.'*

Haverstock Associates, as a practice, apply the same rules that they would in designing classrooms for mainstream children. They design high quality, diverse environments with sensitivity to 'high stimulating' issues such as colour and day-lighting. Colours do tend to be chosen from a neutral palette, allowing teachers and children to add to this in the form of work displays. The practice has been conducting research into the impact of colour on children with autism, which draws on the previous work of Pauli, Egerton and Carpenter (2006), Prashnig (2004) and Ludlow, Wilkins and Heaton (2006).

> *'I think it's about the balance between creating as diverse an environment as possible, that isn't over-stimulating and providing a space that children can feel safe and comfortable in. There are times when the teachers need to be able to close things down a bit, so we need to allow that flexibility. In any of the units we're doing now we actually have integral blinds within the double glazed units and its a very particular item of specification.'*

(John Jenkins: Haverstock Associates)

## D The requirement to accommodate different, 'autism specific' teaching methods

> *'I think in pictures. Words are like a second language to me. I translate both spoken and written words into full colour movies, complete with sound, which run like a VCR tape in my head. When somebody speaks to me, his words are instantly translated into pictures … One of the most profound mysteries of autism has been the remarkable ability of most autistic people to excel at visual, spatial skills while performing so poorly at verbal skills."* (Grandin, 1995, p 1)

Children on the autism spectrum appear to learn differently from mainstream children and special, visual teaching styles have emerged to take account of this: TEACCH, PECS, and ABA, among others. The TEACCH approach requires structured classroom layouts, PECS uses objects, pictures and symbols to enable children to communicate their needs and ABA programmes also require the 'setting-up' of environments in a particular way. Clearly classrooms need to be capable of being adapted to the different approaches, without compromising the need for order and clarity. Some understanding of the nature of the different approaches on the part of the designer would be an advantage to allow them to innovate in terms of the best way this can be achieved.

Whitehurst (2006) explains how at Sunfield:

> *'Children living in the new house operate on different communication levels. Some work with symbols, some with photographs and some with "objects of reference".'*

She then comments on the desire to:

> *'incorporate these communication approaches into the fabric of the building. Carpet tiles were mounted in frames outside the bedrooms so that students could have their name, photo and any symbols required placed onto the carpet squares.'*

Woolgrove School Autism Base in Hertfordshire teaches a curriculum based on five points, three of which are as follows:

- Presenting information visually as well as orally
- Relating learning to first-hand experience
- Providing practical apparatus to help concept information. (Tutt and Cook, 2000).

The National Curriculum remains a framework in most schools, however its application has become broader and more flexible. At Mossbrook School in Sheffield, Heather Wood, the head of science states:

> *'Although we teach the National Curriculum, we teach it in a very, individualised way. Science is taught through a demonstration of the physical phenomena in the world. It's a very practical application of learning.'*

As Young (2004) argues: 'This different way of teaching means that teachers are really using the environment as a teaching tool.' It would seem an exciting challenge for architects to consider the environments they create to be potential 'learning

tools' for children who learn best from the world around them.

## E The need to balance security and independence

Children on the autism spectrum are more vulnerable than mainstream children and are often unaware of the dangers of the world beyond its given limits. Humphreys' point about the importance of good lines of observation is paramount for the well-being of staff as well as children.

As Whitehurst (2006) argues:

> *'Having space within which children can be autonomous, with safe levels of unobtrusive monitoring has encouraged a level of social interaction which staff had not witnessed before. Having individual space means a child can make a choice to be alone or to interact.'*

The need to provide security also needs to be balanced with the requirement to provide access to the outside. Outside space can provide a stimulating alternative learning environment for all ages and is an important part of broadening the educational experience.

Pitmore Special School in Eastleigh, Hampshire is a school for children with behavioural and emotional problems. The garden at the school is used as an alternative to the classroom and is a therapeutic method of releasing stress and frustration. At Sunfield, Whitehurst (2006) comments on how the internal courtyard has had a positive effect on the children who live there, She says:

> *'For many of the children having safe, accessible, out-door play has increased their levels of autonomy and decreased their frustration.'*

Indeed, whilst a secure out-of-doors environment is desirable for all children, it is particularly pertinent to children on the autism spectrum. Daily Life Therapy, pioneered at the Higashi school in Japan, places great emphasis on the importance of physical exercise throughout the teaching day with classroom activities structured in between.

All of the units studied in this paper considered the siting of the building and it's relationship to a secure external environment to be of paramount importance. Clearly the opportunity exists for architects to design the external environment also as a learning tool, with a distinct relationship to the internal, classroom environment.

## F The need to provide simple and reduced detailing

Simon Humphreys advocates a broad, bold detailing approach with a limited palate of materials. This includes the need to provide a simple colour scheme.

## G The requirement for the end-user to be actively involved in the brief building and design process

> *'Users should be consulted throughout the project. The brief should be developed by all parties. All parties should work as a team towards a common goal.' (BB 95: 2002, p 60).*

John Jenkins maintains that it's absolutely crucial that somehow the end users are involved in the brief – building process. He argues that it is key that the end users are buying into the design, so they have some responsibility. Furthermore, Christopher Beaver of GA Architects emphasises the importance of the 'feedback study', which they carry out once the building has been occupied for six months.

## H Appropriate use of technology to aid the autistic learning experience

Plimley (2004) notes that all students designing a virtual environment chose to have electrical/computer items within their design. Computers and 'game-boys' do seem to be popular with children on the autism spectrum.

At Mossbrook School, the architects employed a technological artist, Susan Collins. She worked with the architects to devise an innovative approach to the integration of technology as part of the learning experience and also as a way of creating a connection to the world outside the classroom, as a vehicle for learning.

Employed in an imaginative way, ICT can open up a raft of new and enhanced learning opportunities. The challenge for architects once again is to consider how this technology can be innovatively integrated as part of the learning experience.

## I Technical specification

Some of the points contained in both BB 77 and in the article by Humphreys would appear not to be 'autism-specific' in nature and not capable of being applied

specifically to designs for this group. Many of the points listed, (6, 7 and 8 above), are to be found in BB 95; Schools for The Future, Designs for Learning Communities, DfES: 2002. Section 2.B of the document contains guidance on lighting (2.b1); acoustics (2.b2); heating, ventilation and water (2.b3); finishes, fixtures and landscape (2.b4); furniture (2.b5); and access/security (2.c2). This accords with, and develops on, similar guidance given in BB 77 and by Humphreys. The National Autistic Society has produced a set of architect's briefing notes which contain detailed information on preferred points of technical specification in relation to designing for autism.

John Jenkins of Haverstock Associates makes the point that if these and other design issues are not well considered by the architect they will have an increased detrimental effect on the ability of a child on the autism spectrum to learn. He says:

> *'Mainstream children are probably more 'able to cope' with badly designed spaces than an autistic child would be. So the responsibility to create a 'good' environment is brought into sharp relief.'*

## Summary of design criteria

A The requirement to provide an ordered and comprehensible, spatial structure
B The requirement to provide a mix of large and small spaces
C The requirement to provide increased control of the environmental conditions to the user
D The requirement to provide for different, autism-specific teaching methods
E The need to balance security and independence
F The need to provide simple and reduced detailing
G The requirement for the end user to be actively involved in the brief-building and design process
H Appropriate use of technology to aid the learning experience
I Appropriate technical specification

The second part of this paper analyses four environments which were built specifically for children on the autism spectrum. This assesses the extent to which the criteria above have been addressed.

The analysis will be conducted under the headings A-I, which form the summary of design criteria.

## Case studies

### 1 New Struan – Aitken Turnbull Architecture

**Image 1: The New Struan, Alloa**


New Struan is an independent school run by the Scottish Society for Autism. The building also functions nationally as an Autism Centre encompassing other functions including an autism advisory service, a centre for education and training in autism, an education outreach service and a research, diagnosis and assessment Centre.

A The plan of the building is an upside down 'T' shape, with the 'front of house' activities or public realm of the Scottish Society for Autism contained in the horizontal section of the 'T', which runs east to west. This includes reception, café and training rooms. Diagnosis and assessment are then contained within the spine of the 'T', beyond a set of secure doors. The spine runs north to south and contains a single storey atrium space of circulation with classrooms either side looking east and west into external play areas which are secure. The atrium is the 'social heart' of the school and is a powerful orientation device (see *Image 2*).

**Image 2: Atrium circulation**

The classrooms are integrated with the atrium space by threshold spaces or 'lay-bys', which are personalised and allow the children to assimilate the environmental and spatial change from the atrium space to the classroom. (see *Image 3*).

> *'The interface between the internal street and the classrooms is particularly interesting. Many autistic children have a fear of 'difference', including spatial or environmental difference, so thresholds can often feel threatening. The anterooms smooth the transition between the play space represented by the street and the teaching zone found in the classroom'.* (Andrew Lester, Aitken Turnbull Architecture).

**Image 3: Classroom threshold space**

Semi-public areas such as the dining room and library occur along the length of the 'street' and are open to it to allow children to orientate themselves. The atrium is filled with the children's paintings of the school making the space feel personalised as opposed to institutional (see *Image 4*).

**Image 4: Child's painting of the school**

**B** The classrooms are smaller than would typically be the case, accommodating a maximum of up to six children. They also incorporate a 'one-to-one' space for individual or small group tuition (see *Image 5*). These are visually connected to the classroom through glazed panels. In this way a child can receive individual tuition without feeling removed from the social structure of the group.

**Image 5: Individual tuition space**
**Credit: Aitken Turnbull Architecture**

The classroom threshold spaces discussed above also help to bring down the scale of the main, atrium space and can be used for small-group activities.

**C** The classroom section incorporates clerestorey lighting, with a brise-soleil, (see *Image 6*), which diffuses direct sunlight, throwing it up onto the ceiling. The windows and doors below this have opaque blinds, which can be manually operated. The system of artificial lighting mimics the source of natural light by throwing light up onto the ceiling in the same way, from above the clerestorey sunbreak.

**Image 6: Architect's image of typical classroom incorporating brise-soleil**
**Credit: Aitken Turnbull**

**D** The classrooms are structured around the individual with each child having their own structured workstation along the two side walls of the space (see *Image 7*). Nearer the window, tables provide for circular, group activities. Pinboard space is maximised as many autism-specific teaching methods employ visual cues.

**Image 7: Individual workstations**
**Credit: Aitken Turnbull Architecture**

**E** The school activities contained within the spine of the 'T' are separate from the more public activities of the Society and can only be accessed through a set of secure doors, which can not be operated by the children. The classrooms are either side of the atrium and have a window wall which provides an unobstructed view into the external play areas on either side. These play areas are completely secure and can be accessed directly from the classroom (see *Image 6*). Windows are electronically operated by staff to increase security.

**F** The classroom is designed to be muted in colour, allowing teachers to add stimuli as required. (see Image 7). Finishes such as carpets and wall colours are clearly coded to support the spatial hierarchy. The architects have chosen muted 'earth' colours. The atrium walls are neutral, allowing the children's paintings to personalise the space (see *Image 4*).

**G** The brief for the building evolved through a dialogue between architect and client, including proposed school staff. Visits were carried out to existing learning environments for children on the autism spectrum to discover the problems to be avoided in designing a bespoke facility. The design then evolved through a suggestion and appraisal of ideas by architects and staff. The personal experience of Andrew Lester as the father of a child with autism was considered invaluable. The end user, The Scottish Society for Autism, was extremely pleased with all aspects of the finished building in use for the school and the Society. It should be noted that the end user was extensively involved in every aspect of the design process from beginning to end.

**H** Computers are sited at each work station to allow pupils access to ICT. (see *Image 7*). The school library also incorporates a great deal of information technology.

**I** All artificial lighting has high frequency ballast and dimming control. Also classrooms are sound insulated to a very high standard (150 mm dense concrete masonry wall, with 19 mm thick dense plaster either side).

Finishes and furniture are designed to be hard wearing, with water-based paints and sealants to reduce the building's toxicity. Under-floor heating is used to negate direct heat sources. The building does not utilise auditory signals.

**2 Netley Primary ASD Unit – Haverstock Associates**

**Image 8: Courtyard at Netley**

Netley ASD Unit is a specialist facility for autism built within the existing grounds of Netley Primary School.

**A** The unit accommodates two teaching spaces and a multi-purpose therapy room in addition to a staff office, toilets and storage areas, in a single storey design. The building also accommodates an adult education unit. This includes a crèche, which is used by Camden LEA as a community facility.

The classrooms are accessed through a private courtyard (see *Image 8*), entered from an electronically operated gate, whilst the adult unit is accessed separately from the street (see *Image 9*).

**Image 9: Entrance from William Street**

The site issues were extremely tight with the architects settling on an 'L-shaped' plan, which retains exclusive private courtyard space for the unit, backed up against an existing corner of the main school building.

The two teaching spaces are separated by an entrance lobby which makes use of curves to 'break the mould' of a rectilinear institutional space. This detail echoes the baffled walls to the courtyard of the adult education unit (see *Image 10*)

The classrooms have more space per child than would typically be the case as John Jenkins argues, *' these kids need a bit of elbow room'*.

**Image 10: Entrance to unit**

**B** The classrooms are designed as 3D spaces with different areas defined in plan and section to create diversity within a single space. Both classrooms incorporate a 'one-to-one' or withdrawal space and a separate wet-room area (see *Image 11*).

**Image 11: Classroom space**

Given that the brief for Netley is for two teaching spaces only, it would be unrealistic to expect a greater mix of spaces over and above this.

**C** Both classrooms have extensive, floor to ceiling windows providing good daylight and views to the courtyard. Roof lights to the rear of each classroom provide additional day-lighting and ventilation (see *Image 12*).

**Image 12: Roof lighting to classroom**

The extensive windows to the courtyard were seen by staff as providing too much daylight and visual distraction. As a result the staff have placed opaque paper over the windows, creating an overly internalised environment. The architects have now proposed integral blinds to subsequent units for children on the autism spectrum to allow staff greater control.

**D** The classrooms maximise pinboard space to allow the staff and pupils to introduce their own stimuli. Also the one-to-one space is extensively used to employ different teaching methods like TEACCH and PECS, as the main space can provide many distractions. Pupils' workstations were not 'built-in' to the space in the belief that this would allow

the teaching staff greater flexibility (see *Images 11 and 12*). This was felt by staff to contribute to a lack of order in the teaching environment.

**E** The entrance to the unit, being through a private courtyard is completely secure. The courtyard can only be accessed through an intercom and CCTV system on William Street. The entry systems for the two separate functions of the building are kept entirely separate (see *Image 9*).The extensive window walls to both classrooms provide good views to the courtyard for children and staff (for reasons of supervision). (see *Image 10*).

**F** The classrooms are muted, with neutral colours to both walls and floors. The exception to this is the entrance hall, where the architects have employed colour and used a curved, green wall to create a more welcoming but calm atmosphere (see *Image 13*).

**Image 13: View from classroom to entrance hall**

Research has shown the colour green to have a typically calming effect on people on the autism spectrum (Pauli, Egerton and Carpenter, 1999–2000).

**G** Haverstock Associates were commissioned by Camden LEA in 2000, to carry out a generic feasibility study into autism provision on behalf of the local authority. In addition to the records of meetings with Camden LEA this document contained

- Records of visits to existing ASD Units
- Extensive list of source information (National Autistic Society briefing documents, brochures for existing ASD Units)
- Records of telephone conversations with other LEAs
- Outline brief for proposed autism units
- Clearly defined objectives and client requirements

Subsequent to this, Haverstock Associates were commissioned to carry out the design of the unit at Netley. As stated above, the lack of involvement of the end user teaching staff has led to some conflict between the way the building is used and the way it was intended to be used.

**H** Whilst computers are used in the classrooms at Netley they did not seem to be employed in a way that was specific to the autism learning experience.

**I** Haverstock Associates pursue a green agenda with all buildings and this is reflected in the buildings use of water-based paints and non-toxic materials.

Both classrooms have extensive built in storage areas, which can be completely closed off from the teaching space.

The positioning of some of the ironmongery which could be operated by the children was seen by the teaching staff as presenting a security risk. Staff also said they would like to have greater control over levels of day-lighting within the classroom environment.

## 3 Whitton Gateway ASD Unit, Whitton School, Percy Road, Twickenham, London

**Image 14: Whitton Gateway**
**Credit: GA Architects**

'Whitton Gateway' ASD Unit is a specialist facility for secondary children on the autism spectrum. The unit is situated within the grounds of the existing campus of a school and also doubles up as a school community facility (see *Image 14*).

**A** Whitton is a large school with many buildings in its grounds and the site given to the architects was extremely tight in relation to the brief. The unit is in a corner of the school grounds very remote from the entrance so the architects created a separate

access which allows the children to be dropped off discretely at the door, rather than being taken through the busy playground in the morning and evening. The building in a sense turns its back on the existing school and is intended to be inward looking, private and discrete, with a desire by the architects to create some secluded green space for the children of the unit. The separate access is doubly important as the school governors wished the building to serve as a community facility outside of school hours. The notion of community was developed by the architects from the idea that the circulation space of the unit would not be just a corridor but would be the main social space and 'heart' of the building (see *Image 15*).

**Image 15: Circular court space. School opening with National Autistic Society President, Jane Asher**
**Credit: GA Architects**

This has resulted in a circular 'assembly' or court space. (see **Image 16**). All but one of the classrooms open directly into this court, which also is connected to the library and external green space. The space is well lit by picture and clerestorey windows and is designed to be calming and non-institutional.

**Image 16: Window to circular court**

The circle is a strong platonic geometry and provides a powerful orientation device. The short circulation space which leads from the entrance to the court is also designed to feel non-institutional, using curved walls and is 2 m wide.

**Image 17: main circulation space**

The unit library provides the link between the main circulation space (see *Image 17*) and the court, resulting in an extremely strong spatial hierarchy.

B As explained above the key communal spaces are generous and are capable of being used for functions over and above circulation. Furthermore all of the classrooms are considerably larger than would be the case for mainstream children, with a classroom average of 4–5m$^2$ per child for up to eight children, rather than 2–3m$^2$ for classrooms of 25–34 children. Classrooms are also designed to be clutter-free with generous integral storage.

**Image 18: Classroom picture window**

Each are well lit by a 'picture' window wall (see *Image 18*), which looks into and provides access to the private green space. The classrooms do not incorporate a one to one space within themselves however, which would be useful for undisturbed one to one working.

**C** All picture windows to classrooms and the main court space have internal blinds to allow teaching staff to diffuse sunlight as required. These may however be susceptible to interference by the children. Artificial lighting has dimming control, which can be operated by the staff to adjust lighting levels as required.

**D** Classrooms have extensive use of pin-board space for visual cues. One classroom was capable of being sub-divided by the use of a built in sliding screen which allowed more flexibility to that particular space.

**E** All but one of the classrooms has good visual links to the private, external play space around two sides of the building. The external space has an extensive CCTV system utilised for security and monitoring. Also the site is next to a busy road and so has a 2 metre high reflective acoustic fence around the two exposed sides of the building.

The internal court space also operates as a spill out zone for children who need to take time out from classroom activity. Windows all have electronic, magnetic locking devices so they can not be operated by the children.

**F** The building has a muted colour scheme which supports the spatial hierarchy utilising both green and blue colours which research shows to be calming. The building's materials and surfaces are robust. Walls are block-work and plaster, with an extremely hard-wearing cord carpet on the floor. All paints and adhesives are non-toxic and water-based.

**G** The scheme design of the unit was carried out by London Borough of Richmond, Principal Architect, Malcolm Nixon. The detail design was then taken through the building warrant stage and beyond by GA Architects, who were employed by Richmond Council on the basis of their detailed knowledge of design for autism.

Malcolm Nixon researched two, bespoke autism units, analysing the positive and negative aspects of their designs and interviewing the head teachers of both. Reference was made to BB 77 and to the National Autistic Society's *Briefing Notes for Architects*. Extensive briefing discussions were held with the Head of Special Needs at Whitton, Maureen Mitchell. Malcolm Nixon's extensive experience in designing special needs facilities over a number of years was also important. The input of GA Architects knowledge was crucial to the design detail of the environments created. Malcolm Nixon also has a child with autism so he has first-hand experience of the condition.

The headteacher of the unit, Bob Pullman, representing the end users, was extremely positive about the design of the unit, however he was not involved in the brief development process. Also, as the visit was conducted before the unit had officially opened he was unable to provide feed-back with respect to the building in use.

**H** Computers were set-up to be extensively used within the classroom environment at Whitton Gateway (see *Image 19*). Once again this appeared to be dealt with in a generic way and was not specific to autism.

**Image 19: Computer workstations.**

**I** The main court space is naturally ventilated by a mono-draft, 'wind-catcher' system in the roof, rather than by any mechanical ventilation, which can be noisy and distracting. All classrooms have generous built-in storage.

### 4 Mossbrook Special Primary School, Norton, Sheffield, Sarah Wigglesworth Architects

**Image 20: Mossbrook Science teaching base Credit: Sarah Wigglesworth Architects**

Mossbrook Special School is a school for children with severe disabilities and autism. The unit is a science teaching base within the existing grounds of the school, but sited next to a large pond and nature reserve. It is not designed exclusively for children with autism but to include them (see *Image 20*).

**A** The unit consists simply of a science classroom (see *Image 21*), with three smaller 'resource rooms', each dedicated to a different scientific theme.

**Image 21: Main science teaching class**
**Credit: Sarah Wigglesworth Architects**

The other principal space is a ball pool (see *Image 22*), which gives the children instant access to physical exercise in all weathers. As previously stated, Daily Life therapy pioneered in Japan stresses the importance of physical exercise as part of the working day.

**Image 22: Exercise space**
**Credit: Sarah Wigglesworth Architects**

These principal spaces are separated by a hallway, which provides access to the unit's washroom facilities. The unit does not have to deal with the complexity of a multiple class teaching base as do the New Struan and Whitton schools, however the spatial structure is still simple and legible.

**B** The three individualised resource rooms are very different in character to the main space and are top lit (see *Image 23*). They are situated on the north wall of the building. They allow the children to receive individual or small group teaching, often focusing on specific demonstrations of scientific processes or properties. They also allow children to study quietly away from the remainder of the class.

**Image 23: Individualised teaching space**
**Credit: Sarah Wigglesworth Architects**

**C** All of the windows to the unit have internal blinds. These are capable of completely blacking out all light sources for audio visual presentations. Also the lighting in the three resource rooms is more subdued than in the main space allowing children to retreat to a darker space.

**D** The architects attempted to create an environment that reflected the way these children operate and experience the world in a number of ways.

*'Although we teach the National Curriculum, we teach it in a very individualised way. Science is taught through a demonstration of the physical phenomena of the world. It's a very practical application of learning.'* (Heather Wood, Mossbrook).

This seemed to the architects an exciting opportunity to make a building which was in itself a learning tool and to have elements integrated with the environment

rather than acting as an exhibit (see *Image 24*). The building therefore utilises different materials, allowing the children to learn about them at close hand. It has metal walls, which are reflective and get hot and cold, it also has timber externally, which evolves over time. Polycarbonate sheeting provides an experience of translucency from both inside and out. There is also a 'living wall' to the north side where the building backs onto an existing sensory garden. It has plywood patterning to the internal walls and a clear and legible structure of portal frame. There are felt covered cupboards and a transparent toilet cistern that illustrates the flush mechanism. It has windows to the meadow, the sky and a window set in to the floor which allows the children to experience the movement of life below ground. One of the resource rooms operates as a 'camera obscura' from where you can watch life going on all around the building. Through all of this the building functions as a learning tool for the children of the unit.

**Image 24: Environment as learning tool**
**Credit: Sarah Wigglesworth Architects**

**E**

*'Typically it seems a large part of the agenda in relation to designing for autism seems to be about ensuring the children can remain within boundaries with which they are familiar. There are two sides to that in that we understand how the limits of a human environment can provide security and be very comforting, but at worst it could reflect confinement. We wanted to create a balance with something that could be 'outward oriented' and engage the world beyond the classroom, whilst at the same time making the kids feel secure. On a philosophical level you can see architecture as a vessel that gathers the world into it-self and this building certainly does that in lots of ways.'* (Sarah Wigglesworth).

**Image 25: Relationship to nature**
**Credit: Sarah Wigglesworth Architects**

The building forms a natural gateway to a nature conservation area (see *Image 25*). The teaching space overlooks this area, which enables the children to experience the natural habitat of plants and animals all around. Indeed the building is intended to encourage wildlife to inhabit places within it. There is a window under the building and the hope is to encourage a badger sett to live there. The 'crib' wall to the north is home to a myriad of plants and wildlife. The teaching space has framed views of the meadow, picture windows and a balcony that addresses the pond. The clerestory lets in a different type of light from the north and gives a view of the sky. Additionally there are plasma screens, which often show an enhanced view of things. Cameras are mounted on and around the building and the pond, bringing an enhanced view of the world into the classroom.

This notion of bringing the outside world into the classroom was one of the drivers for getting Susan Collins on board, an artist who specialises in the use of electronic media.

**F** As stated in section D above, The building utilises different materials for their natural properties to enable the children to experience natural processes in an immediate way.

The three resource rooms are rendered in different colours to reflect different qualities. In this way the children are able to access a variety of environmentally different spaces depending on their mood. Over and above the limited palette of materials described in Section D, the building is detailed in a simple fashion, allowing the natural qualities of the materials to take precedence. The walls to the pond and meadow are white, with a very neutral, light grey vinyl floor.

**G** The Classrooms for The Future project was set up by the DfES in 2002 and resulted in 27 new primary school projects around the UK. Individual projects were intended to explore the Government's latest education initiatives about responding to educational and technological change. Chiles (2002) contains a critique of 4 of the Classrooms for the Future constructed in Sheffield, including Mossbrook.

The building design evolved through a dialogue and consultation with staff and pupils. Head teacher, Maggie Brough and head of science, Heather Wood, were intensively involved in the development of the design and in the proposal to include this design in the Classrooms for The Future project. The school council was on board but took a back seat allowing the two members of staff to pursue their agenda as end users. The University of Sheffield students carried out interactive work with the pupils, who built models and did extensive drawings illustrating what they wanted from their environment.

> *'There was certainly an opportunity provided by the school and specifically Maggie and Heather to achieve a special little building. They are incredibly passionate and committed individuals who had thought very hard about what they wanted to achieve with this teaching space. Their positivity and openness to innovation 'put us up' to things which may have been more difficult to achieve in a more typical school building'.* (Sarah Wigglesworth).

**H** The architects, children and teaching staff collaborated with artist Susan Collins to develop ways of incorporating technology into the teaching space. This was one of the key generators of the Classrooms for The Future project. Susan Collins works with electronic media, exploring their relationship with architectural spaces and their surrounding environment.

Webcams are thus located in the conservation area, recording the movements of wildlife and transmitting images onto plasma screens located inside the classroom. There is a boat in the pond, fitted with an underwater camera, which the children can control from inside the classroom to observe wildlife within the pond. The children are also able to control the camera obscura to record the landscape beyond the classroom.

The building also incorporates state of the art digital projection apparatus into the teaching space as well as a number of computer work stations.

**I** Finishes and furniture are typically hard wearing. The flooring material is a heavy duty vinyl. A removable panel in the floor provides a view on the building's systems to allow the children a greater understanding of the workings of their environment. Sarah Wigglesworth pursues a rigorous 'green' agenda and this is reflected in the use of water based paints and sealants to reduce the building's toxicity.

## Concluding comments

This paper has focused on providing a critique of the existing body of knowledge with respect to the design of educational environments for children on the autism spectrum, drawing out a number of key design criteria. It has then focused on a number of designs to assess in practice the implementation of those criteria and to discover where possible where further innovative approaches may exist.

There is clearly a requirement on the part of the designer to be aware of the issues contained within the critique of the 'body of knowledge'. Where these issues are not addressed they will have a detrimental effect on the ability of the child to learn or function effectively within their environment. Beyond these few simple rules architects should be striving to be constantly innovative. The opportunity exists to create designs which rather than the provision of a neutral container provide 'environments for learning', of which the Mossbrook model is an exemplar. Clearly this type of space allows teachers and other professionals to utilise the environment in a way that benefits 'visual learning.' Through this approach the term 'learning space' becomes particular to the experience of the individuals who use it.

Lastly, the body of knowledge which exists with respect to designing for autism is not readily available to designers. Educational professionals and architects would both benefit if design guidance were available in a concise and accessible form. Furthermore, design programmes investigating the 'creation of the classroom environment as learning tool,' would be a wonderful opportunity for students and teachers to further investigate the possibilities of this type of intervention.

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