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The impact of building design on children with autistic spectrum disorders

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Editorial comment
Much attention is now given to the physical and sensory aspects of the environment when designing learning and living spaces for children and adults with ASD. When opportunities arise for new accommodation architects, staff, families and the individuals themselves have to consider its design and key components. In this paper, Teresa Whitehurst, a research and development officer at Sunfield School, describes the main features of a new building created as a residential living space for 12 children with ASD. She then presents some qualitative data based on interviews with staff and families. Staff were able to compare the responses of the children in their previous accommodation at the school to their response to the new build. They were also asked by the architects to comment on any aspects of the design which created problems. Such projects and papers allow us to reflect on the contribution of setting factors to the well-being and behaviour of children with ASDs and to consider what might be altered in existing schools, centres and homes to the benefit of children, staff and parents.

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Introduction

Sunfield school provides 52 weeks education and residential care for children with severe learning disabilities and autistic spectrum disorders (ASD). In addition to the triad of impairments associated with ASD which present problems with communication, social interaction and imagination (Wing and Gould, 1979) children also have difficulties with spatial awareness and sensory issues relating to visual, auditory, tactile, vestibular, proprioceptive, gustatory and olfactory domains (Hinder, 2004). These difficulties not only impact upon the learning environment but in the child's everyday functioning. Can we imagine how complicated a world would be where we have difficulty processing sensory information, understanding spatial cues and even developing a sense of ourselves within space? These, and many other problems, are encountered on a daily basis by children with ASD.

In order to address some of these difficulties, there has been much interest in creating environments which take account of the problems that children with ASD experience. 'Autism-friendly' environments are now often mentioned and much of the literature focuses on creating learning environments which are modified to 'take account of the difficulties with sensory stimuli experienced by some children with ASDs' (DfES, 2002). Research in this area has identified that space, staff and resources are key issues when considering school accommodation but that the ability to move around a school is not sufficient. Other important factors include social inclusion at mealtimes and the provision of environmental conditions which are comfortable and which take into account the welfare, health and safety of those who are vulnerable (Bishop, 2001).

Studies of living environments in ASD as opposed to learning environments are relatively rare. A recent study by Plimley (2004) focused upon the creation of a hypothetical autism-friendly living environment as a task for students undertaking an autism programme of study at the University of Birmingham. This study identified important aspects in the environment but also placed equal emphasis upon 'within-people qualities' such as the understanding and knowledge on ASDs that the staff had. Simon Humphreys, an architect who designs buildings for people with ASD, suggests that:

> *'the human condition is such that ... with architecture it will respond positively to correct scale and proportion, natural ingredients such as light, air and materials as well as thoughtful construction.'* (Humphreys, 2005).

He suggests that buildings should be based on ten simple principles:

- a sense of calm and order
- good levels of natural light and ventilation
- reduction of detail (complex detail may be too visually stimulating for people with ASD)
- good proportion
- proxemics (the amount of space that people feel it necessary to set between themselves)
- containment (ensuring that people with ASD are safe and secure in their environment)
- easily managed, durable materials
- good observation
- good quality acoustics

(Humphreys, 2005)

As an organisation which operates a '24-hour curriculum' (Carpenter, Chatwin and Egerton, 2001) for many of its students, Sunfield was ideally placed to consider not only the learning environment of its children, but also their living accommodation. Staff at Sunfield have a wealth of experience in understanding the problems of daily living for children with ASD. It was upon this knowledge, and the evidence base generated from this professional practice, that designers built the foundations for a new house, created specifically for children with ASD.

Through consultation with Sunfield staff, the architects who were commissioned for the new build incorporated the following design elements:

- **single storey construction** – to maintain safety and ease of movement
- **single bedrooms** – respecting the children's need for privacy, dignity and personal space
- **circulation spaces which make good use of space** – providing areas for play and seating. Play boxes which have lids double as bench seating and there are high-level cupboards for long-term storage.
- **a range of communal areas** – including lounge, dining-room, activity rooms and fully equipped sensory studios. The activity room is situated at the end of the circulation space and affords an excellent view of the courtyard. For this reason, the activity room is often used as a quiet space which children and staff may utilise.
- **outdoor space** – with the creation of an enclosed courtyard incorporating covered areas. This provides a safe outdoor environment for the children and is located centrally so that children can play independently while still being observed by staff. The covered areas consist of hanging canopies which are in effect the continuation of the roof either side of the courtyard. This feature provides a dry open area for the storage of play equipment as well as shelter for outdoor play even during inclement weather.
- **curved walls** – which reduce the need for harsh corners, not only making the environment safer but helping the children to move easily through various areas of the building. Children at Sunfield had been observed having difficulties with right angles so adding curves to the design was a natural progression to aid the children in their visuo-spatial processing and 'cue' the child to move. The curves tend to lead the children to other spaces and have a very 'humanising' effect.
- **high-level windows** – are provided in addition to low-level openings in all bedrooms and some communal areas to give additional daylight and ventilation. This allows ventilation without the risk of a child climbing out of the window. Research also indicates that ventilation can be significant in reducing the negative adrenalin which is produced when stressful events occur (Delfos, 2004).
- **soft, non-flickering compact lighting** – has been used throughout the building. Very bright fluorescent lighting can affect the vision field of some children with ASD (Irlen, 1991).
- **underfloor heating** – has been used to create a warm environment without the need for radiators. This feature eradicates the need for low surface temperature radiators which are not only unsightly and reduce the available space within a room but also addresses the difficulties of children posting objects and climbing onto radiators. In

addition,underfloor heating enables areas to be zoned for temperature control. This feature allows the temperature in different areas to be operated independently. For example, each child's bedroom may be controlled separately. This is particularly important as some children may be more sensitive to heat and require a lower temperature than other children in the same house.

- **floor coverings** – have been carefully chosen to maintain warmth, reduce noise and to be easy to clean. Linoleum has been used in the bedrooms which provides a warm and comfortable touch even when not heated. It is also easy to clean and very hardwearing. The circulation spaces are carpeted in a product which was tried and tested and found to be practical and durable.

- **ceilings with sound-absorbent backings** – have been used to prevent reverberated sound. The ceilings are slatted timber with gaps of about 10mm between each board. The sound travels through the gaps and is absorbed by an acoustic 'blanket' behind. Within the circulation spaces 'fair faced brickwork' has been incorporated. This type of construction features exposed brickwork with deeply raked joints. This has the effect of breaking up the sound waves when they hit the wall and not reflecting them back which is what would happen with plaster or shiny surface finishes.

- **colour schemes** – have been based upon research conducted by Diane Pauli at Sunfield (Pauli, Egerton and Carpenter, 1999; 2000). Dr Pauli's research has found that some colours can disturb or alter the mood of children, while others have a calming effect. Shades of pink and purple have been found to be the most positive colours and these have consequently been used extensively on walls. Grey has also been widely used as this has been shown to be a neutral and non-reflective colour which provokes neither a positive nor negative reaction. Consequently, windows, doors, frames and skirtings have been stained grey (adopting a more environmentally friendly alternative to paint). The bedrooms have been painted in colours chosen by the children who live in the house.

The final design comprised two semi-detached houses with a central shared courtyard space. Both houses operate independently, accommodating six children in each house, and have adjoining doors to allow access when desired.

Within these basic structural designs, certain specific features have been added:

- **bedrooms** – The layout of the bedroom wings follows a zigzag pattern. This enables every child to have a view from their window without being overlooked. All bedrooms open on to the circulation space. Bedroom doors are set back and only reveal themselves as you walk through. This has a subtle effect and creates a sense of privacy for the children. Bedrooms windows have been fitted with special security fittings and opening restrictors. This will allow some children to have control over opening their windows, but for the safety of some children locks are required.

- **bathrooms** – There are two bathrooms in each house equipped with bath, shower, toilet and hand basin. Showers have been built without trays to allow children to move around easily and enabling a chair to be used if required. Timed press taps have been incorporated to switch off automatically reducing the risk of flooding. A third toilet has been constructed to comply with the 1995 Disability

Discrimination Act. Although there are no children currently living in the accommodation who use a wheelchair, this facility provides a useful third toilet and makes provision for staff or visitors who may require wheelchair facilities.

- **sensory rooms** – Each house has a sensory room which is not a teaching room but forms part of the leisure facilities. The sensory studios in each house are different in their design – one is equipped to be calming and the other to be stimulating. These facilities will be shared by both houses. Most of the equipment is not permanently fixed so that the whole room can be changed to meet the specific needs of each individual child. In addition, the rooms have been designed to build in adaptability and flexibility. They could be adapted for another use or even provide an additional bedroom.

- **staff room/office** – A high-level window allows a good view of the circulation space and bedroom wing without intruding on the children's low-level space. This prevents children from looking into the office and also prevents children from feeling constantly observed.

- **kitchen** – This provides a good, practical working area for staff.

- **dining-room** – Curved walls facilitate movement through the dining-room, while the ceiling height maximises light and ventilation. A serving hatch with worktop areas is provided between the kitchen and dining-rooms thus reducing the risk of children entering the kitchen when food is being prepared.

- **living-room** – This is the main communal area in the house. The design incorporates minimum use of right angles. The large window area makes good use of daylight and gives a view of the enclosed courtyard and the fields beyond.

- **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 (Beaver, 2003). This effectively 'breaks the mould' of the institutional approach to accommodation facilities and creates a space which can be utilised, especially for play.

Having created such an environment and, as a charity, having raised in excess of £1 million to fund such a project, it was important to find out how such a living environment had impacted upon the children accommodated there. We set ourselves the task of finding out what difference this type of accommodation had made to the lives of the children living there.

Figure 1 shows the plan of the new build.

Method

A method of evaluation was required which gave the opportunity for all stakeholders to have a voice. Clearly, the creation of such an innovative building

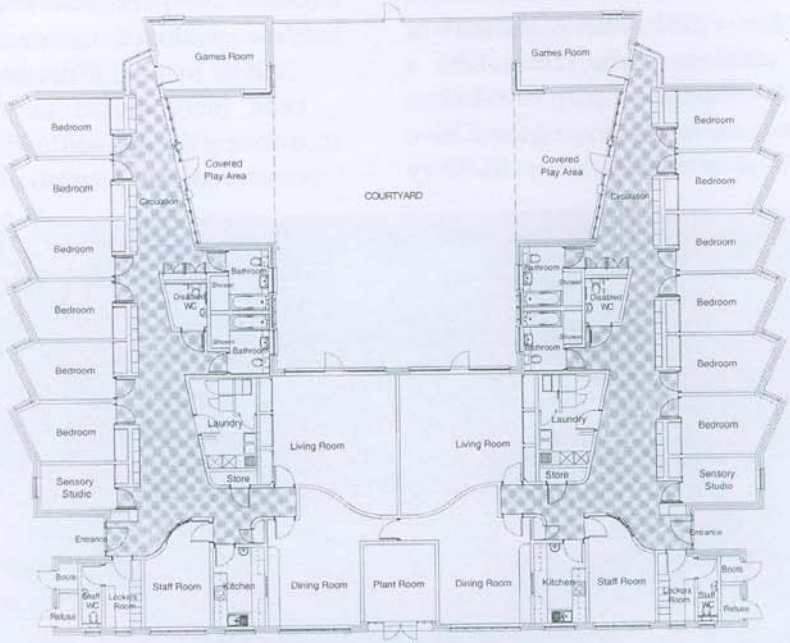

Figure 1: Plan of the building

design can impact in many ways upon many professionals, domestic staff, carers, managers and visitors, as well as the children. However, as the focus of this study was to consider the impact upon the children, it was felt important to obtain the views of those who knew the children well, those who had transitioned with the children from previous accommodation to new accommodation,and those who had experienced the same journey. Consequently, a strategy which was both formative and summative was required but which adopted a participatory stance. Such a strategy was based on:

- interviews with team leaders on both houses at various points throughout the project. Initial interviews were conducted prior to the move, interim interviews after a 'settling in' period and follow-up interviews after a period of six months in residence.

- a focus group consisting of four members of staff who represented care support workers, senior care and the deputy team leader from both houses. The focus groups were carried out monthly for a period of three months once the move to the new accommodation had taken place.

Findings

Previous living space

To set the findings in context it is important to consider the living environment from which the children and staff transitioned. Previous accommodation was located in houses which were geographically separate, although children in both houses had opportunities to socialise together for planned activities. One house was located within the main building at first floor level, thus having no direct access to outside play space. The second house had some access to outside play space but was an older style property whose internal layout was difficult to navigate. Through initial observations it was evident that both houses had limited space for socialising, demanded a level of care which was at times intrusive to the child and gave little opportunity for the child to operate autonomously; visual monitoring of children within the accommodation was reliant upon care workers physically following children around the property.

Impact of the 'autism-specific' accommodation

Following the move, a series of interviews and focus groups was conducted to take account of a range of views. Interviews with team leaders were conducted after four weeks and again at six months. During both sets of interviews the focus was directed towards the impact of the accommodation on both the children and on staff working in the houses. Similarly, a focus group was established which consisted of four members of staff, two from each house. A range of staff was invited to attend to represent differing levels of care professional. Staff included a deputy team leader, two care support workers and a senior care support worker. The focus group was held for three consecutive months following the move.

Several themes were identified which were similar within both team leader interviews and staff focus groups. Although the themes have some element of overlap in terms of the impact upon children and the impact upon staff, both are reported separately.

Impact on the children

- **autonomy**
  - **space** – Staff commented that the design and layout of the new building had given the children more freedom and more choice. They could wander round and mix with other children or equally retire to their own space if they did not wish to socialise. This had a major impact upon children having issues with proximity – sometimes these children get tense and just need space to be alone.

  - **choice** – Children were able to communicate their preferences regarding activities in a much clearer way by using the space and layout of the building. For example, one child would indicate his desire to access the sensory room by taking a bean bag and placing it outside the door of the sensory suite. Similarly, all children have their own television/video equipment in their rooms and may retire to spend time alone. The lounge space was not often chosen by the children; they preferred to use other areas of the building.

  - **privacy** – In previous accommodation, staff had noted that children often wandered into each other's bedrooms, invading private space and causing conflict. This was resolved by locking the doors. This problem, however, has not been encountered in the new building. Children did not seem to feel the need to go into each other's rooms and therefore

doors were no longer locked. Indeed, staff had noted that children were actually 'inviting' peers to watch a video in their room and sharing their space more freely.

- **outdoor space** – This was secure and visible from the main building and allowed the children to play freely and essentially unsupervised. Staff could offer minimal supervision, monitoring children visually through the abundant windows. This had a significant impact on both children and staff. One child in particular got upset in his previous accommodation if he could not go out on his bike (which needed direct staff supervision) or if staff stayed too close to him. This problem was resolved by the design features in the new accommodation.

- **orientation** – Staff observed that curved walls gave a less institutionalised feel to the building and made it more aesthetically pleasing. The curved walls facilitate the movement of the children through the environment. A team leader noted that one child in particular liked to move along the curved wall touching it with his hands. The curved walls in the circulation space were noted to have orientation value in that the children on entering the building were guided into the space and were not met by harsh right angle corners which were visually difficult to navigate.

- **clearer views** – The abundance of large low-set windows gave the children a view of a space which was now accessible to them. In previous accommodation the children had climbed onto radiators to look through windows to areas outside which they had not been able to access. There was a large reduction in jumping and climbing.

- **the long circulation space** – This was specifically mentioned on a number of occasions by staff. This specific design feature had made a big impact on one particular child's communication. The team leader commented that, 'he has become so spontaneous with his speech … the long circulation space has facilitated this … he comes up the circulation space for a purpose rather than standing waiting for staff to say, 'What do you want?.' Similarly, the circulation space appeared to be a place where the children felt comfortable. A bedtime routine had emerged in one house where staff read bedtime stories to the children in the long circulation space sitting on bean bags outside the children's bedrooms. The team leader commented that, 'kids will sit with us, then drift off to their rooms – I think its comforting for the children, like having a proper family with parents just outside their bedroom door, close by'. Again, the curved walls, neutral colours, high ceilings and natural light were felt to be contributing to this feeling of comfort and security.

- **calmness** – Both staff and visitors commented on the aura of calmness which was evident in both houses. This was attributed both to the design which instilled calmness within the children and also to the attention which had been paid to the noise-reducing components built into the fabric of the building. Carpeted areas, high ceilings and insulation have been key to reducing the levels of noise experienced. The calming, neutral colour grey incorporated into the fabric finishes has ensured that visual stimulus is kept to a minimum. Negative adrenalin, which builds up during times of stress, can most effectively be dispersed by running water and fresh air. Children have access to outside areas which are within their own control and which can be entered even during inclement weather due to the design of the sheltered play areas. High-level windows provide additional ventilation without the risk of children absconding.

Impact on staff

Evaluation of a building created as an 'autism-specific environment' should not focus solely upon the impact the design has upon the children. Children do not operate in a vacuum where only the fabric of such a building can be seen as a factor. Interactions within the autism-specific building occur within the daily context of interactions with staff. Team leaders and care staff had noted the following factors:

- **calmness** – among staff as well as children. This was attributed to the design of the building, its maximisation of space and the ability to visually monitor children without invading their personal space. One team leader commented, 'It's amazing – staff have a whole different attitude. They are laughing and playing with the children … before everyone was on top of each other and you know how it is when everything is noisy and you have no space to think'.

- **staff well-being** – A team leader observed that staff were happier – they did not have to be so intense with the children. Previously staff 'couldn't take their eyes off them because of the accommodation'. This had been made possible through careful design planning. The staff office faced the main circulation space and gave access to monitoring the accommodation entrance. Through careful placing of windows into the accommodation, from the office, staff were able to monitor both children and access to the building.

- **children's autonomy** – Staff felt they were able to support the children to be more autonomous. This was attributed to the layout of the building and the visual access afforded by the numerous large windows facing the courtyard space. Staff felt they could be more relaxed knowing they could see the children and that the children were safe. Staff could allow the children to maximise the use of the outdoor space without the need for direct, intrusive, supervision in the knowledge that safety and security were not compromised.

Feedback to the architects by staff

Staff were asked for their views on the building by the architects to use to guide future developments. The following issues were raised by staff:

- Carpet finishes need to be darker as pale colours show marks.

- Dust accumulates on high surfaces and is difficult to reach.

- Furniture in corners should have no spaces behind it as students 'post' items – including themselves!

- Paintwork needs to be washable.

- Showers (in addition to baths) need to be on key control.

- Bathrooms need more storage space (for gloves, wipes, etc).

- Press-down taps in bathrooms are difficult for students to operate.

- Lighting in lounges is too bright and spots and main light cannot be operated independently.

- Lighting in bedrooms is too bright – some students sleep with their lights on.

Many of these issues were easily resolved. For example, electricians have made alterations to the lighting in the lounge to allow spot lights and main lights to operate independently. Dimmer switches which were of a sufficiently robust design to address the problem of lighting in the bedrooms were difficult to obtain. However, this problem has now been addressed using information obtained from the colour project which continues at Sunfield. Ordinary lights in the children's bedrooms are 'screened' with different colours dependent upon the child's individual preferences. For example, one child's light may have a green filter, one may have blue, another may have yellow. Care staff consult with the project director for the research on colour to identify which colour is appropriate to each individual.

Discussion

Evidence from staff clearly indicates that certain design features are important to ameliorate some of the difficulties experienced by children on the autistic spectrum. Interestingly, these match extremely well to the ten fundamental principles suggested by Humphreys (2005). Historically, children with ASD have been portrayed as isolated loners living within their own world. Maybe we have simply not created a world where they can be? Social interaction between children, their peers and staff has been enhanced within the new accommodation. 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. Where there is a lack of space the child has no such choice and may, out of necessity, be forced into the proximity of other people. By creating space we create choice. Staff have witnessed that when children interact there is a new quality to that interaction. They are playing alongside each other because they choose to be there, not because they have to be. Children from both houses, although separate, can play together in the courtyard and visit each others houses in a very natural way.

Communication for some children living in the new accommodation is now purposeful rather than incidental. Limited space in the previous accommodation created an artificial situation where staff were constantly 'on hand' to provide for the

children's needs. Communication has been enhanced due to the child's motivation to actively need to seek out staff. The opportunities for imaginative play have increased as children have control over who they share their space with and which areas they access (eg sensory studio, courtyard, activities room). They have become more autonomous in their decision-making and can schedule their own activities. The calmness they are now experiencing facilitates engagement, imaginative play and communication.

Interactions between staff and children are not, however, simply a consequence of the children's reactions to the new accommodation. Plimley (2004) points out that the notion of 'autism friendliness' is not restricted solely to provision of an appropriate environment but has a human component. Families told us that the things that gave them confidence and support at this time were meeting staff who were capable, competent, flexible, understanding and had experience of the range of challenges which children with autism face (Carpenter, Conway and Whitehurst, 2005). Plimley (2004) suggests that 'human attributes and qualities could make a great deal of difference in the co-operation and response of the person with ASDs' (p. 40). Providing the right environment for children with ASD is clearly, therefore, not solely a matter of negotiating the right design and structure. This research demonstrates that the environment impacted beneficially upon staff as well as children. Additional space and the ability to monitor children from a distance enhanced the staff's feelings of well-being. A feeling of calmness among staff is equally important to that experienced by the children.

Concluding comments

Providing the right environment for children with ASD is not only desirable but it is surely their right. Children with ASD live in a world which is constantly full of negotiations. In order to meet their needs fully we must address the difficulties they experience within all settings. This should not be restricted solely to creating appropriate learning environments but must also extend to creating environments which are pleasant to live in. Environments designed and created specically for children with ASD clearly have a beneficial impact not only on the children themselves but also upon those who care for them. This intricate interplay and delicate balance between environmental factors and human factors converge to create a space where children can be children – not just children with a disability.

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