Analysis of functional program of the building designed for pupils on the autism spectrum disorder, case study of Acland Burghley Resources Centre, London

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Abstract. The article is a case study for Acland Burghley Resources Centre designed by Christopher Beaver and GA Architects for up to 20 pupils on the autism spectrum disorder. This is the inclusive regular school for 1265 students in London, built in 2011. The small part of the building was designed according to the theory developed by Beaver for students on ASD. The school was classified in third place according to Autism ASPECTSS Scores (Mostafa, 2015, p. 67) developed by Magda Mostafa, professor at the American University of Cairo. The case study is based on the diagrams presented in the article which were prepared on the basis of project documentation and photos of the building provided by the architectural office. These materials were prepared to survey opinions of autism therapists on the impact of individual building elements on people on ASD. Pupils on the autism spectrum have problems with the perception of many stimuli such as light, acoustic, aromatic, and tactile stimuli. It is important that autistic students who cannot cope with the mainstream school have an independent part of the building with the outdoor decking, social area, learning spaces, 1 to 1 activity rooms, seating spots, and escape personal spaces. The architect designed a calm space in which students feel sensory comfort and can improve their cognitive abilities. These were achieved with indirect light, neutral colours, matte textures, and curved walls. The interdisciplinary research proves that the functional and spatial solutions which are provided in Burghley Resources Centre are appropriate for the therapeutic purpose and support the therapy.

1. Introduction
Diagnosing autism spectrum disorder (ASD) can be difficult because there are no medical tests, such as a blood test, to diagnose the disorder. Doctors analyse the history of development and behaviour of the child to make a diagnosis. It is often too late to achieve quick results [1]. According to the Diagnostic Criteria of the International Classification of Diseases, tenth edition (ICD-10) and DSMV used in the UK, statistically 14.9% of all pupils have special educational needs (SEN), with 3.1% of all pupils having an Education, Health and Care plan (EHC), 2.25% on the autism spectrum disorder (ASD) [2]. During the COVID19 pandemic, the number of referrals to a specialist for people with suspected autism have not decreased, but the number of first contact visits to a specialist (within 13 weeks of referral) and the number of diagnosed cases of autism decreased [3]. The long waiting time for diagnosis, insufficient therapeutic support and the lack of infrastructure supporting therapy negatively affects the effectiveness of therapy and, consequently, the quality of the child's psychophysical development in the later stages of its development.
The aim of the study is to present the impact of the functional-spatial structure of a building on autistic students through a case study [4] of Acland Burghley Resources Centre located in London designed by Christopher Beaver and GA Architects. An expert method of research [5] was used, which is based on the author interdisciplinary qualifications in both architecture and therapies of autism spectrum people.

2. Case study of Acland Burghley Resources Centre, London (United Kingdom)

2.1. About the architect of the building
The building was designed by Christopher Beaver and GA Architects, who since 1996 have specialized in design for people on the autism spectrum [6]. They designed, among others, some schools for ASD students, such as the Special School for children in Ad-Dammam in Saudi Arabia, the Special Needs School in Twickenham in London, the Kennedy Leigh Family Centre in London and many other facilities for people with autism.

2.2. Autism friendly design theory
Based on professional experience, designers have developed a design model that is based on adapting space to the sensory sensitivity of a person on ASD. The adaptation of the object includes the development of a good layout without corridors or with places to sit (they provide the opportunity to spend time alone or in a group), shaping the building to facilitate finding the way to the individual functions of the building, eliminating harsh corners, avoiding intense colours, applying consistent colour identification of the interior. Matte textures are also used not to cause glare and sound-absorbing materials which eliminate reverb. Sensory comfort is provided with natural lighting and pro-average light sources e.g. roof windows. Flickering fluorescent light is to be avoided and it is important to use gravity ventilation as well as underfloor or ceiling heating [7]. The space should be designed so that people with autism feel at ease under the discreet supervision of carers.

2.3. Functional program of the building
The building complex functions as an independent, closed quarter in London Borough of Camden. It is adjacent to Dartmouth Park and Gospel Oak. The northern part which includes the sports field and parking lots is hung over the railway tracks towards Great Northern, Overground and Thameslink [8]. The main entrance to the building is located in the southern façade and leads to the main administrative shaft in the central part of the building where on the ground floor there is the secretary office, principal office, building service rooms and on the first floor there are teacher rooms. To the east of the main part of the building there are three class buildings – the so-called "Teaching Towers". Each 5-storey block is dedicated to a separate different age group teaching [9] On the ground floor there are canteens, common rooms, and on the upper floors there are classrooms. In the south-west part of the complex, accessible directly from Burghley Road, there is a patio with a concert hall at its heart. The hexagonal shape of the building is connected to the main shaft of the passage.

![Diagram of Acland Burghley Resources Centre](source)

**Figure 1.** Scheme of the Acland Burghley Resources Centre, London
Source: author diagram based on internet source [10]
The zone for students with autism (Figure 1) was designated in the building in 2011 and was designed for about 20 students. It is located in the north part of the building. The space of the section is clearly divided into four functional ‘stripes’. On the south side, a quiet area with views of the courtyard and hexagonal concert hall was organized. In this zone, there is a row of classes in front of which some local extensions of the corridor have been designed so the child can hide in them and calm the senses; this adds to the intimate character to the interior. Each class has its own therapeutic room, the arrangement and size of the rooms allow you to organize both group, one-to-one classes as well as leisure time. In the immediate vicinity of the classes there is a sensory room and sanctuary [10], where the child learns to interact with the environment and to increase or maintain functional skills by stimulating the senses with sound, lighting and odours. Sensory rooms are accessible directly from the recesses in front of the classrooms; children can also use them outside of the classrooms. The corridor is a buffer between the noisy and quiet zone. Designers avoid the use of right angles in all accessible spaces with no curved wall corners walls and furnishings to increase the safety of using space. The designed colour identification of the premises is easily identifiable. The classrooms are grey, the central part for group activities is beige and the corridors are white. The floors are carpeted in neutral grey, which contrasts with the shade of the walls.

An important element of the interior for people with autism is light. The corridor, toilets and sensory rooms are lit only with artificial light. The designer provided the ability to adjust the intensity and colour of the light with its source invisible, located under the suspended ceiling. In addition, some local and general lighting was designed. It is arranged in a thoughtful way. In classrooms it is always located in learning zones, in the corridors the lighting is uniform and located centrally. In sensory rooms the lighting is variable, it is designed to stimulate the senses and develop the perception of the child. The segment uses radiant ceiling heating for even temperature distribution and student comfort. Mechanical ventilation of the premises was used due to the close proximity of the sports field and railway tracks generating high uncontrolled noise.

The learning support assistant room and kitchenette are communal and open to an outdoor garden belonging to this segment only. The doors in the public space were designed to be a partially glass wall in the form of a semicircle; there are also glass walls in therapy rooms so that the teacher or parent could observe the student without any disturbance in the course of the classes.

2.4. Studies of the impact of building architecture on the perception of a person with autism
Magda Mostafa of the American University of Cairo ranked the object in third place in comparison with other schools for students with autism, assessing it on the basis of: acoustics, spatial Sequencing, compartmentalization, transitions, sensory zoning. [11] The study was based on feedback from designers and users. The intended view of the impact of the functional-spatial structure of the object affects the effectiveness of learning process, shaping the right sense of orientation in space and proper cognitive development of the child. The key to good design practices in this area is to understand the impact of building elements on perception, (visual, auditory, tactile of a ASD child) which differs from the perception of a neurotypical child. On the basis of materials provided by GA Architects, functional diagrams of the building and photographs, Table 1 was developed summarizing the design assumptions of the building. The first column contains elements of the structure of the building. Their impact on the perception of a child with autism was assessed on the basis of the opinions of 10 therapists in the field of autism.
### Table 1. Influence of architectural solutions on perception a child with autism spectrum disorder.

| Classes                  | Common spaces                                                                 |
|--------------------------|-------------------------------------------------------------------------------|
| **Location**             | Classrooms are accumulated inside the ‘silent’ zone in order to improve concentration and decrease undesirable sound stimuli.  |
|                          | Merging the Learning Support Assistant, the Social Area and the exterior of the building reduces the ‘laud’ zone into minimum.  |
| **Colours**              | The grey colour of the finishing surfaces as well as the lowered ceiling define the learning spaces and improve the sense of direction of the pupils.  |
|                          | The use of a neutral colour inside the circulation area, indicating the LSA and OS spaces with strong bright colours has soothing influence the senses of ASD pupils.  |
| **Natural lighting**     | Large glazing provides optimal lighting, sunshades and blinds moderate the intensity of indirect light and have advantageous impact on the perception and focus abilities of ASD pupils. The introduced solutions reduce the ‘glare effect’ among pupils. In addition, introducing the milk glass on the height of the eye prevents from distraction during therapy activities.  |
| **Artificial lighting**  | Decorative colourful source of lighting gives possibility of modifying the intensity and the shade. Main lighting sources are split regularly as the ceiling eyelets. Different graduation can help to lead pupils along the area.  |
| **Materials**            | Soft material like carpet provides optimal touch experience as well as the noise suppression. It also reduces light bouncing, consequently self-stimulation of the pupil (sound and sight).  |
| **Ventilation**          | The mechanical ventilation has been applied. Pupils are supposed to be protected from strong noise sources such as nearby sport pitch or the trainline. Hence, any window inside the segment cannot be opened and the mechanical ventilation is to provide fresh air circulation.  |

### 3. Results and discussions

The functional and spatial solutions used at the Acland Burghley Resources Centre are well adapted for students on the autism spectrum. The design of lighting systems of the premises reduces the adverse effect of light stimuli on the perception of the child on ASD. The materials used eliminate the phenomenon of reverberation and they support the processing of sound stimuli. Consistent colour identification of the premises supports the orientation of the child in space. The building under the study provides sensory comfort and student safety, hence it supports the effectiveness of therapy and positively affects the cognitive development of people an ASD. Designers have made it possible to change the intensity of light, sound and odour stimuli, which provides the best conditions to stimulate the perception of children according to their individual abilities and needs. Such conditions are necessary to support interaction with the environment, to increase and maintain the functional skills of the child. This design model emphasises the development of skills which significantly increase the chances of the child to function independently in the future. Furthermore, the study confirms the legitimacy of the implementation of specialist solutions with a particular focus on space parameters affecting the improvement of acoustics, lighting and visual identification. Due to the limited possibilities in...
expressing their needs which children with autism have, the development of design patterns that support their cognitive development was possible through cooperation with therapists who, on the basis of modern therapeutic theories, attempt to provide the best conditions for developing skills of ASD student. The conducted study indicates that the design of educational experiences is an essential part of specialist design, in which space planning is a key to achieve best possible effects of therapy.

4. Conclusions
The analysis performed shows not only that architects, after many years of their experience, have attempted to design a sensory-friendly space for people on the autism spectrum, but also proves that the design of the Acland Burghley Resources Centre is therapeutic in its character. The building is well adapted to the perception of students who are both sensory hypersensitive and sensory insensitive, which is thanks to the fact that the solutions used in the building allow to change the intensity of stimuli of light and acoustics. At the same time, the way the floors and walls are finished counteracts the occurrence of reverberation and glare, which favorably affects the processing of acoustic and light stimuli by people on ASD. This well designed sensory safe space supports the psychophysical development of people with autism. Such a design model constitutes the grounds for good design practices to be widespread.

Acknowledgment(s)
The authors would like to thank group of autism therapists for their cooperation and valuable feedback.

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