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## *Analysis of functional and spatial solutions in selected centres accredited by the National Autistic Society*

### *Introduction*

This article presents an expert preliminary multiple case study of education buildings specialized for people on the autism spectrum. The author has considered only architectural objects that received accreditation from the National Autistic Society (NAS). The results of the literature research indicate some design criteria that should be implemented in buildings for people with autism spectrum disorder. The selected criteria are related to shaping the layout of the space. The examined schools adapted for people with autism were designed taking into account the above-mentioned criteria. The aim of this research was to describe the implementation of the functional and spatial solution with respect to the sensory zoning of space and whether the search for such relationships should be continued at the next stage of research.

### *Materials and methods*

The National Autistic Society was established in 1962. The organization operates in the United Kingdom. It delimits the standards of care for people with autism. The NAS provides help, support, and advice on the challenges of autistic people and their families. NAS accreditation has been granted to 375 facilities, including 223 educational facilities [1]. The conducted analysis revealed that

55 facilities from the database have been renovated or expanded since 2015. The inclusion criteria were met for buildings that were built as part of government programs for improving the quality of education in special schools and to meet the increasing demand for places for students with special educational needs [2]–[4].

*By 2020 the Government would like all schools to be models of social inclusion, enabling all pupils to participate fully in school life, while instilling a long-lasting respect for human rights, freedoms, cultures and creative expression* [5, p. 27], all selected buildings were built based on the design strategies of *Designing for disabled children and children with special educational needs. Guidance for mainstream and special schools* [5, p. 16]. Design standards do not focus on the needs of people with autism, but define the basic parameters of the space adopted for physically disabled people. Selected schools have been designed in cooperation with administrative specialists, including principals, therapists, and parents of people with autism. It is an indispensable tool that supports the design process and supports the assessment of design solutions already at the design stage and at the stage of final social consultations. The selected schools should be identified among the best adapted for people with autism.

The multiple case study was conducted using the expert method [6], [7] from the perspective of an architect and a therapist of people with autism. As a resource material, the author used pre-design studies, government documents, and photos.

### *Research background*

The literature review was carried out through multiple databases such as SCOPUS, Science Direct, Web of Science,

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EBSCOhost, Primo and Google Scholar. It revealed 125 peer-reviewed scientific articles on the phrase “autism, design, architecture and environment”, on Ex Libris. Revealed scripts have been published between 2000–2023. During the analysis of multiple abstract contents, 13 publications have been selected as directly related to the design of schools for people with autism. Moreover, 6 of the above-mentioned publications concern design criteria for pupils with autism spectrum disorder (ASD).

The study carried out by Magda Mostafa presents the use of the Autism ASPECTSS™ Index method in the context of post-occupancy evaluation of learning environments. The described guidelines concern seven design criteria: Acoustics, Spatial Sequencing, Escape Spaces, Compartmentalization, Transition Spaces, Sensory Zoning and Safety [8]. The post occupancy evaluation (POE) study has been also conducted by Julie Irish, who has taken into account criteria such as materials, colour scheme, wayfinding, lighting, acoustics and security [9], [10]. On the other hand, ASD pupils mentioned the following as the most important issues in school design: a playground divided into zones, a sense of security (location of the teacher’s room), noise and calm zones, internal circulation spaces, legibility, their own autistic spectrum condition (ASC) Resource Base and the wider school environment [11]. Other studies focus on the analysis of particular physical properties of space. It has been revealed that acoustic control of rooms can reduce difficult behaviours and help in therapy [12]. For instance, neutral colours have a calming effect, and flashy colours stimulate [13]. These publications present the core issues of designing for people with autism against a background of research in the field of psychology, sociology, pedagogy through the involvement of therapists, people with autism and their parents.

The diagnosis of people with autism spectrum disorder includes social interaction skills, interpersonal communication skills, repetitive and stereotyped behaviours. ASD symptoms also result in significant malfunctioning of personal, family, social, educational, occupational or other important areas of everyday life [14]. The built environment ought to respond to the sensory needs coming from the different perception of people with autism. The organization of space can stimulate the development of areas where cognitive deficits are diagnosed based on strengths in order to achieve satisfactory therapy effects [15]. The literature review indicate that buildings designed for people with autism should be designed taking into account the needs of children resulting from the diagnostic criteria of the International Classification of Diseases 11<sup>th</sup> (ICD-11).

### *Multiple case study*

This publication designates non-statutory guidance on planning and designing accommodation for new and existing schools in England – all of which will have at least some children or young people with special educational needs (SEN) and disabilities. The buildings were built to meet the current and increasing demand for the number of places for students with special educational needs. The capacity of Ysgol Plas Brondyffryn was expanded by

104 spaces [2], and Oaklands School by 152 spaces [3]. Garston Manor School had no plans to increase capacity, but before redevelopment, the school was nearly half the size per pupil [4].

The layouts of schools were analysed based on the example of accredited buildings: Ysgol Plas Brondyffryn, Oaklands School, and Garston Manor School, which meet design standards and take into account the limitations of people with autism. The accomplished analysis of solutions responding to specific design problems concerns the issue of sensory zoning, which determines the way in which the zones have been divided in the layout of the building, the type of transition space between the zones, and the degree of complexity of wayfinding.

### *Ysgol Plas Brondyffryn, Land West of Ystrad Road, Denbigh, UK*

#### 1. General information.

The school has been designed for 116 children, however, current count is 136 students and 63 on the reserve list. All the admitted students have a certificate of the need for special education in the field of autism. At the moment, the facility is overcrowded and dispersed – it is located in 4 different locations in the city. The authorities have decided to build a new facility that would accommodate 220 students, 32 teachers and 65 assistants. The new seat of the school has been built on a plot of approximately 2.42 ha, and would have an area of 6564 m<sup>2</sup>. The existing sports ground in Ystrad Road, Denbigh, adjacent to Denbigh Leisure Center in the suburbs, has been used as the construction site of the facility [16].

#### 2. Functional and spatial solutions of the school.

The site plan design divides the plot into multiple accessibility zones. The public area includes the main entrance to the school, the entrance to the cafeteria and parking spaces. Introducing a new small venue open to the local ASD community gives students the opportunity to acquire social skills in a controlled environment. The second zone is available only to employees of the facility (parking lots). The third, safe zone is designed for students and includes sensory playgrounds, quiet zones and sports fields, but also a drop-off area [17].

The main entrance zone is located in the eastern part of the building, in close proximity to an administrative area. Students are driven to school, received by school staff in the drop-off area and dedicated via multiple assigned entrances to each educational stage. There are no collective cloakrooms, they are all located in classrooms. In the central part of the building, between the entrance zones, there are two dining rooms, which are assigned to each school, respectively, with stations for individual/group meal preparation. The organization of space improves the development of self-care and social skills. The middle and south wings are two-story. The first houses the Secondary School, the second is dedicated for the youngest children who attend Primary School and Early Years [18]. There is a café in the northern part of the building. It is directly adjacent to the lowest wing of the building, which has one



Fig. 1. Ysgol Plas Brondyffryn School, author's scheme based on source data [17], [18]

Il. 1. Szkoła Ysgol Plas Brondyffryn, autorski schemat na podstawie danych źródłowych [17], [18]

floor and houses a school for the oldest children over 16 years of age (SSD).

The sensory zones of the space are clearly separated in the layout of the building (Fig. 1). The loud zone of the building is grouped with the other noisy zones of the environment (north-east), similarly with the delineation of the boundaries of the quiet zone (south-west). The corridor functions as a buffer and transition zone and provides access to both low stimulus and high stimulus functions. This layout corresponds to the gradation of space accessibility – the zone with a high stimulus is generally available, the zone with a low stimulus is identified with specific groups of students. The simple communication system introduces a clear layout of the space. The vertical line defines the general communication zone, the horizontal lines are related to the division of individual educational stages.

#### *Oaklands School, Gresham Road, Hounslow, UK*

##### 1. General information.

The facility was expanded in 2023 by 152 places and at the present time provides education at all educational stages, including adult education up to 25 years of age. The school has the capacity to accommodate 224 students, 38 teachers and 98 assistants. According to the data for 2023, the school capacity has reached 213 students. All of them have a statement of the need for special education: 70 with ASD, 90 with specific learning disability (SLD), 64 with profound and multiple learning disabilities (PMLD) (data refer to maximum occupancy). New headquarters built on a plot of the area of 1.76 ha, will have an area of 9,661 m<sup>2</sup>. The site is on the east side of Gresham Road in the London Borough of Hounslow. The school

was built in a recreational area, accessible to the local community, in close proximity to a residential zone [19].

##### 2. Functional and spatial solutions of the school.

The public area is located in the north-western part of the site and consists of outdoor playgrounds with e.g. a sports field that is dedicated for shared use by the school and the community. The land development plan includes a safety drop-off area for students (one-way road system) in the northern part of the site. Parking spaces for staff and separate parking zone for parents delivering children to school have also been designed. The building is located in the eastern part of the site, with adjacent, intimate and quiet outdoor spaces grouped outside the classrooms on the eastern and southern site. They function as a buffer zone between the utility building and the residential area. This is in line with the need to ensure safety away from publicly located areas as well [20].

The entrance area is located in the central part of the building. In its closest proximity are facilities that can be used by the local community such as a multi-purpose sports hall, gym, cafeteria, changing rooms, a hydrotherapy pool and a small hot water pool, art studios, a music studio, a food technology room and a library. The administrative sector is directly adjacent to the entrance zone. Students are transported to school, picked up by the school staff in the drop-off area and they use entrances assigned to each educational stage. There are no collective cloakrooms, they are all located in classrooms. The building is clearly divided into Primary School, Secondary School and Further Education zones. Divisions are visible in the functional layout of the building as well as on the façades. Younger children study in the north-eastern part of the building,



Fig. 2. Oaklands School, author's scheme based on source data [3], [20]

II. 2. Szkoła Oaklands, autorski schemat na podstawie danych źródłowych [3], [20]

which is accessible from the external entrance area. The college classrooms are accessed through an open central courtyard and are located in the southernmost part of the building. The school is a two-story school, rooms for students with autism spectrum are located on the ground floor – 12 classrooms, each for 7–9 students [3].

The sensory zones are clearly indicated in the layout of the building (Fig. 2). The noisy zone of the building borders on the noisy zone of the surroundings (north-west), similarly with the determination of the boundaries of the quiet zone (south-east) in the vicinity of single-family housing. The atrium and the corridor function as a transition zone and buffers between low-stimulus and high-stimulus areas. This layout corresponds to the gradation of space availability – the high-stimulus zone is located in the entrance zone and is open to the public. The low stimulus zone is assigned to specific groups of students. The communication system introduces a clear layout of the space. The vertical curved line marks the internal communication zone and connects all educational stages. The horizontal line is public communication, which is a link between the sports and recreation zone and the school complex.

*Garston Manor School, Horseshoe Lane,  
Hertfordshire, UK*

1. General information.

Garston Manor School was built in 2014. The previous school building was intended for demolition in 2013 due to the low standard of use and no required area of the school (shortage of 46%). The new one-story building was built on a plot of 3.3 ha and has an area of 3007 m<sup>2</sup>. The school has a capacity of 150 students, aged 11 to 16. All students are certified as for “Learning Difficulties, Autism and Speech Language and Communication Needs”. Teaching staff counts around 47 employees. The school is located in

the north-west of Horseshoe Lane within the Green Belt. It has access to the Horseshoe Lane road which provides the main communication route to the school. The school is flanked to the north and east by other schools and their playing fields. In the south, it borders on a residential area [21], [22].

2. Functional and spatial solutions of the school.

The public zone is located in the north-western part of the plot. It consists of two sports fields, parking spaces and a drop-off area. The sports zone is dedicated for the school and the local community. The main corpus is located in the central part of the plot. It is separated from the car parks and sports zone by a narrow buffer zone. From the south, it borders on intimate and quiet outdoor spaces. This is in line with the need to ensure safety away from publicly located areas [4].

The main entrance is located in the north-western part of the building. In its close proximity, there is a hall/dining room, which also provides a space for indoor sports. The building is one-story, with a raised ceiling in the place where the assembly hall is located. There is an administrative zone near the entrance area. The Secondary School and Sixth Form educational clusters are organized along one corridor. The classrooms, which are oriented to the north-west, are almost directly adjacent to parking lots and playing fields. Southeast-oriented classrooms are adjacent to peaceful recreation areas. In total, 19 classrooms have been designed in the school with direct access to private gardens.

The sensory zones of the space are clearly indicated in the layout of the building (Fig. 3). The western part with the entrance zone and the sports hall is noisy, the middle part with classrooms is isolated from the noisy zone by a buffer zone. The eastern part of the building with classrooms is located in a quiet zone and borders on a noisy

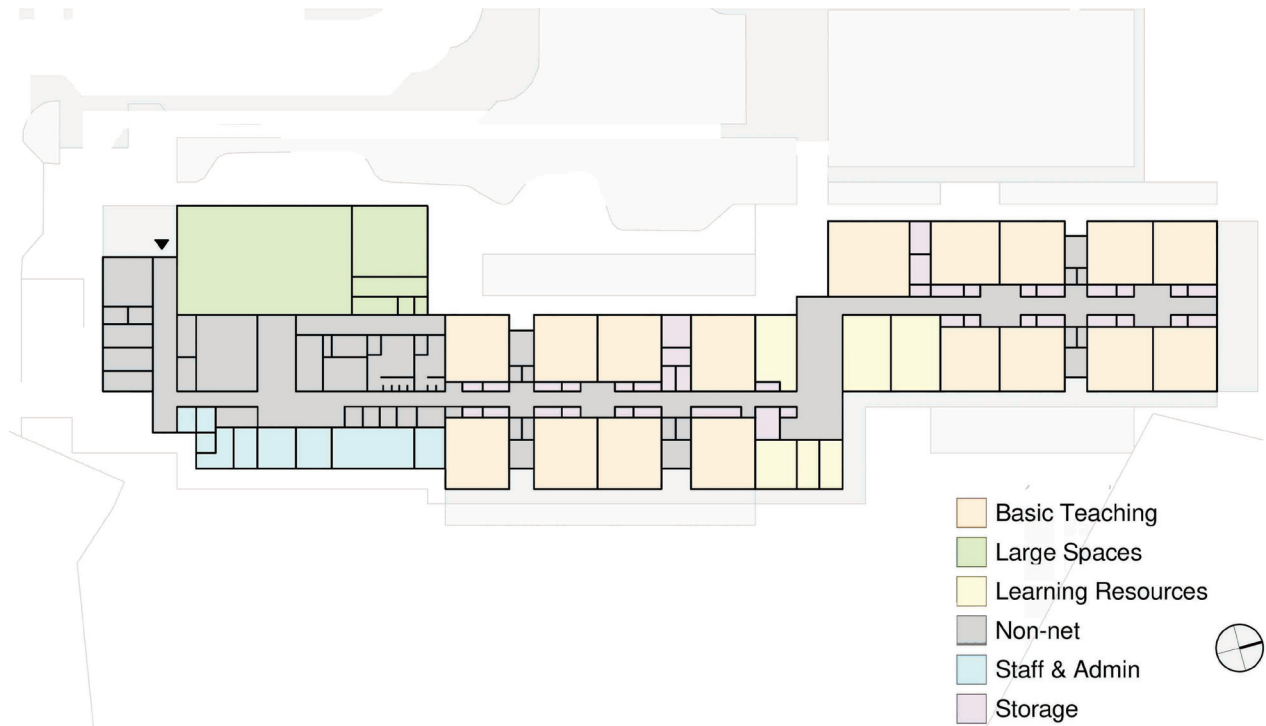


Fig. 3. Garston Manor School, author's scheme based on source data [4]

Il. 3. Szkoła Garston Manor, autorski schemat na podstawie danych źródłowych [4]

zone of the environment – a sports field. In the transition zone, administrative rooms have been located between the hall and the clusters. The functional layout of the space is related to the gradation of zone accessibility for third parties. The communication system is simple. The horizontal line defines the general communication zone, which turns into internal communication of educational clusters.

### Results

Two of the analyzed examples present a comprehensive approach to education, they deal with educating students at all educational stages without the need to change the seat. After completing the individual stages, students do not have to move to other schools and go through a difficult adaptation process. The facility along with the environment, teachers and school policies will positively affect students' sense of security.

The method of designing the functional and spatial solutions of buildings is subordinated to sensory zoning. In each building there is a clear division into a noisy zone with a high stimulus intensity and a quiet zone with a low stimulus intensity. The zones are not adjacent to each other and do not interpenetrate in any way. In one case, an exception was noted. The conflict occurs at Garston Manor School, where the noisy zone – the pitch is adjacent to the educational cluster.

There is a transition zone between the zones described above. It is provided in each of the described buildings. It is an acoustic buffer and indicates a change in the intensity of the stimulus. In the analyzed examples, the noisy zone is indicated as the rest of common access zone with a high

stimulus. The low-stimulus zone always occurs within educational clusters, with the exception of clusters with high-stimulus rooms – such a situation was noticed at the Ysgol Plas Brondyffryn school. The high-stimulus rooms were concentrated in the middle wing, on the ground floor.

A simple communication system introduces a clear layout of the building. The introduced sequencing of space improves the wayfinding for students. The internal layout of the space and the finishing material allows smooth movement from one zone to another. The student's journey between the drop-off area and the classroom should run with minimal disturbance and distraction. There is no public cloakroom in schools, students have their own independent space with cloakrooms within the classrooms. This solution allows using the gardens designed in front of the classrooms anytime, without going through the public noisy zone.

### Conclusions

The article describes the implementation of selected design criteria in three accredited autism-friendly schools (Table 1). The functional and spatial solutions of the built environment in terms of the sensory quality of the space can influence student perception. Moreover, the design of the transition zones is worth noting. In the mentioned examples this space is used to separate high-stimulus and low-stimulus zones. The functional-spatial arrangement provides the availability of low- and high-stimulus functions from a sensory-neutral space. The solution improves the calibration of the senses and provides sensory rest between activities with different stimuli intensities. Wayfinding in the mentioned buildings causes minimal

Table 1. Summary of the functional and spatial evaluation of the analyzed objects in the category of sensory zoning (elaborated by K. Mentel)

Tabela 1. Podsumowanie oceny funkcjonalno-przestrzennej analizowanych obiektów (oprac. K. Mentel)

| School          | Sensory demarcation | Transitions zones | Wayfinding |
|-----------------|---------------------|-------------------|------------|
| Ysgol Plas      | Tangible            | Courtyard         | Simple     |
| Oaklands School | Tangible            | Courtyard         | Medium     |
| Garston School  | Tangible            | Administration    | Simple     |

interference with external stimuli, introducing limitation of the variability of the intensity of stimuli on the student's way. Architects in the design process should take into account the different perceptions of people with autism. These aspects affect the sense of security and support cognitive mechanisms. The model of analysis of the collected

data presented as part of the preliminary study can be used to develop the research method. It seems desirable to continue collecting and examining more objects in order to obtain reliable data and extend the design criteria of the research. Extensive scientific research will enable the development of diagrams that can be a design tool for architects.

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## **Abstract**

### ***Analysis of functional and spatial solutions in selected centres accredited by the National Autistic Society***

In Great Britain specialist centres best adapted to people with autism spectrum disorder are rated and accredited by the National Autistic Society. The article presents Multiple Case Study research analyses and compares three building examples.

The subject of the research is the analysis of objects from the list that met the inclusion criteria or have been developed as part of the British government programs to improve the quality of education. The research purpose was to analyse and compare the design criteria selected based on literature research. The criteria also influence the development of the functional and utility structure of the centres. Research has been carried out as a "pilot study" and has been conducted using the expert method from the perspective of an architect and therapist of people with autism spectrum disorder. The author has used pre-design studies, technical documentation, and photos as a source material.

The analysis revealed that the functional layout in the above-mentioned facilities was designed regarding the sensory gradation of space. The high-stimulus zone and the low-stimulus zone are accessible from a transition zone that is sensory-neutral. Sensory zoning of the space is a guideline for functional design.

The model of analysis of the collected data presented as part of the pilot study can be used to develop the research method. It seems advisable to extend the list of design criteria and continue collecting data in order to obtain reliable results.

**Key words:** autism, case study, design, architecture

## **Streszczenie**

### ***Analiza rozwiązań funkcjonalno-przestrzennych w wybranych ośrodkach akredytowanych przez National Autistic Society***

W Wielkiej Brytanii specjalistyczne ośrodki najlepiej przystosowane dla osób ze spektrum autyzmu otrzymują akredytację stowarzyszenia National Autistic Society. W artykule przedstawiono badanie typu *multiple case study* wybranych przykładów takich ośrodków.

Przedmiotem badania były trzy obiekty z listy, które spełniły kryterium włączenia, zostały rozbudowane w ramach rządowych programów podnoszenia jakości kształcenia. Celem badania była analiza i porównanie wybranych na podstawie badań literaturowych kryteriów projektowych wpływających na kształtowanie struktury funkcjonalno-użytkowej ośrodków. Badanie ma charakter pilotażowy i zostało przeprowadzone metodą ekspercką z perspektywy architekta i terapeuty osób z autyzmem. Wykorzystano materiały źródłowe; badania przedprojektowe, dokumentację techniczną i zdjęcia.

Dzięki przeprowadzonej analizie wykazano, że układy funkcjonalne w wyżej wymienionych obiektach zostały zaprojektowane z uwzględnieniem gradacji sensorycznej przestrzeni. Strefa o wysokim bodźcu i strefa o niskim bodźcu są dostępne ze strefy przejściowej, która jest neutralna sensorycznie. Strefowanie sensoryczne przestrzeni jest nadrzędne w stosunku do projektowania funkcjonalnego.

Model analizy zebranych danych przedstawiony w ramach badania pilotażowego może posłużyć do rozwijania metody badawczej. Celowe wydaje się rozszerzenie listy kryteriów projektowych i kontynuowanie zbierania danych w celu uzyskania miarodajnych wyników.

**Słowa kluczowe:** autyzm, studium przypadku, architektura, projektowanie

