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# Therapeutic Facility for Individuals with Autism Spectrum Disorder

## Ośrodek terapeutyczny dla osób ze spektrum autyzmu

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**Abstract:** The number of individuals diagnosed with Autism Spectrum Disorder (ASD) is currently growing, and despite this, their needs are rarely accounted for in construction codes and design guidelines. People with ASD are particularly sensitive to the environment, mainly due to the specificity of sensory functioning: either a hyper- or hypo-reactivity to stimuli and non-standard interests in the sensory aspects of their surroundings. The objective of this paper is to present the design of a therapeutic facility for individuals with ASD which incorporates psychological research findings, proposed general guidelines concerning design for this user group, existing buildings and original design solutions.
**Keywords**: Autism Spectrum Disorder, therapeutic facility, architectural design, site-specific conditions

**Abstrakt:** Współcześnie wzrasta liczba osób z diagnozą zaburzeń ze spektrum autyzmu (ASD), a mimo to ich potrzeby rzadko są uwzględniane w przepisach budowlanych i wytycznych projektowych. Osoby z ASD są szczególnie wrażliwe na otaczające środowisko, głównie z powodu specyfiki funkcjonowania sensorycznego: hiper-lub hipo-reaktywności na bodźce oraz niestandardowych zainteresowań sensorycznymi aspektami otoczenia, a także wrażliwości na dystraktory i deficyty uwagi przestrzennej. Celem artykułu jest przedstawienie projektu ośrodka terapeutycznego dla osób z ASD, z uwzględnieniem wiedzy psychologicznej, postulowanych ogólnych wytycznych dotyczących projektowania dla tej grupy użytkowników, istniejących już obiektów oraz własnych rozwiązań.
**Słowa kluczowe**: spektrum autyzmu, ośrodek terapeutyczny, projektowanie architektoniczne, warunki środowiskowe

### Introduction

Autism Spectrum Disorder (ASD) is a type of neurodevelopmental disorder. The main symptoms of ASD include social communication deficits, limited and repetitive behaviour, interest or activity patterns and a non-standard reception of sensory stimuli (APA, 2013). The aetiology of ASD is not fully understood, although the most probable causes include interactions between genetic and environmental factors (Beversdorf, Stevens & Jones, 2018; Bölte, Girdler & Marschik 2019).

At present, there is an observable increase in the number of diagnosed cases of ASD (Sheldrick & Carter, 2018). Social awareness concerning the specificity of how people with ASD function is increasing, but the group itself is often ignored in the process of architectural design. The needs of individuals with ASD are rarely, if ever, considered in building codes and design guidelines. This is a serious problem, as such people are more sensitive to their physical surroundings than neurotypical individuals (Whitehurst, 2006). When individuals with ASD cannot understand or adapt to their surroundings, they typically experience strong discomfort, which can lead to problem behaviours (Dellapiazza et al., 2020). Although the surrounding environment has such a strong impact on individuals with ASD, there are relatively few publications on designing spaces that would be friendly to them (McAllister & Maguire, 2012; Zulkanain & Mydin, 2019).

People with ASD are particularly sensitive to the environment around them, which is primarily caused by sensory processing disorder. The clinical presentation of ASD is diverse and highly individualised, and can include hyper- or hypo-reactivity to sensory stimuli (e.g. a visible obliviousness to pain, heat and cold, or the opposite - a negative reaction to specific sounds or surfaces) or unusual interest in the sensory aspects of the environment (obsessive smelling or touching of items, fascination with blinking lights or rotating objects) (APA, 2013, 2015; Takahashi et al., 2018; Seungwon Chung & Jung-Woo Son 2020). People with ASD were also observed to have deficits in spatial cognition (Ronconi et al., 2018) which are responsible for focusing on a single specific area of space, which significantly hinders effective behaviour control. Distractions can also adversely affect the capacity to learn or engage in therapy (McAllister & Maguire, 2012), which is why factors that can affect the sense of hearing and sight (distractors) should be minimised (Khalifa et al., 2020). On the other hand, it was observed that individuals with ASD display a tendency to focus on details in their local environment. They navigate based on orientation points - landmarks (Blanchette et al., 2019).

M. Mostafa (2014; 2015) proposed seven criteria for designing for people with ASD, known as ASPECTSS™: /1/ Acoustics, /2/ Spatial sequencing, /3/ Escape space, /4/ Compartmentalisation, /5/ Transitions, /6/ Sensory zoning, and /7/ Safety.

/1/ Acoustics. This criterion is intended to minimise background noise, echo and reverberation. The level of acoustic control should differ depending on attention focus intensity that is required within a given space and the intensity of autism symptoms of the persons inside the space. For instance, activities that require greater focus should be performed under conditions with a higher degree of acoustic control and be a part of low-stimulus zones. One should also provide different levels of acoustic control, so that individuals with ASD could gradually move from one level to another. /2/ Spatial sequencing is based on taking advantage of the propensity of persons with ASD for routine and predictability. It requires areas to be ordered and logically sequenced, based on planned use of space. Spaces should be as fluid as possible, moving from one activity to another, via one-way circulation, with minimum disruption and distraction, and with the application of intermediate zones. /3/ The purpose of Escape space is to provide individuals with ASD with respite from excessive stimulation in the surroundings. It can comprise a small area sectioned by partition walls or an isolated space in a quiet part of the room (or building). /4/ The philosophy behind Compartmentalisation is based on defining and limiting the sensory environment of every activity, organising classrooms or even entire buildings into compartments. Every compartment should have a single, clearly specified function and a resultant sensory quality. The border between these compartments does not need to be crisp, but it can be demarcated via furniture placement, flooring material or even differences in lighting. The sensory characteristics of every space need to be used to determine this function and separate it from nearby spaces. Combined with consistency in action, sensory cues can be delivered as to what is expected of people in every space while maintaining minimum ambiguity. /5/ The presence of Transitions aids individuals with ASD in recalibrating their senses while moving from one stimulus level to another. Such zones can take on different forms - from a separate node which signalises change, to a full sensory room which allows sensory recalibration prior to moving from an area with high stimulus intensity to a low-intensity area. /6/ Sensory zoning is a proposal to organise spaces according to their sensory quality and not their typical functional division when designing for persons with ASD. This requires grouping spaces depending on their permissible stimulus level into 'high-stimulus' and 'low-stimulus' areas with transition zones in-between. /7/ Safety should be a priority when individuals with ASD are concerned, for instance with the application of safety appliances that regulate hot water temperature and avoidance of sharp edges or corners.

The objective of this paper is to present the design of a therapeutic facility for individuals with Autism Spectrum Disorder that accounts for the specificity of their functioning. We intended to design a building that, through a simple internal space layout, legible massing and the inclusion of spaces for individual forms of therapy, would create a friendly environment for people with ASD. In the design, apart from rooms associated with the building's operation, sanitary facilities and rooms adapted to animal assisted therapy, we also designed spaces intended to support the intellectual and physical development of individuals with ASD. These are, among others, sensory spaces and Snoezelen sensory rooms. We also designed a sensory garden equipped with appropriate plant types.

## 1. Design inspirations

Prior to engaging in design work on the facility for individuals with ASD presented in this paper, we researched buildings that had a similar function, focusing not only on the aesthetic properties of such buildings, but also on their functio-spatial programme. Each of the buildings presented below had some degree of impact on our work. The designs presented are cases of excellent, world-class architecture in the field of buildings for users with mental disorders. Innovative uses and properly designed spaces in these buildings aid specialists in offering therapy to individuals with ASD and other disorders, but most importantly exert a positive influence on them.

### 1.1. Healthcare Centre in Vic, Spain

From among the buildings analysed, the design inspiration chosen first was the Healthcare Centre located in the Spanish city of Vic in northern Catalonia. The building was designed by Comas–Pint arquitectos, a local design firm. The entire complex is based on several repetitions of a module that is 6 m wide. The site plan features a series of well-blended structures around a central pavilion. These structures are separated from each other by gardens cultivated by the centre's patients. Due to these procedures, the building appears to blend well with the surrounding nature, creating a place that is positively received by persons with psychological problems. On an area of 1657 m$^2$, a series of spaces was designed for various types of individual and group therapy. The building has an economic, modular, high-performance energy system, which allows adapting energy demand to the interior of a space and the external climate[1].

### 1.2. New Struan, A Centre For Autism

The second building that was analysed in the preparation of our conceptual design proposal was A Centre for Autism – New Struan, which is located in Alloa, Scotland. The building was designed by Aitken Turnbull Architects with architect Andrew Lester at the helm, who is privately a father to a girl diagnosed with ASD. The building, apart from operating as an autism centre, fulfils various other functions, such as a research and diagnosis centre, offers training courses and counselling. It also includes an independent school operated by the Scottish Society for Autism—the New Struan School. The building's functional programme is distributed across its ground floor, which has the shape of the letter *T*. the building has seven classrooms for group learning, an excellently equipped multi-sensory room, a library, a staff room, a foyer, an early learning centre and spaces for therapists. During the design of New Struan, its architects clearly stressed providing a large

[1] https://www.archdaily.com/870911/psychopedagogical-medical-center-comas-pont-arquitectos

amount of sunlight into each of its spaces. It is also for this reason that the atrium, which runs along the entire length of the building, is covered by a glazed gable roof with a relatively high pitch, which admits daylight into the entire space of the building[2].

**1.3. Child Psychiatry Hospitalisation Building of 12 beds**

The final chosen inspiration was the Child Psychiatry Hospitalisation Building of 12 beds, designed by the a + samueldelmas architectural firm. The building, which has a floor area of 1428 $m^2$, was sited in the French locality of Bures-sur-Yvette. The building's individual spaces are placed around its centrally located courtyard. Despite the building's uncomplicated massing and the application of traditional finishing materials, it produces an impression of being a modern building by, among others, large, irregularly placed glazed surfaces on its facade. On its ground floor there is a large courtyard covered in short and tall greenery. The space inside and outside the building is clearly divided into different zones depending on patient needs. The courtyard opens up towards a patio and a dining room which act as integration spaces. There are also several rooms here that form an intimate zone for individual therapy. This level is used more for everyday living than therapy due to the rooms located here (dining room, living room, individual living quarters). The second storey includes spaces whose equipment is used in exercise therapy. The courtyard, which can be reached from the building's first floor, is partially covered by varying types of low-lying greenery. These procedures make the building more eco-friendly and allow it to better blend with the environment, which is mostly natural.

**2. The building under design and its site**

We sited the building in Rzeszów, a city lcoated in south-eastern Poland, at Forsycji Street. Rzeszów's Old Town Market Square is located 3.3 km from the site, as measured in a straight line. The area near Forsycji Street is located in the south-eastern part of the city (Fig. 1).

Figure 1. The site chosen for the design – aerial view of the city and the development surrounding the site (source: http://mapy.geoportal.gov.pl/) (access: 21.05.2020).

[2] https://www.aitken-turnbull.co.uk/project/centre-autism-new-struan

The site is located in the northern part of a complex of single-family houses in the district of Zalesie. Despite the plot being located in relatively close proximity to the city centre, the area is quiet and peaceful. The immediate area features detached and terraced single-family housing and several low-rise multi-family buildings. The site fulfils the functions necessary due to its planned use and the facility's functional programme as individuals for whom the building was designed are not isolated from the rest of society and can come into contact with the local community. This can also positively influence residents, who could begin to gradually better understand the facility's patients. Another of the site's strengths is the circulation layout, as it is very safe due to low traffic intensity. We have presented the facility's site plan in Figure 2.

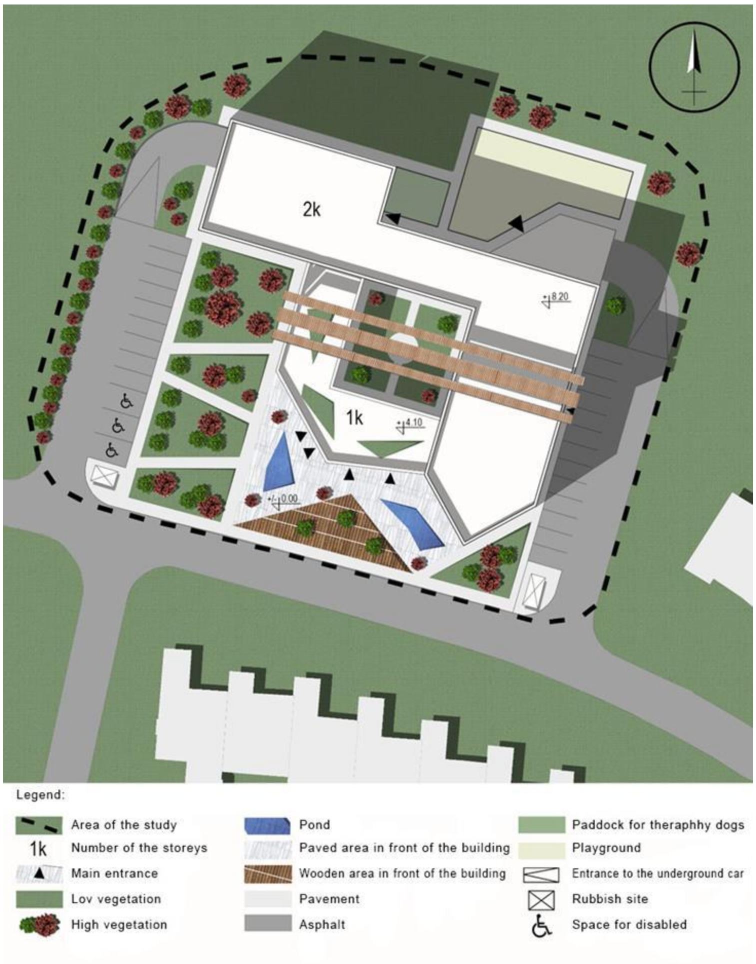


Figure 2. Site plan, design

The site development was designed so that the facility could blend in with its immediate surroundings. The main entrances to the building were placed from the south-west. In front of the building's entrance, the site was arranged to feature a small formal square. Outside of the paved surfaces, it also features two ponds, a triangular square covered with wooden flooring with openings for small trees, and pavements that cross through areas covered with landscaped low-lying and tall greenery.

Two entrances to an underground car park have been marked on the plan. Outside, 25 parking spaces were designed, including three adapted to the needs of persons with disabilities. To the north-east of the building, we placed a dog park for therapy dogs and a playground, whose direct exit leads to a sports hall designed on the building's ground floor. The building's massing has been presented in figure 3 and the underground car park's floor plan - in Figure 4.

Figure 3. The building's massing, design

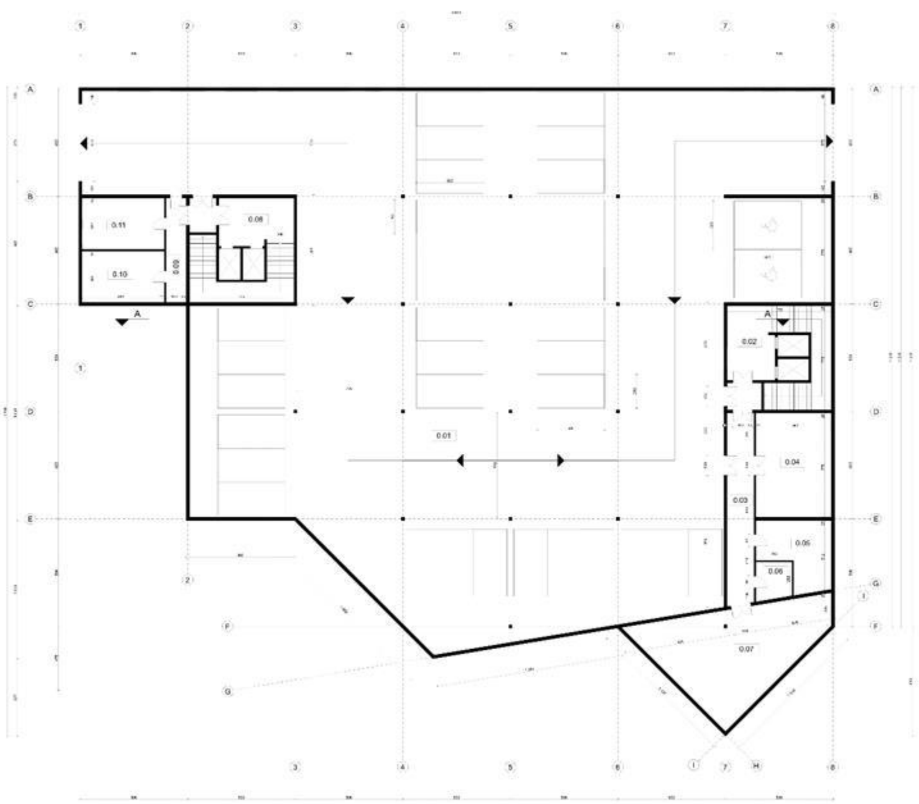

Figure 4. Underground car park floor plan, design

We designed the building to be equipped with an underground car park, inside which, apart from parking spaces for automobiles, there are also several spaces associated with the essential operation and alimentation of the building (server room, power distribution station, water connection room, central heating unit room, ventilation and air-conditioning unit space, and storage area; there are 35 parking spaces, two of which are dedicated to individuals with disabilities and parking space dimensions comply with applicable standards)[3] .The ground floor plan has been presented in figure 5.

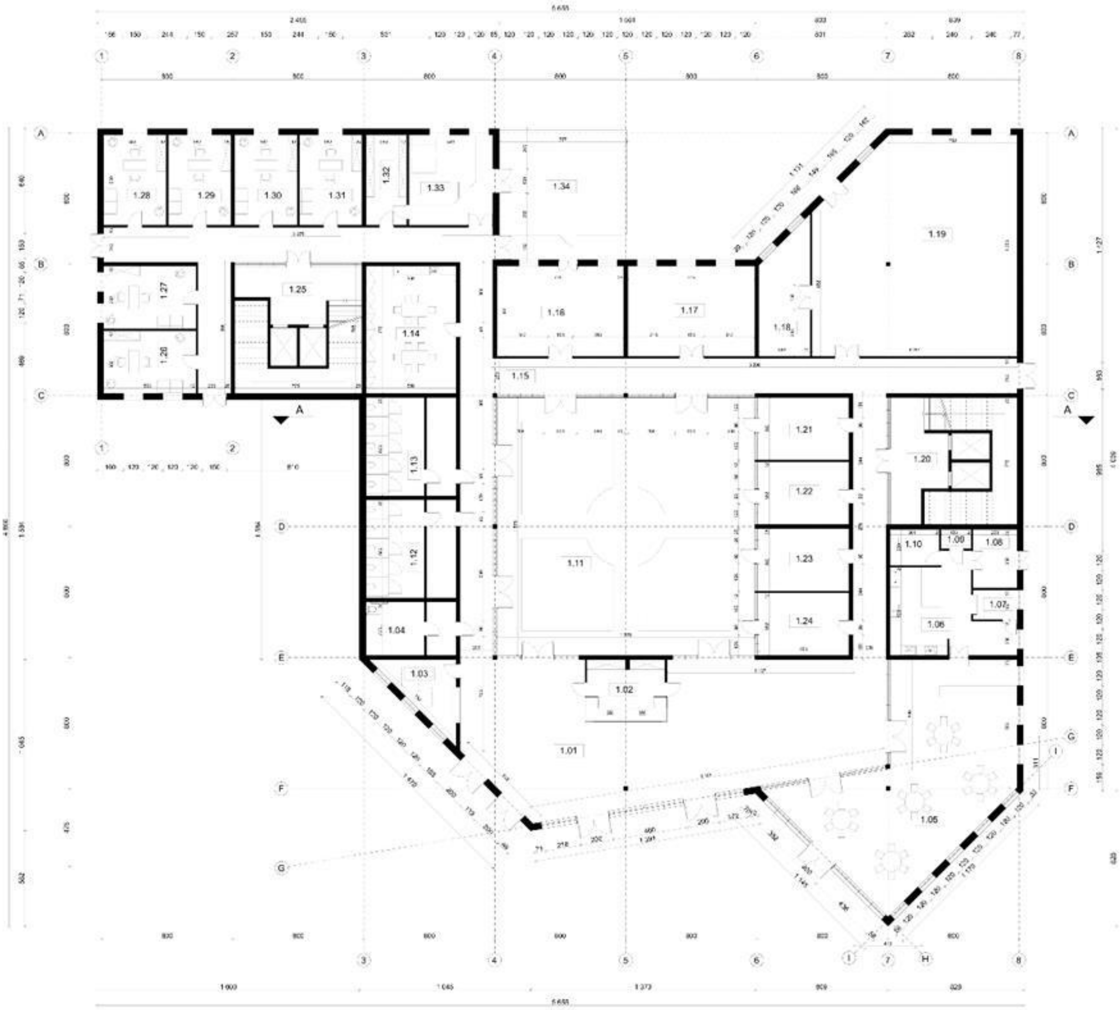

Figure 5. Ground floor plan

[3] Ordinance of the Minister of Infrastructure and Construction of 14 November 2017 (Dz. U. 2017, item 2285).

Table 1. Room floor area schedule for the underground car park

| Room no. | Room name | Floor area ($m^2$) |
|---|---|---|
| 0.01 | Car park | 1556.3 |
| 0.02 | Stairwell | 60.1 |
| 0.03 | Circulation | 28.5 |
| 0.04 | Storage | 43.6 |
| 0.05 | Central heating unit | 23.4 |
| 0.06 | Water supply connection room | 7.4 |
| 0.07 | Ventilation and air-conditioning unit space | 80.1 |
| 0.08 | Stairwell | 60.1 |
| 0.09 | Circulation | 11.6 |
| 0.10 | Server room | 23.4 |
| 0.11 | Power distribution station | 23.4 |
| Total floor area | | 1917.9 |

We designed the facility to include sensory rooms, Snoezelen sensory rooms, rooms that support intellectual and physical development and a room adapted to animal assisted therapy, a sensory garden with appropriate plants, ancillary spaces and sanitary facilities. To improve the functioning of the central nervous system, we programmed specialist classes in the sensory integration room. We planned the interior to be equipped with specialist training and play equipment.

The large open courtyard featured in the design was placed in the central part of the building, where it will serve not only to facilitate interpersonal interaction in the centre, but also provide access to daylight to corridors in the building and its modern individual therapy rooms which are open in the direction of the central interior. The entrance to the building does not lead to a hall, but instead directly to the foyer. Because of this, we designed air curtains at each of the main entrances. The foyer was designed to include a reception space as a place to direct obtain information. Individual therapy rooms, along with the sports hall, stairwell and coffee shop with necessary ancillary spaces were placed in the eastern part of the building.

Table 2. Room floor area schedule for the ground floor

| Room no. | Room name | Floor area ($m^2$) |
|---|---|---|
| 1.01 | Foyer | 195.9 |
| 1.02 | Reception space | 18.9 |
| 1.03 | Cloakroom | 14.3 |
| 1.04 | Accessible toilet | 18.0 |
| 1.05 | Coffee shop room | 127.4 |
| 1.06 | Kitchen | 34.3 |
| 1.07 | Dishwashing room | 4.8 |
| 1.08 | Storage area | 9.6 |
| 1.09 | Waste area | 2.2 |
| 1.10 | Cold room | 6.6 |
| 1.11 | Courtyard | 248.6 |
| 1.12 | Women's toilet | 33.1 |
| 1.13 | Men's toilet | 33.1 |
| 1.14 | Staff room | 42.7 |
| 1.15 | Circulation | 217.7 |
| 1.16 | Dog assisted therapy room | 43.0 |
| 1.17 | Education room | 43.0 |
| 1.18 | Storage area | 22.3 |
| 1.19 | Sports hall | 158.0 |
| 1.20 | Stairwell | 60.1 |
| 1.21 | Individual therapy room | 21.1 |
| 1.22 | Individual therapy room | 21.1 |
| 1.23 | Individual therapy room | 21.1 |
| 1.24 | Individual therapy room | 21.1 |
| 1.25 | Stairwell | 60.1 |
| 1.26 | Office | 21.5 |
| 1.27 | Office | 21.5 |
| 1.28 | Office | 21.5 |
| 1.29 | Office | 21.5 |
| 1.30 | Office | 21.5 |
| 1.31 | Office | 21.5 |
| 1.32 | Storage area | 13.8 |
| 1.33 | Room for dogs | 28.6 |
| 1.34 | Dog enclosure | 49.3 |
| Total floor area | | 1677.3 |

The western part of the building was designed to include toilets and a staff room. The northern section houses an animal-assisted therapy room and a common education room. The north-western part of the building primarily includes office rooms for specialists, in addition to another stairwell and spaces suitable for therapy dogs along with a storage area for feed and other accessories for the animals. The plan of the first floor has been presented in figure 6.

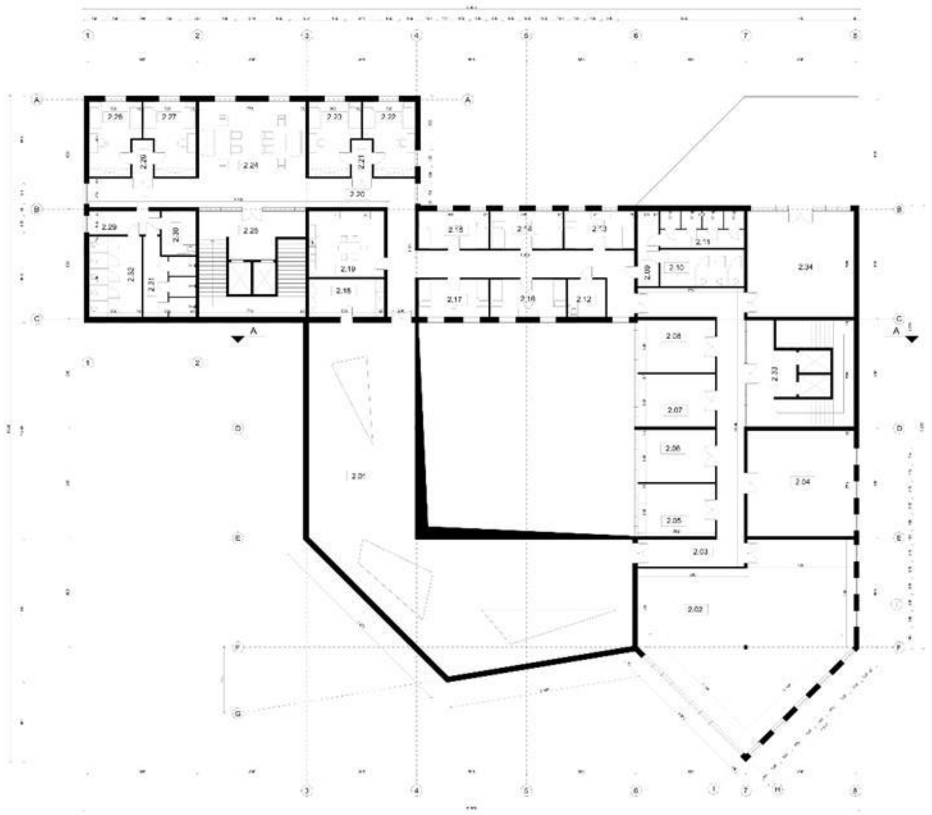

Figure 6. First floor plan

Table 3. Room floor area schedule for the first floor

| Room no. | Room name | Floor area (m²) |
|---|---|---|
| 2.01 | Green terrace | 293.1 |
| 2.02 | Group integration room | 168.3 |
| 2.03 | Circulation | 65.3 |
| 2.04 | Snoezelen sensory room | 59.7 |
| 2.05 | Sensory integration room | 21.5 |
| 2.06 | Sensory integration room | 21.5 |
| 2.07 | Sensory integration room | 21.5 |
| 2.08 | Sensory integration room | 21.5 |
| 2.09 | Vestibule | 8.3 |
| 2.10 | Toilet | 16.5 |
| 2.11 | Shower | 16.5 |
| 2.12 | Accessible toilet | 7.6 |
| 2.13 | Room | 14.1 |
| 2.14 | Room | 14.1 |
| 2.15 | Room | 14.1 |
| 2.16 | Room | 14.1 |
| 2.17 | Room | 14.1 |

| | | |
|---|---|---|
| 2.18 | Storage space | 15.3 |
| 2.19 | Kitchen | 26.8 |
| 2.20 | Circulation | 105.1 |
| 2.21 | Circulation | 4.2 |
| 2.22 | Room | 18.7 |
| 2.23 | Room | 18.7 |
| 2.24 | Living room | 43.6 |
| 2.25 | Stairwell | 60.1 |
| 2.26 | Circulation | 4.2 |
| 2.27 | Room | 18.7 |
| 2.28 | Room | 18.7 |
| 2.29 | Vestibule | 9.0 |
| 2.30 | Accessible toilet | 8.0 |
| 2.31 | Shower | 18.6 |
| 2.32 | Toilet | 22.5 |
| 2.33 | Stairwell | 60.1 |
| 2.34 | Snoezelen sensory room | 60.1 |
| Total floor area | | 1304.2 |

On the first floor of the building, we designed nine rooms for persons who need to stay in the building for periods exceeding the scheduled therapy hours. A living room was also designed for these persons, which is to facilitate integration between class participants. In this part of the building, apart from sanitary facilities, we designed a kitchen which can be used to prepare meals by both the facility's staff and individuals with ASD. The largest space on this level is the group integration room.

We designed four sensory integration room near each other and equipped them with glazed surfaces from the side of the courtyard. Directly near the stairwell, on both of its sides, we designed Snoezelen sensory rooms. In the design, we assumed that planning windows or doors on several walls can be distracting, and instead found it to be a good idea to place several glazing modules near each other on a single wall, through which we also provided a good source of daylight. A part of the roof above the ground floor was designed as a green terrace, which could allow patients to plant and cultivate plants under the supervision of therapists. Figure 7 shows the building's elevations.

Figure 7. Elevations, design

As a form of accounting for site-specific conditions in the design of the architectural form of the building, we opted for a proposal of contrasting the massing of the facility with its contextual development. However, we decided to use traditional technologies on the building's facades so as to reference regional practices. Most external walls, covered with white cement and lime plaster with decorative dark-graphite brick elements, was to reference the colour compositions used throughout the region. The glazings in the building, with identical modules, are intended not to cause anxiety and distract the facility's particularly sensitive users. Figure 8 shows the building's cross-section.

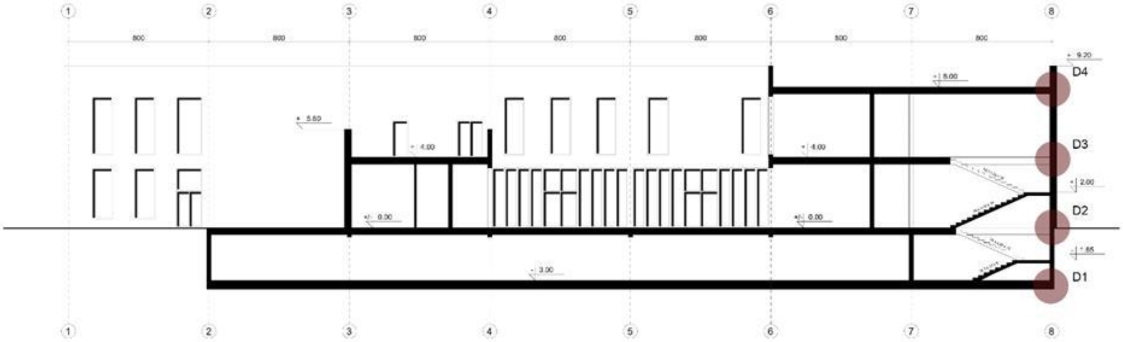


Figure 8. Cross-section A–A, design

On the building's cross-section, which cuts through its stairwell, we can see the significant dimensions of the building in relevant places, as shown on elevation markers. The drawing includes structural axes and the dimensions of the distances between them. On the drawing to the right, we used the colour red to mark places for which design details were drawn (not included in the paper).

### 3. Structural and material solutions

The building rests on a reinforced concrete slab footing which is 40 cm thick. The surface layer of the footing slab is covered in grated concrete grout with a thickness of 12 cm, which is to act as a car park floor and allow the movement and parking of automobiles inside. We used traditional materials in the design as they have beneficial health-related characteristics.

The internal and external load-bearing walls were designed from Wienerberger Porotherm P+W ceramic masonry units with a thickness of 25 cm. The external walls were designed as insulated with 15 cm styrofoam panels covered with cement and lime plaster and decorative brick in selected places. For partition walls, we proposed Wienerberger Porotherm P+W ceramic masonry units with a thickness of 11.5 cm. Due to structural reasons, we introduced columns with a cross-sectional dimension of 25 x 25 cm, made out of reinforced C25/30 class concrete. The columns were placed axially throughout the building, spaced every 800 cm. The deck, with a thickness of 22 cm, was designed as a cross-reinforced slab due to the spans between columns, beams and load-bearing walls (reinforced concrete walls are to be cast in place on-site).

Concerning individuals with disabilities, which would form the majority of the facility's users, we designed a simple and well-legible circulation layout with a base width of 2 m. We chose wood as the material windows frames and doors, which are to have the colour of mahogany. The glued, single-hollow, safety glass windows, with a low-emission film and thermal frame filled with a noble gas, e.g. argon, 4/16/4, with a $U_{max}$ = 1.00 W/m²K. We assumed a thermal transmittance of U = or < 1.1 W/m²K.

We planned comfortable two-run stairs with a riser height of 14.3 cm and tread width of 32 cm, a run width of 200 cm and a landing width of 150 cm. The reinforced-concrete stairs are to be cast in place on-site out of C25/30 class concrete. In each of the two stairwells there are to be two lifts adapted to the needs of persons with disabilities.

We designed three decorative structural elements in the shape of the letter *C*. These elements are visible outside of the building and run parallel to the main entrances of the building. They are to be composed of metal hollow sections with a wall width of 4 cm and horizontally covered with ornamental laths, which shall magnify the effect of the visual composition.

The attic walls at the top of the building were designed as built from ceramic masonry units with a width of 20 cm, insulated from outside with styrofoam panels with a thickness of 15 cm from the outside and with 8 cm panels from the inside. We also designed the flat roof so as to be based on traditional technology.

## 4. Visualisations of the building


Figure 9. Visualisation no. 1.


Figure 10. Visualisation no. 2

**Conclusions**

Cooperation between architects and psychologists brings results in design solutions that are conducive to safety, good health and development (Coburn, Vartanian and Chatterjee, 2017). In the paper, based on studies about the needs of people with ASD, followed by the analysis of design guidelines oriented towards this group and existing buildings, we prepared a design of a facility for individuals with ASD.

Due to the fact that an increasing number of children is being diagnosed with Autism Spectrum Disorders, the design of buildings adapted strictly to their needs is gaining in significance. It also leads to the need to pursue modern solutions in contemporary therapeutic architecture. The facility we designed meets not only the requirements of a building in which individuals with ASD have a chance to improve their social and everyday functioning through therapy, but also allows them to live safely. The proposed form and detailed solutions of the building can potentially have beneficial effects on the psyche of its residents and their social ties. Architects, by cooperating with psychologists, have stepped up to the challenge of designing space and the pursuit of architectural solutions for persons who receive environmental stimuli in a non-standard way. At present, designers also face the new experience of creating spaces not only for neurotypical persons, but also those with various disorders and dysfunctions. In architecture, evolution strives to design new functions for living spaces. Such an attempt was presented it in this paper.

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