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# Rehabilitation Spaces – Architecture for Children with Multiple Disabilities

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**Abstract.** Supporting the development of children with multiple disabilities and raising the level of their autonomy requires the creation of a safe and inspiring environment. Conditions which it is supposed to provide decide about the effectiveness of the support and, in consequence, of the whole rehabilitation process. Developing the concept of rehabilitation space for children with complex, coupled or multiple disabilities, including intellectual handicap, requires making continuous attempts to answer some fundamental questions: what do we know about the possibilities of rehabilitation, what can we achieve by creating friendly architecture and what features should it possess?

The aim of the publication is discussing the idea of creating spaces with the highest level of accessibility for users with a broad spectrum of disabilities. Based on a special school modernization project conducted in cooperation with the students of The Faculty of Civil Engineering, Architecture and Environmental Engineering (Technical University of Lodz), the Author discusses the strategies for providing children with the most comfortable and independent ways of taking advantage of the existing architectural facilities. It should be emphasized that the design team was expected to develop solutions allowing the preservation of the existing construction and functions of the school, having made an assumption that all kinds of interference would be restricted by the scarce funds which had been allocated for the transformation of the facility.

Due to the fact that the school modernization project was based on the universal design principles, according to the regulations of the United Nations Convention on the Rights of Persons with Disabilities adopted on 13<sup>th</sup> December 2006, the designers resigned from many solutions that are currently considered as being operationally too difficult, costly, unaesthetic or stigmatizing, which in the future should become a new standard of architectural design. The paper presents examples of rational improvements realized by the application of varied, economically and aesthetically attractive design solutions, which could enable the creation of universal spaces. It also analyses the needs of an intuitive user, which can be fulfilled by employing simple methods of clear navigation within the buildings and in their surroundings. The possibilities of eliminating the barriers and supplementing hard-to-access stimuli with stimuli appealing to other senses as well as the use of orientation elements are being discussed. The Author makes an attempt to answer the question: what principles should be followed in the process of transforming degraded and unfriendly buildings and facilities into spaces which would inspire children to develop their maximum individual potential and build the highest possible degree of independence.



## 1. Introduction

Supporting children with multiple disabilities and raising the level of their autonomy requires creating a safe and inspiring environment. The conditions which it is supposed to provide decide about the effectiveness of the support and, in consequence, of the whole rehabilitation process. Formulating the substance of rehabilitation space for children with complex, coupled or multiple disabilities, including intellectual handicap, involves continuous attempts to answer some fundamental questions: what do we know about the possibilities of rehabilitation, what can we achieve by creating friendly architecture and what features should it possess?

In the Author's opinion many facilities currently operating in Poland are based on spatial solutions which are now considered as obsolete and incompatible with the European Union policy, i.a. with the regulations of the United Nations Convention on the Rights of Persons with Disabilities [1] or the Convention on the Rights of the Child [2]. Therefore, new methods and objectives are being indicated for developing school or rehabilitation facilities compatible with the contemporary understanding of the ideas of supporting children and making them independent. The presented solutions include design concepts with an extra-individual character, which are possible to be implemented in many facilities with the same or similar profile.

The aim of the publication is discussing the ideas concerning the creation of attractive spaces with the highest possible degree of accessibility for users with a broad spectrum of disabilities. Based on the example of a special school modernization project conducted in cooperation with the students of The Faculty of Civil Engineering, Architecture and Environmental Engineering (Technical University of Lodz), the Author discusses the strategies for providing children with the most comfortable and independent ways of taking advantage of the existing architectural facilities. It should be emphasized that the design team was expected to develop solutions allowing the preservation of the existing construction and functions of the school, having made an assumption that all kinds of interference would be restricted by scarce funds which had been allocated for the transformation of the facility.

Due to the fact that the school modernization project was based on the principles of universal design, according to the regulations of the United Nations Convention on the Rights of Persons with Disabilities adopted on 13<sup>th</sup> December 2006, the designers resigned from many solutions that are currently considered as being operationally too difficult, costly, unaesthetic or stigmatizing, which in the future should become a new standard of architectural design [3]. The paper presents examples of rational improvements realized by the application of varied, economically and aesthetically attractive design solutions, which could enable the creation of universal spaces. It also analyses the needs of an intuitive user, which can be fulfilled by employing simple methods of clear navigation within the buildings and in their surroundings. The possibilities of eliminating the barriers and supplementing hard-to-access stimuli with stimuli appealing to other senses as well as the use of orientation elements are being discussed. The Author makes an attempt to answer the question: what principles should be followed in the process of transforming degraded and unfriendly buildings and facilities into spaces which would inspire children to develop their maximum individual potential and build the highest possible degree of independence.

## 2. Functions of the rehabilitation space

In the field of architecture and urban planning the issue of accessibility has been discussed in the studies concerning the principles of universal design, the idea of which involves creating spaces accessible for all people regardless of their physical or mental limitations [4-8]. It seems, however, that this set of design principles mainly concerns persons with the dysfunctions of movement, hearing or vision, while the problem of development and rehabilitation of children with multiple disabilities is so complex that it requires a separate discussion, which should lead to providing practical solutions.

Persons suffering from limited ability do not constitute a homogenous group due to the fact that each genetic defect, disease, damage or injury that results in the loss or limitation of a particular function or skill - depending on the stage of the child's development when the incident occurred - leads to a variety of psychological or social consequences or in other ways affects further development

and activity of the individual in the social environment. Another factor that hinders everyday functioning of both disabled children and their closest surrounding tends to be – and this occurs most frequently – the overlap of different limitations [9].

It should be assumed that the rehabilitation space is a significant part of the support system understood as the action which is: intentional, complex, applied systematically and individually differentiated [10]. “The support process involves activating the development-enhancing factors and (...) it should be perceived as one of the first stages of the disabled children’s rehabilitation leading to their autonomy in the adult life (to the extent allowed by the individual’s condition). The successful development of autonomy depends on the needs and possibilities of a disabled person as well as on their environment” [10 p. 9]. An example of therapeutic actions that involve stimulating and inspiring the child’s activity and initiative is the method by M.Ch Knill [11, 12], aimed at creating appropriate conditions (including safety), which will facilitate maintaining the appropriate level of concentration.

“A child with multiple disability often exhibits a low level of activity, which is not the matter of individual choice” [10]. Disability, in general, results in being less active, leading to the experience of impaired identity [13]. “One of the ways of supporting the child’s development is designing spaces where the very functioning of the child would by itself have a supportive character” [10]. It is of particular importance while trying to stimulate the development of the youngest children since early rehabilitation provides a chance to achieve higher competences. It is the effect of, among others, a big plasticity of the young nervous system, which enables not only the correction of the disturbed functions but also the compensation of developmental deficits [10]. There is also a possibility of preventing or inhibiting the progressive disorders. Thus, the process of supporting the individual’s development depends on many factors, including a complex influence on a child via a friendly, clear and accessible space where he or she is functioning. In this context architectural planning could be perceived as one of the essential constituents of the active rehabilitation process.

### **3. Concept of rehabilitation space**

Developing the concept of increasing the accessibility of an existing facility was the objective of the workshop “Universal Planning – Shaping the Public Spaces and Buildings for Persons with Disabilities” organized by the Technical University of Lodz in cooperation with the local authority institutions and organizations of persons with restricted mobility and perception. The participants of the event, which was held on 6th-10th November 2017, were students of the Faculty of Civil Engineering, Architecture and Environmental Engineering of the Technical University of Lodz. Based on the audit of accessibility and the consultations with persons with disabilities, the students designed a project of modernization of a special boarding school including the developments around the facility.

The facility serves children with slight, moderate and severe disability and is located on a fenced and developed land. It consists of a set of joined 1-, 2- and 3-storey buildings, which house a school, a gym and a canteen with a kitchen (figure 1). The facility was constructed in the 1970s using traditional technology. In recent years there have been some modifications made in order to adjust it to the needs of persons with restricted mobility. The works involved the construction of an external elevator and a ramp, renovation of the external staircase and reconstruction of the internal staircase.



Figure 1. The special boarding school. The existing state. Source: J. Borowczyk

The school modernization project designed during the students' workshop was based on the idea of creating a space which is attractive and accessible for the users with a broad spectrum of disabilities (figure 2). Attempts were made to reach the highest possible degree of compliance with the principles of universal design developed at the North Carolina State University in 1997 by a team of designers and scientists under the direction of the American architect Ron Mace [14]. The complementary universal design principle defined by Konrad Kaletsch as "Perception of Equality" [15] was also taken into consideration. The aim of the concept's authors was developing a facility which would inspire the pupils to realize the maximum of individual potential and build the highest possible degree of independence.



Figure 2. Conceptual design of the special boarding school. Authors: J. Borowczyk and the students of the Faculty of Civil Engineering, Architecture and Environmental Engineering: E. Cłapińska, A. Frątczak, M. Gajowskiak, M. Grzegorz, O. Kacprzak, N. Kobza, A. Maciejewska, W. Marczak, M. Rogozińska, T. Rohovska, A. Służewska, K. Stefańska, M. Szymczak, M. Walczak vel Walczyk, M. Zięba, K. Woch. Source: J. Borowczyk, M. Gajowskiak, T. Rohovska.

Communication spaces were designed in a form of a tactile path. The whole facility and its surroundings were equipped with appliances, personal devices and *typographic* terminals enabling the children to find their way in the surrounding space. The necessity of supplementing hard-to-access stimuli with stimuli appealing to other senses as well as the use of orientation elements, including proper colour schemes and contrasts was also taken into consideration. One of the aims of the design process was modification of the existing obstacles and elimination of those elements which complicate the space in an unjustified way, such as hard-to-climb stairs, abrupt changes in lighting values or unclear communication systems. A sense of being lost in the buildings with complex functional systems is very common among all users, therefore particular attention was paid to the legibility of signs in the rooms and zones. A unique system of colour identification was introduced, which was the same for the internal and external spaces in the whole facility (figure 3). During the design process the needs of persons with impaired vision as well as those with intellectual disability were taken into account.

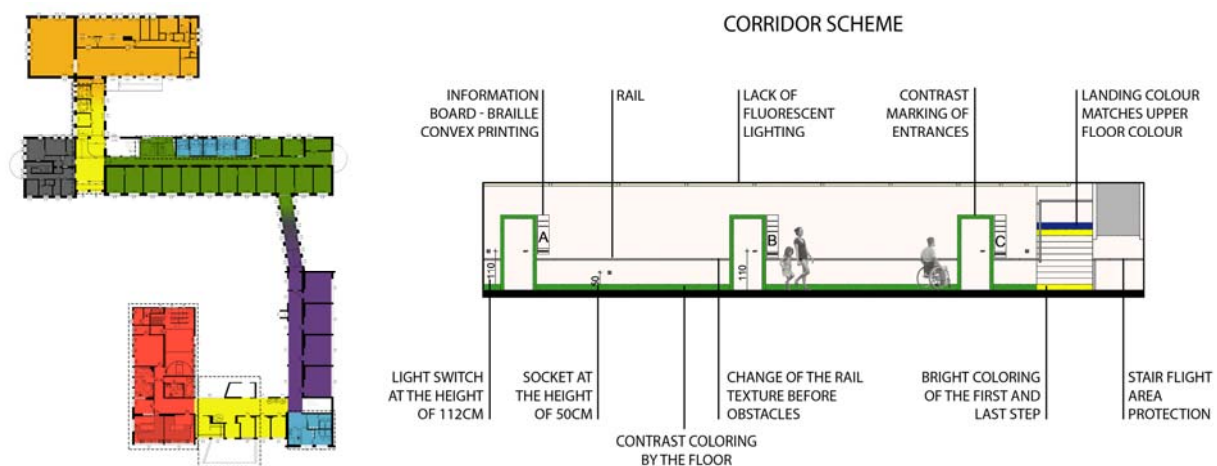


Figure 3. Design of the special boarding school. Concept of the homogenous system of colour identification and a proposal of using orientation elements. Source: J. Borowczyk, A. Służewska.

The main task was supporting the space user's orientation. Therefore, most external wall surfaces were designed in the grey colour (brushed metal), constituting a background for contrast yellow (RAL Classic – 1023 Traffic Yellow) for the entrance zones and multicolour window recesses. It was assumed that the elevation materials should be economical, easy to clean and could be used in other buildings of the same type. Thus light aluminium façade panels were chosen as the leading material covering the external walls.

It was suggested to paint the interior window recesses in colours which corresponded with the colour markings of the zones inside the building (the cost of the proposed finish of the windows and sills was comparable to that of standard solutions). For example, in the dormitory building the boys' floor has been painted green, so the window recesses on this floor will be in the same colour. Such a solution in connection with the eligible facility plans positioned at strategic points will enable all users to find a place they are looking for. Displaying the zones on the elevations will help in the spatial orientation not only outside the building. While staying inside, just by looking through the window one will obtain information about types of rooms in the neighbouring facility.

Entrance zones, as representative elements of the block, have been accentuated with perforated aluminium panels, which let the sunlight into the rooms, slightly dispersing it. The patterns of perforations are different for particular buildings. The holes have been arranged to form words in the Braille alphabet (figure 4, figure 5). Blind and impaired vision patients can come up to the elevation and feel its texture – one row of perforations at the height of 120 cm from the ground level has been replaced with insets in the same pattern.



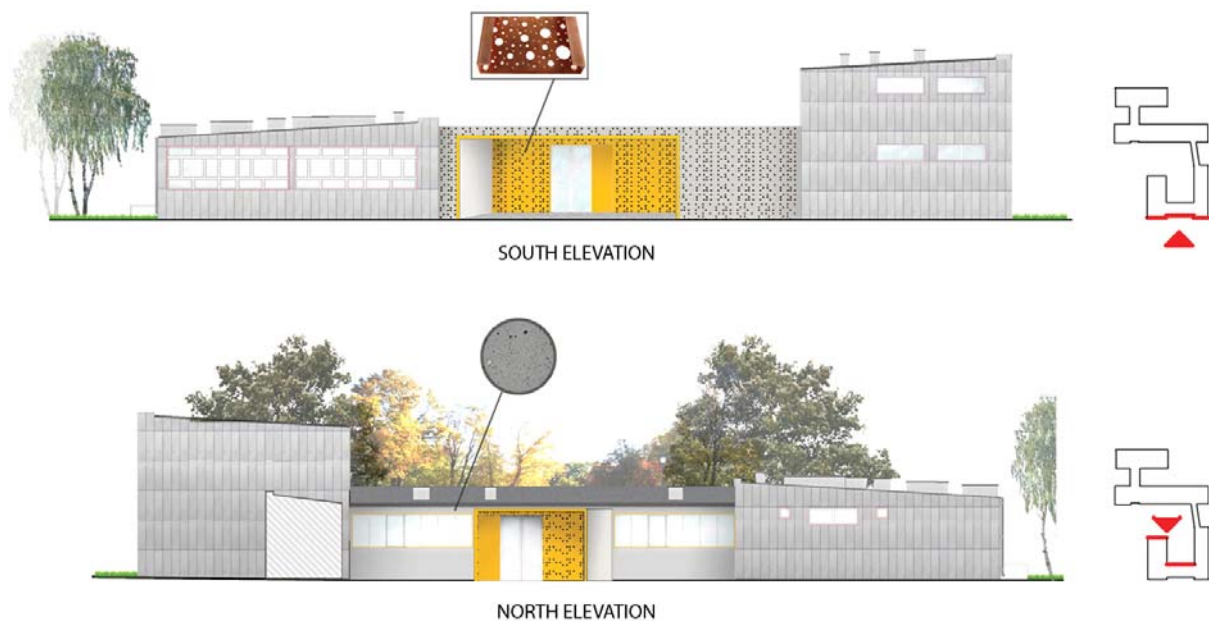


Figure 4. Conceptual design of the special boarding school. Elevation.  
Source: J. Borowczyk, M. Gajowiak, A. Maciejewska.



Figure 5. Conceptual design of the special boarding school. The main entrance.  
Source: J. Borowczyk, M. Gajowiak, T. Rohovska.

Starting from the very beginning, a decision was made about the necessity to even the slope of the area, so that the main entrance to the dormitory was on level 0.00 of the building. As a result, the entrance was made rid of ramps and stairs. Replacing the interior stairs with mild slopes and the use of sliding doors allowed creating a collision-free access to the building (automatic doors will allow both blind persons and those in wheelchairs to avoid problems connected with opening and holding them). The assumptions of the concept involved simplifying the communication passage in the main entrance zone. Therefore, it was decided to change the location of the entrance door, which allowed

establishing a straight line of communication and eliminating uncomfortable bends on the way of the users. The extension of the vestibule has raised the usage quality of the space and installation of glass walls have brightened the interior. In order to avoid discrimination of persons with disabilities, the narrow slip and the stairs in the main hall of the dormitory have been replaced with a broad ramp.

The school entrance zone required slight but important modifications. Hinged doors have been replaced with more convenient automatic ones. The mudroom has been extended so that two persons in wheelchairs can pass each other without collision. Opposite the door there is a wall with a raised relief map of the buildings. Like in the dormitory, each floor has been individualized and particular floors have been marked with colours in order to facilitate the users' orientation and communication between particular areas. Next to the map there is a door leading to the yard.

In the school building there are zones dedicated to different activities of children. The space for cooking classes consists of two rooms separated with a sliding partition wall. Each room consists of the cooking space and the eating space. Working lines and the space in the rooms were designed in such a way as to enable each participant to actively use the kitchen during the class (figure 6). Different heights of the countertops and the island, the selection of kitchen appliances as well as types of cupboards have been adjusted to the needs of users with a different degree of disability. At the entrances small sanitary annexes have been placed, in which pupils can prepare for the classes. The colouring of both rooms was designed in such a way as to correspond with the colour markings in all buildings of the school.



Figure 6. Conceptual design of the special boarding school. View from the room for cooking classes.

Source: J. Borowczyk, M. Gajowski, T. Rohovska.

The principle of full accessibility was also obeyed while designing the school gym. The changing rooms have been arranged in such a way that pupils can use them independently. Doors which slide or open without any effort of the user (servomotors or heavy door leaves are not recommended) have been installed. Like in the whole facility, the position of the door has been made visible against the wall by framing it with a proper colour. The gym, which can be used for school ceremonies, has been equipped with an induction loop. Due to excessive reverberation, acoustic panels have been fixed on the ceiling and the walls, which is supposed to improve the orientation of blind and visually impaired



persons. A play zone supporting the kinaesthetic rehabilitation of children has become an interesting complementation of the gym, where a soft floor has been placed to enable the movement of people in wheelchairs. The equipment of the gym includes various kinds of blocks and gymnastic sets, which constitute tracks for the activation of the children. At the swimming-pool one can find foam balls, a special entrance and seats for persons with disabilities.

One of the key design issues was the transformation of the connector between the school building and the dormitory. The previous construction has been replaced by a broad ramp with a mild slope. All communication spaces have been adjusted to the needs of persons suffering from perceptual dysfunction. While creating the intuitive system of finding the way in the building, it was necessary to apply a visible contrast of colours and materials, use convex materials on the surfaces marking the beginning and the end of the ramp or stairs.

While planning the development of the area between the dormitory and the canteen building, a multifunctional floor was designed to stimulate the creativity of the users. It is going to be a venue for school picnics and other events. Behind the canteen there is a small garden where children can grow fruit, vegetables and other plants. Thanks to special solutions, it is accessible for persons with different disabilities. In the northern part of the plot there is a multifunctional pitch and in the front part of the plot low green plants will be grown to create a homogenous composition with the surrounding trees (figure 7). The surface between the school building and the dormitory has been hardened in a way which will enable the organization of gatherings and assemblies. Additionally, board games have been installed in the floors. The other half of the existing yard has been provided with a function of a playground with toys adjusted to the varied needs of the children.



Figure 7. Conceptual design of the special boarding school. View of the entrance to the school.

Source: J. Borowczyk, M. Gajowiak, T. Rohovska.

#### 4. Results and discussion

The cooperation between the young architects, school authorities and persons who every day experience numerous limitations connected with using the space allowed designing a preliminary framework of solutions for providing the children with the most comfortable and independent ways of

taking advantage of the free access to all the functions offered by the school. This attempt has also proved that transformation of schools and rehabilitation centres with the same or similar profile is for the designers a task with the highest degree of complexity because it requires taking into consideration the varied needs of the users in order to make the system of supporting the development of children with multiple disabilities coherent and the long-term efforts more effective. Considering the above conclusions, it has become necessary to popularize the knowledge concerning the creation of a friendly space and the role of accessibility in the formation of the functional and spatial structure of the rehabilitation facilities. The right concept of universal planning should be taken advantage of wherever the implementation of its assumptions in the design practice is possible. From today's perspective, there is an urgent need to continue interdisciplinary research regarding the design of rehabilitation facilities (support) and common spaces accessible for all users (inclusion). Multidirectional analyses are expected to answer the following questions:

- What means could be used by designers, investors and local authorities in the process of arranging the space, to ensure that their activities comply with the principles described i.e. in Article 9 of the United Nations Convention on the Rights of Persons with Disabilities?
- How should the policy of building new rehabilitation centres as well as modernization and maintenance of the existing spaces and facilities be coordinated to make the results of these actions become part of a complex therapy of children with multiple disabilities?
- What is the definition of a friendly space and how can we find the way of planning common accessible spaces for supporting the social inclusion?

The real chances of further development of facilities supporting the development of children with special needs will depend on the integrated activity of researchers, designers, investors and local authorities, who are strongly motivated to create facilities with a therapeutic character. At the same time, the principles of universal design should be implemented in the broadly understood design practice in all its fields and become an inherent element of the design of facilities and public spaces as many of the conducted studies clearly reveal numerous contraindications against uncompromising and permanent institutionalization of persons with multiple disabilities.

## 5. Conclusions

The general conception of the modernization of the special boarding school presented in the paper includes a preliminary recommendation of the tools that can be used for modernizing a facility for children with various disabilities. It proves that architects have a wide range of means that can enable the creation of spaces which support and stimulate the individual's activity, thus leading to the inhibition of disorders with a progressive course. The conducted research clearly indicates that the supreme aim of professionals who intend to design facilities with a therapeutic character is co-creating a complex support system, which could activate the factors contributing to the child's development and autonomy in the future adult life. The success of rehabilitation depends both on the needs and possibilities of the disabled person and on the influence of the environment.

The idea of universal planning promoted in this study is not a minimalistic attitude aimed at providing the disabled children with an access to a facility in a modest form required by law. Its concept has been based on the principle of equality to a larger extent than the concept of general accessibility and it assumes that the suggested solutions will support the rehabilitation processes and fulfil the needs of users with a broad spectrum of disabilities. At the same time, the objective of universal design is to prevent stigmatization and offer solutions whose formal and functional expression does not imply that they might have a character of specialist design instruments, aimed exclusively at children with special needs.

In order to create optimal conditions for the compensation of deficits and contribute to the comfort and autonomy of the children with multiple disabilities, it is necessary to develop cooperation between all participants of the support system including architects, educationalists, psychologists and families. The standards should include paying attention to the evolving capacities of children with disabilities and respect for the right of children with disabilities to preserve their identities, defined by the United

Nations Convention on the Rights of Persons with Disabilities [1]. The aim of further research will be clarifying the tools for the individual's development and life on the highest quality level. Because „recognizing that children with disabilities should have full enjoyment of all human rights and fundamental freedoms on an equal basis with other children, and recalling obligations to that end undertaken by States Parties to the Convention on the Rights of the Child” [1], working out practical solutions for supporting the rehabilitation process should be accepted as one of the priorities of contemporary architecture.

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