

PROSTOR

30 [2022] 1 [63]

A SCHOLARLY JOURNAL OF ARCHITECTURE AND URBAN PLANNING  
ZNAJSTVENI ČASOPIS ZA ARHITEKTURU I URBANIZAM

UNIVERSITY  
OF ZAGREB,  
FACULTY OF  
ARCHITECTURE  
SVEUČILIŠTE  
U ZAGREBU,  
ARHITEKTONSKI  
FAKULTET

ISSN 1330-0652  
[https://doi.org/  
10.31522/p](https://doi.org/10.31522/p)  
CODEN PORREV  
UDC 71/72  
30 [2022] 1 [63]  
1-138  
1-6 [2022]

92-105 NATÁLIA FILOVÁ  
LEA ROLLOVÁ  
ZUZANA ČEREŠŇOVÁ

UNIVERSAL DESIGN PRINCIPLES APPLIED IN MUSEUMS' HISTORIC BUILDINGS

SCIENTIFIC SUBJECT REVIEW  
[https://doi.org/10.31522/p.30.1\(63\).9](https://doi.org/10.31522/p.30.1(63).9)  
UDC 72.012 727:069



Af



FIG. 1 ENTERING THE GRAZ MUSEUM SCHLOSSBERG

# NATÁLIA FILOVÁ<sup>1</sup>, LEA ROLLOVÁ<sup>2</sup>, ZUZANA ČEREŠŇOVÁ<sup>3</sup>



<sup>1</sup> CEDA (CENTRE OF DESIGN FOR ALL), INSTITUTE OF ARCHITECTURE OF PUBLIC BUILDINGS, FACULTY OF ARCHITECTURE AND DESIGN, SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA (FAD STU), NÁMESTIE SLOBODY 2911/19, 812 45 BRATISLAVA, SLOVAKIA

ORCID.ORG/0000-0002-8927-9444

<sup>2,3</sup> CEDA (CENTRE OF DESIGN FOR ALL), INSTITUTE OF ARCHITECTURE OF PUBLIC BUILDINGS, FACULTY OF ARCHITECTURE AND DESIGN, SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA, NÁMESTIE SLOBODY 2911/19, 812 45 BRATISLAVA, SLOVAKIA

CEDA (CENTRE OF DESIGN FOR ALL), ÚSTAV ARCHITEKTÚRY OBČIANSKÝCH BUDOV, FAKULTA ARCHITEKTÚRY A DIZAJNU, SLOVENSKÁ TECHNICKÁ UNIVERZITA V BRATISLAVE, NÁMESTIE SLOBODY 2911/19, 812 45 BRATISLAVA

natalia.filova@stuba.sk  
lea.rollova@stuba.sk  
zuzana.ceresnova@stuba.sk

## SCIENTIFIC SUBJECT REVIEW

[https://doi.org/10.31522/p.30.1\(63\).9](https://doi.org/10.31522/p.30.1(63).9)

UDC 72.012 727:069

TECHNICAL SCIENCES / ARCHITECTURE AND URBAN PLANNING

2.01.01. – ARCHITECTURAL DESIGN

2.01.04. – HISTORY AND THEORY OF ARCHITECTURE AND PRESERVATION OF THE BUILT HERITAGE

ARTICLE RECEIVED / ACCEPTED: 8. 4. 2022. / 14. 6. 2022.

## UNIVERSAL DESIGN PRINCIPLES APPLIED IN MUSEUMS' HISTORIC BUILDINGS

ACCESSIBILITY  
ADAPTATION  
EXHIBITION  
GRAZ MUSEUM SCHLOSSBERG  
INCLUSION  
UNIVERSAL DESIGN PRINCIPLES

Museums represent an architecturally multifaceted typology. Regardless of their variant focus, their current task is to provide an opportunity for cultural, educational, and exploratory experience for all. The accessibility of the physical environment is important, but so is the accessibility of the perception of the exhibition. This paper deals primarily with spatial and design qualities, which determine the degree of inclusion in museums. The principles of Universal Design (UD) are considered in this regard; therefore, the article reviews means of applying these principles in museums theoretically, and also practically,

through on-site evaluation using checklists. Specifically, solutions beneficial for inclusion are examined in an outstanding example, the Graz Museum Schlossberg, which demonstrates many inclusive principles. The aim of the article is to support suitable ways to implement UD in museum architecture with a historical background, one which would meet the needs of the largest possible range of visitors and preserve the historical value of architecture. Beneficial ideas from theory and practice should also be applicable in the future and are commented on in the article.

## INTRODUCTION

The origins of the museum are linked to one of the basic human activities – collecting. The collection of objects appeared in all ancient cultures, the origins of the precursors of the museum date back to the period of ancient Greece, where they appeared in two forms. The first is the “thesauroi” type of building used for storing rarities, with its main function being to collect and store objects safely, as in a bank (Hoffmann, 2016: 12). However, collector’s items were not displayed here, so the building fulfilled only a fraction of the purpose of today’s museum. The second type of the museum predecessor was the “museion”, which was used to name the part of Alexandria around the famous library (Hoffmann, 2016: 12). This Greek term<sup>1</sup>, which originally referred to ancient schools of poetry and philosophy, by the 18<sup>th</sup> century covered mainly academies and schools and only secondarily places for collections. The Capitoline Museums, opened in 1734 in Rome, can be described as the first museums of modern Europe open to the general public (Lehmbruck, 1974: 126). However, it was not until the 19<sup>th</sup> century that a name was provided for the museum as it is understood today – “a building that preserves and presents collections and conducts related research” (Naredi-Rainer, 2004: 13) – which spread over a larger area in several countries. Traditional museums were based on rich and high-quality collections and were situated in lofty, landmark buildings resembling (or originally) palaces. Rare

collections were assembled by different monarchs and were not open to ordinary visitors for a long time or they did so later with only limited access.

In the 20<sup>th</sup> century, the museum opened up to an increasingly wider public, taking on other roles besides collecting and exhibiting – for example, offering various educational programmes, becoming more interactive. Along with these changes, the issue of accessibility for all also came to the fore. Today’s museums have the opportunity to play an important role in reducing inequalities and increasing the inclusion of people with different needs. In order to create a quality environment for all museum visitors, it is necessary to take into account the requirements of diverse users, i.e. people of different ages and people with different abilities or disadvantages. This article explains the principles of universal design in the context of museum architecture. These principles help to achieve the goal of forming an inclusive museum environment for all people.

Museums are quite exceptional among types of buildings, because in order to create inclusive museums welcoming as many diverse visitors as possible<sup>2</sup>, many aspects need to be considered in the process of two activities: 1. planning of the architecture and design of the buildings, 2. creating exhibitions. A museum building must be designed according to principles of UD, so that it provides access to culture for all, and also exhibitions and exhibits must be designed in this way. This paper deals primarily with accessible museum architecture; however, the topics of

<sup>1</sup> μούσειον: place of the muses; the place and dance floor of the muses and their mother Mnemosyne, the Greek goddess of memory; Gökçığdem (2016: viii) claims that “Muses stood for the values of reflection and inspiration”, and that museums should strive to “illuminate positive human qualities”, among others empathy, and surely also inclusion.

<sup>2</sup> The question of social inclusion is connected to inclusion of people with various needs; it is also a crucial topic, which should be mentioned. Inclusive museums for various social and economic groups are highlighted, for example, by Sandell (2003) in the publication “Museums, Society, Inequality”. A feeling of belonging and being welcomed can contribute largely, and museum architecture can help create a friendly, welcoming atmosphere and support inclusion in that way. The resulting success is largely influenced by attitudes of people who inhabit this architecture, thus, it is a larger, multidisciplinary issue, and a topic for possible further research.

<sup>3</sup> Today, they are applied on buildings of various types. However, UD is often a solution above standards, and many buildings respond only to barrier-free principles, which are suitable for visitors with physical disabilities.

<sup>4</sup> For example, also research by Boháčová and Schleichner (2022: 25) deals with UD in cultural buildings (namely theatres), and they emphasize it: “Together with to these days also ignored, or misunderstood sustainability, universal accessibility has the potential to create a better-quality architecture, public space, or everything in between.”

exhibition and exhibits are linked to museums so tightly that they are mentioned multiple times as well. The multisensory forms enhance the experience of the exhibition for all visitors.

## BACKGROUND

Universal Design (UD) was coined in 1985 by architect Ronald L. Mace, coordinator of a research centre at the North Carolina State University. His research group consisted of architects, designers, engineers and researchers in the field of environmental design. The principles of UD, first formulated by Mace et al. (1997) have been studied as a starting point and considered for the purposes of museum architecture, so in the theoretical part of this research, 7 principles of UD are applied to museums' environment. Key factors that help to evaluate selected museums considering UD are found in 'The Universal Design File: Designing for People of All Ages and Abilities' by Story, Mueller & Mace (1998), where the authors of The Universal Design File explained the seven principles of Universal Design.<sup>3</sup> These principles are known and promoted worldwide, including the region of Central Europe, as can already be seen partially in practice and publications.<sup>4</sup> This research considers the UD principles as an important part of participation and inclusion of various museum visitors and, therefore, explores and promotes these principles. In addition to the UD principles, various factors that have an impact on the quality and sustainability of the building were taken into account.

<sup>5</sup> UD principles are intersecting, and some properties can be occasionally interpreted under multiple principles (e.g., an element is flexible and perceptible at the same time).

<sup>6</sup> In some cases, alternative solutions, which are equally important and interesting, can be proposed, e.g. two equally important and informative exhibition paths.

<sup>7</sup> Čerešňová (2009: 10) mentions two aspects of the philosophy of Design for All: the first one is "to make the physical environment accessible – to enable access and movement without physical barriers [...]", the second one is "to accept different perception and communication possibilities of people – to enable conceptual understanding and accessible information and services [...]".

<sup>8</sup> This can be beneficial, especially for visitors with small children or older people, and in the case of a museum with a great volume of exhibits. People can revisit parts of an exhibition, which is important according to Black (2005), but also skip parts that do not currently interest them, etc.

<sup>9</sup> Multifunctional solutions are also preferable to Caulton (1998: 28): "exhibits [...] employ a range of interpretative techniques, appealing to visitors with a wide range of interests and learning styles."

<sup>10</sup> The topic of learning in museums is a very important one and tied to UD, as well. Information related to it provide Falk and Dierking (2018), Hein (1998), Jůva (2004), Andre, Durksen, and Volman (2017), Song et al. (2017) and others. The authors of this paper examine this topic in their research, too, e.g. in Filová & Rollová (2019) and Filová & Čerešňová (2020).

Designing with UD principles considers the diversity of users so that people with disabilities can enjoy all spaces and services on an equal basis with others and thus be included in society. "Universal design" means the design of products, environments, programmes and services to be usable for all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed." (Article 2 United Nations, 2006: p. 4). The Convention has been ratified by a number of countries, as well as the EU as a whole, so UD principles should be put into practice. Accessibility and non-discrimination are mandatory in EU-funded investment projects, and non-compliance is an exclusionary criterion in the evaluation.

For the selected research task, it is important to apply the principles of UD to the context of museums, so the basic requirements of UD were taken into account when analysing and researching the museum architecture.<sup>5</sup> Additional relevant literature on inclusive museums and exhibitions and long-time research contribute to this section.

**1. Equitable Use** – Design responds to the needs of all people. No user is excluded or segregated because of architectural barriers. The same means of design are applied to all when possible, or equivalent when not, so there is preferably one common entry and main vertical communication. Exhibition routes are suitable for all, for example, using a ramp.<sup>6</sup> "Design for All", or precisely "Culture for All", aims to provide access to culture for all different visitors.<sup>7</sup>

**2. Flexibility in Use** – The design can adapt to numerous choices or methods, visitors can choose among several route options, order, and timing of spaces. Visitors may or may not respect the recommended route; they can for instance see only one part during one visit.<sup>8</sup> Vertical communication is provided by several means, sometimes even in an innovative way of vertical circulation such as a model of a train or cable car, mainly in children's museums. Flexibility is also important with respect to exhibits and exhibition spaces. Schleicher (2017: 91) says: "Primary and fundamental is the adaptability of the spaces to absorb the different nature of the changing exhibitions. But equally important is the philosophical adaptability of direction in the ever-changing environment of art, new media, etc."<sup>9</sup> Flexibility encourages everyone's choices, interests and techniques in learning or discovery of exhibitions.<sup>10</sup>

**3. Simple and Intuitive Use** – Intuitive moving and wayfinding is very important for every

TABLE I EVALUATION CRITERIA OF MUSEUMS ACCORDING TO UD PRINCIPLES

The UD principle	Main characteristics	Implementation in museum architecture
1. Equitable Use	– the needs of all various people with no exclusions	– museum's public premises are accessible to all visitors equally
	– the same or equivalent means of design applied	– accessible entrance and routes (horizontal and vertical), not creation of separate accessible solutions (e.g. side entrance, staircase lift)
2. Flexibility in Use	– the building can adapt to user's preferences	– connect or divide exhibition space with movable partitions – different route options and timing – flexible routes also support creativity of the exhibition
	– several means of vertical communication	– use of elevator, ramp, stairs, escalator, etc., possibility of innovative ways of vertical circulation, as well
3. Simple and Intuitive Use	– a clear position of lifts, toilets, etc. is highlighted	– open plan, orthogonal, circular routing – signage of the rooms above door openings
	– means of helping in navigation are applied	– using contrast in colour or material – interior and exterior vistas
	– self-explanatory solutions	– the exhibition is clearly structured, exhibits facilitate understanding and learning, museum employees explain
4. Perceptible Information	– multisensory information	– haptic models and relief floor plans, acoustic information, sign language and the relief Latin and Braille – a building model presented in the entrance space
	– various forms	– in multiple languages, easy-to-read, logos and pictograms
	– clear visibility – glass walls marked with contrasting graphics	– exhibits can be observed from multiple visual perceptions from different distances and angles – contrasting background behind exhibits
5. Tolerance for Error	– no dangerous barriers – spaces with low ceilings, under the arms of a staircase, ramp or beam marked in multiple ways	– the low ceiling spaces can be interspersed with aesthetic interior elements or visual exhibits – exhibits hanging from the ceiling or cantilevered elements are marked on the floor below them by colour contrast and also haptically
	– safe evacuation	– the safest evacuation from the 2 <sup>nd</sup> floor in large museums is down the ramp – in smaller museums, an evacuation lift is recommended
	– no sensory overload (sharp lights, reflections on glossy surfaces, unsuitable contrasts, colours, noises)	– diffuse effect and matte surfaces create a less visually tiring environment – noise-absorbing materials help the space become less hectic and more restful
6. Low Physical Effort	– comfortable movement – ergonomic solutions	– ramps with suitable slope, anti-slip surface and handrails and elevators reduce physical effort
	– minimal physical effort in manipulating the interior elements	– automatic doors – easy-to-manipulate exhibits
	– opportunity for rest	– seating
7. Size and Space for Approach and Use	– many spatial dimensions based on the wheelchair parameters – also for people with baby strollers	– the entrance and circulation areas allow for the free movement. – suitable widths of the doors, corridors, lifts, as well as the furniture arrangements (e.g. aisle widths between exhibits) – exhibits placed at an appropriate height

user. The layout should be clear, important points of interest highlighted. Wayfinding and routes are usually intuitive in an open floor plan. In case of layout with multiple rooms for exhibition, orthogonal or also circular routing should be clear. Signage of the theme of the rooms facilitates navigation.<sup>11</sup> The use of spaces and elements should not require special abilities or skills. The space legibility enables people to see or predict activities in the space. As Black (2005: 140) suggests: "Visitors will require an understanding of the 'whole' as well as parts, and parts must be understood in the context of the whole". Visual and other sensory contact with the environment (the view of daylight, the colour solution<sup>12</sup>, or feeling fresh air from

the exterior) can satisfy human senses and contribute to well-being.<sup>13</sup> Views help visitors navigate, thus people more accurately determine their position and direction of movement with respect to their surroundings.<sup>14</sup>

**4. Perceptible Information** – The communication is effective when different modes are incorporated. Various information is provided in a multisensory way, e.g., the main entrance uses contrast, it could be marked aurally by acoustic beacon<sup>15</sup>, and haptically by tactile paving which is a more universal solution. Exhibition should be interactive, supporting hands-on, and multisensory approach.<sup>16</sup> Visual, acoustic and haptic types of information are very important in museum architecture and exhibition. Models, sometimes even originals, can be accessible by touch under certain conditions. Modern technologies are applied, as well.<sup>17</sup> Occasionally, even olfactory information and taste are incorporated in specialised exhibitions. The distinctive vertical or horizontal elements can be seen from several levels, positions and angles.

**5. Tolerance for Error** – The environment is risk-free, hazards and errors are minimised. People using the white stick technique need to recognize the presence of protruding elements. Stairs should preferably not have nosing because of the risk of tripping. In the environment, suitable colour contrasts and acoustic methods are used to prevent the risks of injury. Crucial for planning in accordance with this principle are (1) experiencing the museum environment through different senses, e.g., soundwalking and sound mapping technique in museums<sup>18</sup>, and (2) participatory planning. Users with different needs or impairments can then name the risks they

<sup>11</sup> And also offers choice to visitors about which exhibition theme they want to visit.

<sup>12</sup> Interesting lighting solutions in architecture can be seen in Lumitecture by Yudina (2016), and the power of colour effects is researched by Urandová (2016).

<sup>13</sup> Comfort in physical environment is another crucial issue and is examined for example by Kotradyová (2015). Elements contributing to a feeling from space is also interestingly reviewed in Atmospheres by Zumthor (2006).

<sup>14</sup> This aspect is associated with proprioception, which is related to the perception of natural or artificial space, influences activities, interactions, and movement in it. 'Ecological proprioception' examined by Pacher (2015) is a factor of being aware of the relationship between one's position and the surrounding space.

<sup>15</sup> Although they can sometimes have high demands on technical devices, and there are many people with visual impairment who do not have these devices

<sup>16</sup> Exhibits, sometimes even parts of the building, stimulate multiple senses in various ways described in the publication *The Multisensory Museum* (Levent and Pascual-Leone, 2014). The meaning of multisensoriality is also enhancement of experience, memorability, and accommodating multiple learning styles.

<sup>17</sup> Čerešňová and Rollová (2015: 95-96) mention "transformation of visual formats into audio or tactile form".

experience in the built environment and can review the ideas of architects and also suggest suitable solutions for them.<sup>19</sup> Measures for evacuation from the premises are also included. Design should avoid unpleasant light, colour and contrast effects. Similarly for acoustic background, materials and spaces should not create echo and unwanted noises.<sup>20</sup> Redundant information and music should not be imposed on visitors.

**6. Low Physical Effort** – The design causes minimum fatigue and repetitive actions. The layout should not require redundant walking and vertical transfers which can cause fatigue and discomfort. Communication spaces offer a refreshing experience, when combined with rest zones. Exhibition spaces benefit from rest zones, benches, and informal seating.<sup>21</sup> They could be placed in divided nooks and in the exhibition area next to exhibits. Locating a café near the information desk and a playroom for children is a refreshing idea, reduces fatigue and helps visitors stay focused for a longer time. Exhibits and activities require minimum strength, so that children, older people, and people with disabilities are able to manipulate and interact with them. Automatic doors increase comfort and enable independence for people with disabilities: (1) to the photocell, (2) on the button, and (3) fire doors that are open in normal operation but close automatically when smoke is detected.

**7. Size and Space for Approach and Use** – The elements are visible, approachable and reachable by a standing or seated person, and by users of various body sizes, including children. The spatial solution of buildings must accommodate a wide range of users, including persons in a wheelchair, taking into

<sup>18</sup> Examined for example by Kannenberg (2020).

<sup>19</sup> Research by Vaz, Freitas & Coelho (2020) shows participatory approach with participants with visual impairments in a museum environment.

<sup>20</sup> Preferably, there are headphones or sound boxes in the exhibition area that allow visitors to choose to listen according to their preferences.

<sup>21</sup> They provide visitors with the possibility to relax and consolidate gained knowledge from exhibitions. It is also an opportunity for people to look after children from a seated position. It is a design opportunity to create benches that are aesthetically harmonized with surrounding exhibits, and are at the same ergonomic.

<sup>22</sup> Sometimes, exhibits are made available using small stages which can help smaller children to reach, but these are not suitable for people using wheelchairs, so it is not a UD solution.

<sup>23</sup> The authors' related research can also be seen in papers and seminar works with students elaborated within the course Universal Design. Examples of related research: Čerešňová (2018), Filová & Rollová (2019), Filová & Čerešňová (2020) and Filová, Rollová & Čerešňová (2022), as well as other publications.

<sup>24</sup> Additional 10 museums have been evaluated by architecture students with the help of the authors of this paper within the course Universal Design.

TABLE II SELECTION OF 12 POSITIVE ANALYSED EXAMPLES OF HISTORIC BUILDINGS ADAPTED INTO MUSEUMS IN THE REGION OF CENTRAL EUROPE

Name of the museum	City	Year of adaptation	Author of reconstruction
Graz Museum Schlossberg	Graz	2020	Studio WG3
Joanneum Museum: Neue Galerie, Natural History Museum, and CoSA	Graz	2009-2011	Nieto Sobejano Arquitectos; eep Architekten
Kunsthalle Wien	Vienna	2001	Ortner & Ortner Baukunst
Vienna Museum of Science and Technology	Vienna	2010	Querkraft Architekten
Silesian Museum	Katowice	2010-2014	Florian Riegler, Roger Riewe
Techmania Science Center	Plzeň	2012-2014	Atelier Soukup and designer Štěpán Soutner
Olomouc Archdiocesan Museum	Olomouc	2000-2006	HŠH Architekti
National Museum	Praha	2011-2019	Zdeněk Žilka, Pavel Jerie
Kulturpark Košice	Košice	2012-2013	ZEROZERO
Slovak Museum of Nature Protection and Speleology	Liptovský Mikuláš	2011-2014	B4ARCH & ARCHITEKTI
Esterházy Palace: Slovak National Gallery	Bratislava	2004-2005	Rosica Borsčová
Old Town Hall: Museum of the City History	Bratislava	2008-2011	Peter Bouda

account the size of the manoeuvring space with a wheelchair. Exhibits are placed at an appropriate height, lower than it was usual in the past, or ideally installed on an adjustable panel, allowing movement of the exhibit.<sup>22</sup> Exhibition desks should be lower and have free knee-space, so seated people can easily tuck in and manipulate with objects on the desks. Texts can also be repeated in several heights, so that various visitors can read it in a comfortable position. Table I systematises main criteria which have been considered in the evaluation of museums according to UD principles.

## METHODOLOGY

The purpose of broader research is to assess selected museums from several perspectives related to Universal Design and to promote inclusive solutions. Areas of interest in museum buildings have been listed in checklists, elaborated in CEDA (Centre of Design for All) at the Faculty of Architecture and Design at Slovak University of Technology in Bratislava, in which the authors of this paper have participated.<sup>23</sup> Consequently, this checklist tool is introduced in the article. Secondly, the assessments of 52 museums regarding principles of Universal Design, and also suitability for children visitors, have been conducted by the authors of this paper during the last four years.<sup>24</sup>

The museums selected for the comparative analysis are located in Central Europe, and were chosen according to following criteria: (1) it was needed to cover various regions forming the whole territory of Slovakia to gain comprehensive knowledge of the situation in this area; (2) the chosen museums are of national significance to study relevant facilities; (3) 12 Slovak museums required the

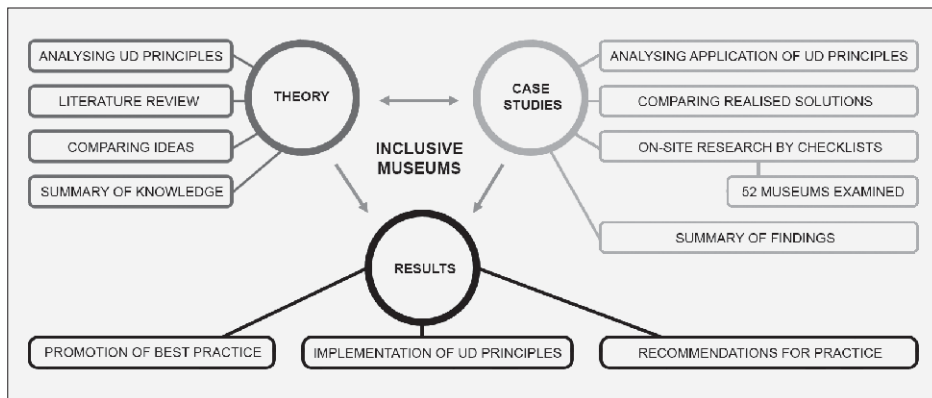
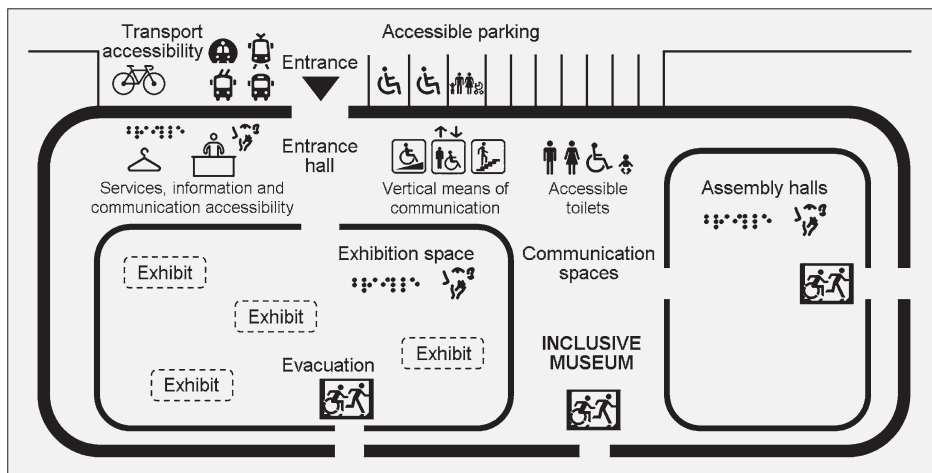


FIG. 2 DIAGRAM ILLUSTRATING METHODOLOGY OF THE RESEARCH

analysis and advice by themselves because they have taken steps to become more inclusive; (4) the museums from countries outside Slovakia were selected based on desk research as good examples for future practise; (5) the selected museums were established in various periods to see the progress in the UD application in time.

These museums from Central Europe were submitted for a comparative analysis. Most of the museums in the region are located in historical buildings. 36 buildings are historic

FIG. 3 SCHEME OF EXAMINED MUSEUM AREAS



and 14 are new buildings. That led the research to focus more on discussing ways to make historic cultural buildings more inclusive for all people with various needs. From these museums, Table II presents selection of 12 analysed examples of historic buildings adapted into museums, which reflect UD principles in many positive aspects.

Accessibility modification of historic architecture is a specific problem and the principles of monument restoration must be respected in its solution. The accessibility of the historic environment must therefore be carried out by means of sensitive interventions that do not undermine the historic value. The selected case study represents a good example of how to approach the accessibility of historic architecture in accordance with monument restoration and protection, in order to preserve the heritage value of the buildings.

Evaluation Methods – Principles to achieve inclusiveness are examined; the main goal is the visitability and understandability of all parts of the museum by people with various needs. The accessibility of the museum’s architecture, exhibitions and exhibits are the target examined features. Among methods of this part are on-site observations, interviews with museum employees, and as a source of information, serve museum and architectural websites, as well. Photo documentation of the buildings underline the studied phenomena. The methodology and main goals are visually presented on the diagram in Fig. 2.

**EVALUATION CHECKLISTS**

Several evaluation factors have been considered. Evaluation checklists serve as an instrument for examining environments in terms of accessibility. This Access audit system is based on the results of several years of research in collaboration with various groups of users (Samová et al., 2010). “CEDA FAD STU has compiled the structure of the evaluation checklists into tables according to the particular types of spaces [...]” (Čerešňová et al., 2018: 91). They evaluate buildings from the point of view of UD, but are sequenced according to the buildings’ premises (not each principle of UD separately), because it appears easier to evaluate separate segments of spaces from various points of view than to assess the whole building according to 7 principles of UD. These checklists are a basis for creating evaluation reports which contain recommendations to make the evaluated premises more accessible and inclusive. They form together access audits of built environments. Many building owners of public buildings, especially the state or cities, ask professionals to evaluate their buildings to help create a more inclusive environment for all.

TABLE III EXAMPLE OF A SEGMENT OF ACCESS AUDIT CHECKLIST BY CEDA<sup>25</sup>

F. Exhibition spaces				
F.1	Are there accessible routes in the exhibition space?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> y/n <input type="checkbox"/> o	<input type="checkbox"/> the floor is at the same level <input type="checkbox"/> using a suitable ramp <input type="checkbox"/> using an inclined stair platform (on a handrail / on the wall) <input type="checkbox"/> using a vertical lifting platform	comments:
F.2	Is there sufficient viewing area in front of the exhibits for manoeuvring a person in a wheelchair?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> y/n <input type="checkbox"/> o	<input type="checkbox"/> more than 1,5 m <input type="checkbox"/> more than 3 m <input type="checkbox"/> hall open spaces	comments:
F.3	Is there a tactile wayfinding system in the exhibition space?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> y/n <input type="checkbox"/> o	<input type="checkbox"/> relief orientation plans <input type="checkbox"/> tactile paving guidelines on the floor (tour route) <input type="checkbox"/> room descriptions in relief/Braille	comments:

yes – meets the requirements; no – does not meet the requirements; y/n – partially meets the requirements; o – space / element does not exist



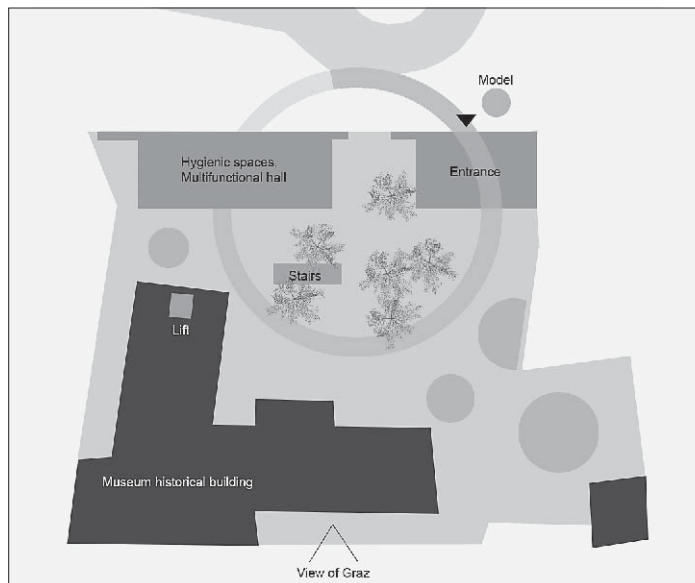


FIG. 4 SCHEME OF THE MUSEUM SCHLOSSBERG AREA GROUND FLOOR

FIG. 5 COLLAGE FROM PHOTOGRAPHS: SIDEWALK TO THE MUSEUM SCHLOSSBERG; FRONT OF THE MUSEUM; HAPTIC MODEL

There are several types of checklists according to building types. Among them is also the checklist for cultural facilities (i.e. museums), which is the most relevant for this research.

These areas are evaluated in the checklist: (A) Transport accessibility and parking, (B) Entrance to the building, (C) Entrance hall and communication spaces, (D) Vertical means of communication (lift, stairs), (E) Accessible toilets, (F) Exhibition spaces, (G) Assembly halls, (H) Services and information and communication accessibility, (I) Evacuation. See visualisation of the assessed areas in Fig. 3 and an example of evaluating questions in Table III.

### GRAZ MUSEUM SCHLOSSBERG CASE STUDY

For the purpose of this paper and after continuous analyses of the museums, a highly elaborated museum in terms of UD, the Graz Museum Schlossberg, has been selected as an exemplary case study.<sup>26</sup> The museum is presented in historical buildings, and its supporting functions are placed in new subtle structures. In the museum and its area, the UD principles are incorporated very well, possibly also because it was recently adapted and opened, thus the architects who design adaptations have used contemporary knowledge about inclusive design. Interestingly, it deals with its demanding historical context, originally with many barriers, of course, considering and protecting its important historical value at the same time.

The Graz Museum Schlossberg is a recently opened museum (September, 2020) that strives to support inclusion of everyone. It is designed by the architecture studio WG3, which won the architectural competition with this solution. They formulate their concept as an open, inviting museum with no barriers (wg3.at). The emphasis on inclusiveness is even more remarkable and inspiring in this project due to its historic foundations and elevated position in the city, on a hill. It communicates largely in alternative forms, especially in haptics, and in hands-on/interactive approach in the exterior part of the exhibition. These additional methods and functions are an added value and create an innovative form of museums. Schleicher (2019: 186) mentions: “in the context of museum buildings, especially those that go beyond the classical understanding of the museum are particularly interesting.”

The museum area consists of new and historic buildings. The new buildings have rather supportive functions (entrance with shop/café, toilets, lockers, multifunctional hall), whereas the historic structure serves the main museum purposes (Fig. 4). It has a ground floor and an underground historic floor accessible via a lift as the main route, as well as stairs as an alternative route and a fire exit.

The sidewalk leading to the museum contains natural guiding lines in the form of paving stones in contact with the lawn connected to the relief marking in front of the entrance, an artificial guiding line, tactile tiles for people with visual impairment. It also connects to the paving in the shape of a circle, which is a design trait of the urban-architectural solution. The guiding tactile tiles lead to the en-

<sup>25</sup> The entire checklist is 10 pages long.

<sup>26</sup> The study does not attempt to be an access audit; rather a promotion of beneficial UD solutions in historical cultural context.



FIG. 6 COLLAGE FROM PHOTOGRAPHS: ENTRANCE AREA WITH THE COUNTER DESK ILLUSTRATED WITH PERSONS OF VARIOUS HEIGHTS

trance and also to a tactile model of the museum and its surrounding area. The model represents the spatial form and proportions of the architectural elements; the model is interesting and informative for all visitors, including children and people with visual impairment. All these elements are a reflection of the 4<sup>th</sup> principle – Perceptible Information in practice. The area in front of the entrance is illustrated in Fig. 5.

There is one common entry for all as a reflection of the 1<sup>st</sup> principle – Equitable Use. After entering a suitable automatic sliding glass door with a pictogram which is in line with the principles 6 – Low Physical Effort, and 4 – Perceptible Information, visitors find the information and ticket area. The tactile paving continues from the exterior through the interior and guides people to the ticket and shop counter, which has a lowered height with an empty space at the ground. This space can be used to insert footrests of a person sitting in a wheelchair. The height of the counter is suitable for people using wheelchairs, but children and persons with lower height also benefit from this solution (Fig. 6).<sup>27</sup> This reflects the 7<sup>th</sup> principle – Size and Space for Approach and Use.

FIG. 7 COLLAGE FROM PHOTOGRAPHS: EXTERIOR AREA WITH GREENERY AND MOVABLE CHAIRS; INTERACTIVE EXTERIOR EXHIBITS



The exterior spaces of the museum, the “Garden of Wonders” (wg3.at), are full of interactive and creative exhibits with no strict order accompanied by resting elements. Sometimes, a café also functions there. Children can explore and discover various stories according to their wishes and educate themselves in a playful way (Fig. 7). This is application of the 2<sup>nd</sup> principle – Flexibility in Use and 6<sup>th</sup> principle – Low Physical Effort. Used materials in these exterior pieces are soft, good contrast is used also, so the principle 5 – Tolerance for Error is presented.

To overcome exterior differences in terrain height, ramps are used, but there are also stairs, so people can choose, thus it is the 2<sup>nd</sup> principle – Flexibility in Use. Several points in the area offer extraordinary views of the city projected also onto a relief model of the view with signs in Braille. Information about one’s position in the area and individual museum buildings and exhibits is provided by information and orientation boards. The principles 3 – Simple and Intuitive Use, and 4 – Perceptible Information are applied here. Boards with a uniform recognizable circular shape and good contrast, and are, therefore, clearly presented. To become even more accessible, there could also be some parts in easy-to-read format and Braille on these boards. The mentioned exterior features can be seen in Fig. 8.

The interior ground floor contains showcases lower in height and elevated, allowing space for footrests for people on wheelchairs. The exhibition space also contains multisensory and acoustic exhibits. They are presented in different formats, multifaceted and diverse methods of communication, so they are accessible for many people with sensory disabilities. These are principles 7 – Size and Space for Approach and Use, and 4 – Perceptible Information. One semi-circular exhibit is installed hanging from the ceiling. It should be ideally marked at floor level (e.g., with a stop or interior furnishings) so that it would not pose a risk of collision for people with visual impairment. In the future, the museum plans to add even more interactive, playfully mechanical elements and audio-visual media installations (wg3.at).

The underground area, the casemate, is also accessible to all thanks to the installation of a lift. The Graz Museum (wg3.at) claims that its aim was a “comprehensive inclusion and the greatest possible removal of barriers”.<sup>28</sup> Thus, the lift makes the underground space

<sup>27</sup> Moreover, it is also comfortable for the employees, who can sit and still have a view, so it does not require unnecessary physical effort.

<sup>28</sup> Policies in the city of Graz are aimed to build its new facilities that are fully accessible for people with disabilities.



FIG. 8 COLLAGE FROM PHOTOGRAPHS: RAMP TO VIEW POINT; VIEW WITH RELIEF MODEL; INFORMATION AND ORIENTATION BOARDS



FIG. 9 COLLAGE FROM PHOTOGRAPHS: GROUND FLOOR (INTERIOR EXHIBITION WITH SHOWCASES); UNDERGROUND FLOOR - THE CASEMATE (RAMP ROUTE, AUDIO-VISUAL SCHLOSSBERG MODEL, LIFT)



FIG. 10 COLLAGE FROM PHOTOGRAPHS: HYGIENIC SPACES AND LOCKERS; ACCESSIBLE TOILET

TABLE IV RESULTS OF EVALUATION TAKING INTO ACCOUNT PREVIOUSLY STUDIED PRINCIPLES OF UD AND THEIR APPLICATION IN THE 52 MUSEUMS

Principle of UD	Unsuitable solutions	Compliant implementation in practice – recommendation
1. Equitable Use	<ul style="list-style-type: none"> <li>– Missing accessible entrance.</li> <li>– Separate accessible side or rear entrance (not visible from the main entrance).</li> <li>– Staircase lift – not suitable solution for all visitors.</li> <li>– Steep ramp or missing handrails.</li> <li>– Accessible toilets only for people in wheelchairs.</li> </ul>	<ul style="list-style-type: none"> <li>– One common entrance – suitable for all visitors.</li> <li>– If necessary to use the side entrance – clearly visible and easy to find.</li> <li>– All accessible adaptations usable for all visitors (not only for specific groups).</li> <li>– Exterior spaces and ramps are comfortable for all visitors.</li> <li>– Accessible toilets for all visitors, including people with small children.</li> </ul>
2. Flexibility in Use	<ul style="list-style-type: none"> <li>– Only one solution for the vertical movement.</li> <li>– Only one exhibition route – strictly defined and difficult to pass.</li> <li>– No interactions with the exhibition.</li> <li>– Few activities for various groups of visitors (including children).</li> <li>– Meeting room/hall only with fixed seats.</li> </ul>	<ul style="list-style-type: none"> <li>– Vertical communication to all floors by lift and stairs, ideally also by ramp for evacuation and easy routing.</li> <li>– Free exhibition route of museum buildings and exhibition pieces.</li> <li>– Many ways of perceiving and interacting with the exhibition.</li> <li>– Possibilities for interior and exterior activities.</li> <li>– Flexible multifunctional hall for various activities and different users.</li> </ul>
3. Simple and Intuitive Use	<ul style="list-style-type: none"> <li>– Complicated solutions of the floor layouts.</li> <li>– Lack of visual and tactile identification of the main exhibition and circulation routes.</li> <li>– Lack of colour or tactile contrast of the walls, doors, stairs, etc.</li> <li>– Dark spaces – no visual overview/preview inside and outside spaces.</li> </ul>	<ul style="list-style-type: none"> <li>– Clear orientation (tactile paving as guidelines, interior ramp as a programmed route in otherwise possibly less clear floor layouts).</li> <li>– Easy routes for wayfinding, providing many views.</li> <li>– Colour and tactile contrast or colour coding of specific zones in the building.</li> <li>– Visual and other sensory contact with the environment.</li> </ul>
4. Perceptible Information	<ul style="list-style-type: none"> <li>– Lack of various (multisensory) forms of perception of information and exhibition.</li> <li>– No clear and legible signs and information.</li> <li>– Dark exhibition spaces – not legible information.</li> </ul>	<ul style="list-style-type: none"> <li>– Multisensory (haptic – by relief, acoustic – using headphones, visual – good lighting and contrasts) and hands-on exhibits.</li> <li>– Aesthetic and understandable signs and pictograms.</li> <li>– Multimedia information in alternative formats (with good lighting).</li> </ul>
5. Tolerance for Error	<ul style="list-style-type: none"> <li>– Protruding objects/exhibits at the circulation routes.</li> <li>– Glass walls and doors without contrasting marking.</li> <li>– Improper shape and dimensions of stairs and ramps (and no handrails).</li> <li>– Slippery and glossy flooring.</li> </ul>	<ul style="list-style-type: none"> <li>– Glass doors marked with colour-contrasting signs.</li> <li>– Exhibits and used materials are durable, resistant, easy to operate.</li> <li>– The environment is risk-free (stairs are straight shaped with no nosings, ramp is generally preferred).</li> <li>– Slip-resistant floor materials without glare.</li> </ul>
6. Low Physical Effort	<ul style="list-style-type: none"> <li>– Steep or long ramp as a part of the exhibition route.</li> <li>– No places to rest or only uncomfortable benches.</li> </ul>	<ul style="list-style-type: none"> <li>– Comfortable movement (including slight ramp slope and landings).</li> <li>– Many resting points. Comfortable solutions for furnishing.</li> <li>– Movable chairs with back support for resting.</li> </ul>
7. Size and Space for Approach and Use	<ul style="list-style-type: none"> <li>– Insufficient space for manoeuvring of a person in a wheelchair and inconvenient access to interior elements.</li> <li>– Narrow corridors, insufficient door widths, small dimensions of lifts, etc.</li> <li>– Missing accessible toilets with baby-changing facilities.</li> </ul>	<ul style="list-style-type: none"> <li>– The elements are visible, approachable and reachable for all.</li> <li>– Counter and showcases with lower height.</li> <li>– Appropriate dimensions for manoeuvring of the person in a wheelchair or people with baby strollers.</li> <li>– Appropriate width of the corridors, doors, ramps, lifts and stairs.</li> </ul>

accessible to all, including wheelchair users, the elderly, people with prams, and people with reduced mobility. Furthermore, the underground exhibition route is formed with a suitable subtle ramp, which does not visually compete with important spatial traits and structure of the historical setting. It comfortably guides all visitors through the underground space and forms a clear route common for all. This way prevents accidents that could occur due to bumpy floor surfaces and protects the historical structure from damage. This is regarded as application of the principles 1 – Equitable Use, and 5 – Tolerance for Error. Visitors find there an audio-visual “Schlossberg Story” around a spectacular new transparent Schlossberg model,

which illustrates the history of the hill. Visitors perceive the information about the Schlossberg Story visually and auditory, so possibly the museum could consider also adding a haptic model, a relief board, or an interactive tactile exhibit somewhere in the museum premises in the future, so it would saturate the 4<sup>th</sup> principle – Perceptible Information even more. The interior exhibition areas are presented in Fig. 9.

Finally, one can also mention universally designed hygienic spaces and lockers at various heights (Fig. 10). Both toilets serve all people, both are accessible, and one of them even contains a changing table for babies (Fig. 10). Principles 1 – Equitable Use, and 2 – Flexibility in Use are applied. The design is very appealing; possibly, a colour contrast between doors and walls could be used to facilitate navigation to people with partial visual impairment and would therefore be more according to the 4<sup>th</sup> principle – Perceptible Information.

## RESULTS

The selected exemplary museum in this article was chosen because it reflects the UD principles very well and shows possible ways to welcome all diverse visitors in the environment of a museum with a historic core. The inclusive approach is also shown in its exhibitions, interactive for different age groups and people with various needs. Even in a great solution, it is possible to find some elements that could be even better, so we briefly proposed a few suggestions in the article, most of them with regard to people with reduced vision or visual impairment relating to the 4<sup>th</sup> principle – Perceptible Information. However, this case study was not selected for a detailed access audit, it was chosen as an exemplary realisation that presents an overall positive implementation of UD.

The result of broader research is the evaluations of several museums; some of the museums’ founders are even inclined to implement recommendations into practice, so this has the impact on strengthening a more inclusive practice of creating a museum environment. Based on the findings and evaluations of 52 visited museums, the implementation of UD principles in Table IV is summarised.

## CONCLUSION

The paper explained the methods used in the research, the original background from 7 principles of Universal Design, and characterised also the tool of Access Audit Checklist which has the structure different from original UD principles because it considers functional areas from all points of view from UD

(not each principle separately in the whole building at once) to facilitate the examination process. Multiple museums with regard to Universal Design were evaluated. In many cases, museums are situated in historic buildings, so the topic of UD is an important issue in the process of their restoration and renovation.

The issue of applying UD principles to historic buildings is very important for architects and people in general. This research indicates that a significant number of museums are situated in historic buildings and often tied to historical times, people and events. Applying UD principles in the process of renovation and adaptation of these objects provides access to education, experiences and participation in social life to all people with different needs. The presented example illustrates that combining methods of UD with sensitive monument restoration is possible and even complementary (e.g. the ramp pro-

viding accessible route and protecting the historic constructions at the same time).

In current and future practice, there is a strengthening trend and a great desire to make public buildings, including museums, more accessible and welcoming. This article demonstrates theoretically, and practically, through the case study, that it is possible to apply UD principles even in a difficult terrain and historic environment, and combine it with the effort to preserve the historical value of the place in a very aesthetic way. Multiple ways are shown to give various visitors a quality experience of the museum tour and global impression from the visit. The summarisation of findings proposes suitable ways of implementing UD principles in museums' historic buildings.

[Translated by: Natália Filová  
(originally written in English).  
Proofread by: Zuzana Čeresňová]

## BIBLIOGRAPHY AND SOURCES

1. ANDRE, L., DURKSEN, T. and VOLMAN, M.L. (2017) "Museums as avenues of learning for children: a decade of research". *Learning Environments Research*, 20(April), pp. 47-76 [online]. Available at: <https://link.springer.com/article/10.1007/s10984-016-9222-9> [Accessed: 08.04.2022]. <https://doi.org/10.1007/s10984-016-9222-9>
2. BANASIAK, M. (2020) "A Sensory Place for All". In: LINDSAY, G. (ed.) *Contemporary Museum Architecture and Design: Theory and Practice of Place*. 1<sup>st</sup> ed. New York: Routledge, pp. 231-245.
3. BLACK, G. (2005) *The Engaging Museum: Developing Museums for Visitor Involvement*. 1<sup>st</sup> ed. Abingdon: Routledge. <https://doi.org/10.4324/9780429021176-13>
4. BOHÁCOVÁ, K., SCHLEICHER, A. (2022) "European and Slovak Examples of Pop-up Theatres – Alternative Theatres across Europe". *Ěpítés Építészettudomány*, 50(1-2). pp. 17-26 [online]. Available at: <https://akjournals.com/view/journals/096/50/1-2/article-p17.xml> [Accessed: 08.04.2022]. <https://doi.org/10.1556/096.2021.00015>
5. CAULTON, T. (1998) *Hands-on Exhibitions*. 1<sup>st</sup> ed. New York: Routledge.
6. COHEN, U., McMURTRY, R. (1985) *Museums and Children: A Design Guide*. 1<sup>st</sup> ed. Milwaukee: Center for Architecture and Urban Planning Research [online]. Available at: [https://dc.uwm.edu/cgi/viewcontent.cgi?article=1017&context=caupr\\_mono](https://dc.uwm.edu/cgi/viewcontent.cgi?article=1017&context=caupr_mono) [Accessed: 08.04.2022].
7. ČERESŇOVÁ, Z. (ed.) (2018) *Inclusive Higher Education*. 1<sup>st</sup> ed. Prague: Gasset [online]. Available at: [https://www.stuba.sk/buxus/docs/stu/pracoviska/rektorat/odd\\_vzdelavania/UNIALL/UNIALL\\_O6\\_Inclusive\\_higher\\_education\\_final\\_elektronicka.pdf](https://www.stuba.sk/buxus/docs/stu/pracoviska/rektorat/odd_vzdelavania/UNIALL/UNIALL_O6_Inclusive_higher_education_final_elektronicka.pdf) [Accessed: 08.04.2022].
8. ČERESŇOVÁ, Z. (2009) "Design for All Implemented in Culture". In: ČERESŇOVÁ, Z. (ed.) *Culture for All*. 1<sup>st</sup> ed. Bratislava: Faculty of Architecture, Slovak University of Technology. pp. 10-14.
9. ČERESŇOVÁ, Z., ROLLOVÁ, L. (2015) "Universal design: Methodology to enhance engagement of students in higher education". In: Hawkins, J. (ed.) *Student Engagement: Leadership Practices, Perspectives and Impact of Technology*. 1<sup>st</sup> ed. New York: Nova Science Publishers, pp. 91-115.
10. FALK, J.H., DIERKING, L.D. (2018) *Learning from Museums*. 2<sup>nd</sup> ed. Lanham: Rowman & Littlefield.
11. FILOVÁ, N., ČERESŇOVÁ, Z. (2020) Innovative forms of exhibitions focused on architecture in children's museums [in Slovak language: Inovatívne formy expozícií so zameraním na architektúru v múzeách pre deti]. In: *Architecture in Perspective 2020. Proceedings of the International Conference: 14-15 October 2020*. Ostrava: Vysoká škola báňská – Technická univerzita Ostrava, pp. 338-344.
12. FILOVÁ, N., ROLLOVÁ, L. (2019) „Human centered design of a children's museum“. *SWS Journal of Social Sciences and Art*, 1(2), pp. 67-80. <https://doi.org/10.35603/ss2019/issue2.06>
13. FILOVÁ, N., ROLLOVÁ, L. and ČERESŇOVÁ, Z. (2022) "Route options in inclusive museums: Case studies from Central Europe". *Architecture*

- Papers of the Faculty of Architecture and Design STU*, 27(1), pp. 12-24. <https://doi.org/10.2478/alfa-2022-0003>
14. GÖKÇİÇDEM, E.M. (ed.) (2016) *Fostering Empathy through Museums*. 1<sup>st</sup> ed. Lanham: Rowman & Littlefield.
  15. HEIN, G.E. (1998) *Learning in the Museum: Museum Meanings*. 1<sup>st</sup> ed. London: Routledge.
  16. HOCHREITER, O. (2020) *Graz Museum Schlossberg* [online]. Available at: <https://www.graz-museum.at/en/graz-museum-schlossberg/> [Accessed: 08.04.2022].
  17. HOFFMANN, H.W., CHRISTIAN SCHITTICH (ed.) (2016) *Museum Buildings: Construction and Design Manual*. 1<sup>st</sup> ed. Munich: DOM Publishers. <https://doi.org/10.1129/9783955532963>
  18. JŮVA, V. (2004) *The Children's Museum: an educational phenomenon for the 21<sup>st</sup> century*. [in Czech language: Dětské muzeum: Edukační fenomén pro 21. století]. 1<sup>st</sup> ed. Brno: Paido.
  19. KANNENBERG, J. (2020) *Listening to Museums: Sounds as objects of culture and curatorial care*. Master. London College of Communication, University of the Arts London [online]. Available at: <https://www.johnkannenber.com/home/phd> [Accessed: 08.04.2022].
  20. KOTRADYOVÁ, V. (2015) *Comfort in a microenvironment* [in Slovak language: Komfort v mikroprostredí]. 1<sup>st</sup> ed. Bratislava: Premedia.
  21. LEHMBRUCK, M. (1974). "Museum Architecture". *Museum*, 26(3/4), pp. 126-280.
  22. LEVENT, N., PASCUAL-LEONE, A. (eds.) (2014) *The Multisensory Museum: Cross-Disciplinary Perspectives on Touch, Sound, Smell, Memory, and Space*. 1<sup>st</sup> ed. Lanham: Rowman & Littlefield.
  23. NAREDI-RAINER, P.V. (2004) *Museum Buildings: A Design Manual*. Berlin: Birkhäuser Architecture.
  24. PACHER, M. (2015) *Proprioception and architecture*. Master of Architecture. Faculty of the Graduate School, University at Buffalo, State University of New York [online]. Available at: <https://www.proquest.com/openview/7775e887bc45dca931e3512d5b133f69/1?pq-origsite=gscholar&cbl=18750> [Accessed: 08.04.2022].
  25. SAMOVÁ, M., ROLLOVÁ, L., ČERESŇOVÁ, Z., KORCEK, P., MAJCHER, S. and KONČEKOVÁ, D. (2010) *Audit of barrier-free environment: results of the scientific research grant task VEGA 14/09 of the Ministry of Education Audit program – universal accessibility of the physical environment* [in Slovak language: Audit bezbariérovosti prostredia: Výsledky vedecko-výskumnej grantovej úlohy VEGA 14/09 Ministerstva školstva Auditorský program – univerzálna prístupnosť hmotného životného prostredia]. 1<sup>st</sup> ed. Bratislava: CEDA Faculty of architecture STU.
  26. SANDELL, R. (ed.) (2002) *Museums, Society, Inequality*. 1<sup>st</sup> ed. London: Routledge. <https://doi.org/10.4324/9780203167380>
  27. SCHLEICHER, A. (2017) Small-scale exhibition forms for contemporary art and art development: contemporary art galleries in Bratislava [in Slovak language: Malé výstavné formy pre súčasné umenie a rozvoj umenia: galérie súčasného umenia v Bratislave]. In: *Architecture in Perspective 2017. Proceedings of the International Conference: 2-3 November 2017* [online]. Ostrava: Vysoká škola báňská – Technická univerzita Ostrava, pp. 87-92. Available at: <https://www.fast.vsb.cz/export/sites/fast/226/cs/spoluprace/konference-a-seminare/architektura-v-perspektive/predchozi-rocniky/architektura-v-perspektive-2017-sbornik.pdf> [Accessed: 08.04.2022]. WOS: 000432503300021.
  28. SCHLEICHER, A. (2019) Limits of the museum [in Slovak language: Hranice múzea]. In: *Architecture in Perspective 2019. Proceedings of the International Conference: 2-3 October 2019*. [online] Ostrava: Vysoká škola báňská – Technická univerzita Ostrava, pp. 180-183. Available at: <https://www.fast.vsb.cz/export/sites/fast/226/cs/spoluprace/konference-a-seminare/architektura-v-perspektive/architektura-v-perspektive-2019-sbornik.pdf> [Accessed: 08.04.2022]. WOS: 000505658000037.
  29. SONG, L., GOLINKOFF, R.M., STUEHLING, A., RESNICK, I., MAHAJAN, N., HIRSH-PASEK, K. and THOMPSON, N. (2017) "Parents' and experts' awareness of learning opportunities in children's museum exhibits". *Journal of Applied Developmental Psychology*. 49(March-April), pp. 39-45. [online] Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0193397317300394> [Accessed: 08.04.2022]. <https://doi.org/10.1016/j.appdev.2017.01.006>
  30. STORY, M.F., MUELLER, J.L. and MACE, R.L. (1998) *The Universal Design File: Designing for People of All Ages and Abilities*. Revised ed. Washington, DC: North Carolina State Univ., Raleigh. Center for Universal Design [online]. Available at: <https://files.eric.ed.gov/fulltext/ED460554.pdf> [Accessed: 08.04.2022].
  31. United Nations (2006) Convention on the Rights of Persons with Disabilities and Optional Protocol. [online] Available at: <https://www.un.org/disabilities/documents/convention/convoptprot-e.pdf> [Accessed: 02.05.2022].
  32. URLANDOVÁ, A. (2016) *Power of colour* [in Slovak language: *Síla farby*]. 1<sup>st</sup> ed. Bratislava: Eurostav.
  33. VAZ, R., FREITAS, D. and COELHO, A. (2020) Perspectives of Visually Impaired Visitors on Museums: Towards an Integrative and Multisensory Framework to Enhance the Museum Experience. In: *9<sup>th</sup> International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion (DSA 2020)*. pp. 17-21 [online]. Available at: <https://dl.acm.org/doi/fullHtml/10.1145/3439231.3439272> [Accessed: 08.04.2022]. <https://doi.org/10.1145/3439231.3439272>
  34. WG3 studio (2021) *Competition Schlossberg-museum Graz* [in German language: Wettbewerb Schlossbergm WG3useum Graz] [online]. Available at: <https://www.wg3.at/projekt/schlossbergmuseum-graz/> [Accessed: 08.04.2022].
  35. YUDINA, A. (2016) *Lumitecture: Illuminating Interiors for Designers and Architects*. 1<sup>st</sup> ed. London: Thames & Hudson.
  36. ZUMTHOR, P. (2006) *Atmospheres: Architectural Environments – Surrounding Objects*. 5<sup>th</sup> ed. Basel: Birkhäuser.

## SOURCES OF ILLUSTRATIONS AND TABLES

FIG. 1-3, 5-10 Authors, 2022

FIG. 4 Authors, 2022; drawn according to personal visit, information provided in information tables in the area and also from WG3 studio (wg3.at)

TABLES I-IV Authors, 2022

## AUTHORS' BIOGRAPHIES AND CONTRIBUTIONS

**NATÁLIA FILOVÁ** is a Ph.D. Candidate. Her thesis topic is "Museum for children?", and she focuses on inclusive museum architecture.

Assoc. Prof. **LEA ROLLOVÁ**, Ph.D. is a university teacher, the head of CEDA, and the Institute of Public Buildings. She leads projects related to Universal Design (UD).

Assoc. Prof. **ZUZANA ČERESŇOVÁ**, Ph.D. is a university teacher, her research focuses on human-centered design, she provides expert advice and leads projects related to UD.

The article emerged from the cooperation of Natália Filová (N.F.), Lea Rollová (L.R.) and Zuzana Čerešňová (Z.Č.). The main concept of the article was developed together. Used methodology resembles methods applied in previous research of L.R. and Z.Č. On site research was realised by N.F. All coauthors shared their resources. L.R. and Z.Č. supervised and reviewed the draft of the paper written by N.F.

Conceptualization: N.F., L.R., Z.Č.; Methodology: L.R., Z.Č.; Software: N.F.; Validation: L.R., Z.Č.; Formal analysis: N.F.; Investigation: N.F.; Resources: N.F., L.R., Z.Č.; Data curation: N.F.; Writing – original draft preparation: N.F.; Writing – review and editing: L.R., Z.Č.; Visualization: N.F.; Supervision: L.R., Z.Č.; Project administration: N.F., L.R.; Funding acquisition: L.R.

All authors have read and agreed to the published version of the manuscript.

## ACKNOWLEDGMENTS

The paper is published in the framework of the national project Support for Universal Design No. NF-P312040APA3, which is implemented thanks to the support from the European Social Fund under the Operational Programme Human Resources.

