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Examination of Re-Functionalized Museums in the Context of the Principles of Universal Design: Bursa

Yeniden İşlevlendirilen Müzelerin Evrensel Tasarım İlkeleri Bağlamında İncelenmesi: Bursa

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ABSTRACT

Museums should be open to the experiences of all users without any discrimination. Universal design that includes everyone is critical for identifying how users with different physical and mental characteristics experience spaces. This study aimed to evaluate the status of re-functionalized museums in the context of the principles of universal design. This study employed observation and on-site inspection to evaluate whether the re-functionalized museums in Bursa satisfied the principles of universal design. The sample consisted of seven museums under active preservation. The museums were assessed based on seven principles established by the Centre for Universal Design at North Carolina State University. The buildings in question originally had different functions. They were then re-functionalized into museums. However, the results show that users cannot experience the museums as much as they should. Although the museums have reasonable adjustments for disabled access, those adjustments do not allow users with diverse abilities to use the spaces without discrimination and assistance. Museums nurture their users culturally and socially. In return, users develop a sense of belonging to the society in which they live. When repurposing old buildings, architects and designers should not only focus on accessibility but also on inclusiveness. Therefore, they should make sure that their designs comply with the principles of universal design. Repurposing should focus on melting cultural heritage and universal design in the same pot and meeting user needs while avoiding damaging cultural heritage.

Keywords: Accessibility, cultural heritage, repurposing, universal design, user experience.

ÖZ

Müze yapılarının farklı özellikteki kullanıcıların deneyimine açık olması ve bu deneyimleri kullanıcılar arasında ayırımcılık yapmadan sağlaması gerekmektedir. Evrensel tasarımın herkes için kapsayıcı olması farklı kullanıcıları dikkate alması, farklı özellikteki kullanıcıların mekân deneyimini belirlemede önemli bir etmendir. Bu araştırma, müze olarak yeniden işlevlendirilen tarihi yapıları evrensel tasarım kriterleri bağlamında değerlendirmek amacıyla yapılmıştır. Çalışmada, Bursa'da müze olarak yeniden işlevlendirilen tarihi yapılarında gözlem ve yerinde tespitler yapılarak, bu yapıların evrensel tasarım kriterlerine uygunluk durumları değerlendirilmiştir. Bu kapsamında aktif koruma yaklaşımı ile müze olarak kullanılan 7 müze, Kuzey Karolina Devlet Üniversitesi Evrensel Tasarım Merkezi tarafından belirlenen ve evrensel tasarım anlayışı bağlamında literatürde kabul görmüş 7 prensip temel alınarak incelenmiştir. Özgün halinde farklı işlevlerle inşa edilmiş, günümüzdeyse müze olarak kullanılan yapıların farklı özellikteki kullanıcılar tarafından yeterince deneyimlenemediği saptanmıştır. Bu yapılarda engelli kullanıcılar için çözüm önerileri geliştirildiği tespit edilmesine rağmen, uygulanan çözümlerin farklı özellikteki kullanıcıları ayrımcılığa sebep olmadan ve mekânları yardım almadan kullanabilmesi için yeterli olmadığı dikkati çekmiştir. Yapılan bu çalışmada; yeniden işlevlendirilme çalışmalarında hem kültürel miras hem de evrensel tasarımın ortak payda da buluşturulması ihtiyacı görülmektedir. Uygulanacak çözümlerin hem kullanıcı ihtiyaçlarını karşılayacak, hem de kültürel mirasa zarar vermeyecek nitelikte olması gerektiği vurgulanmak istenmektedir.

Anahtar Kelimeler: Erişilebilirlik, kültürel miras, yeniden kullanım, evrensel tasarım, kullanıcı deneyimi.

Introduction

A space offers users experiences, meets their needs, and is defined by their actions. Spaces that fit this description focus on users. Users with different characteristics should be able to experience public spaces. In other words, public spaces should serve users without making any sensory or physical discrimination. Spaces stand the test of time as long as they provide services to users. Spaces that cannot meet their users' social, technical, or functional needs are doomed to remain idle. A space is successful only if every-one can use it without encountering any problems.

Universal design is defined as the design of products and environments to be usable by all people without the need for adaptation or specialized design. Although this definition seems too simplistic, it has its challenges in practice. This principle is based on the premise that a space should allow all users to experience it without discrimination regardless of their physical or mental characteristics (Aslaksen et al., 1997; Evcil, 2014; Imrie, 2014; Pritchard, 2014).

Universal design is associated with different concepts such as design for everyone, inclusive design, and life-long design. Ronald L. Mace, an architect, was the first to coin the term universal design. According to him, universal design is the design of products and environments in a way that as many users can experience them as possible, regardless of their abilities (Evcil, 2014). The important thing here is that spaces should not prevent users from experiencing them. In other words, each user should be able to experience spaces with his/her efforts without assistance (Andy, 2014).

Public buildings should be designed according to the principles of universal design so that every user can experience them (Imrie & Hall, 2003). Museums are responsible for providing information and contributing to cultural identity and diversity. Therefore, they are supposed to serve users with different characteristics. This means that they should adhere to the principles of universal design and be open to the experiences of all users without any discrimination.

Countries repurpose historic buildings into museums because they reflect and pre-serve cultural, social, and historical identity (Andy, 2014; Imrie & Hall, 2003; İslamoğlu, 2018). Repurposing historic buildings into museums allows us to reinvent urban spaces and adapt existing infrastructure to new needs (Aydın, 2014; Ma, et al., 2023). Although there are various studies in the literature in the field of universal design, it is also seen that special solutions for historical buildings are insufficient in practice (Kristl et al., 2020). This study aimed to determine whether buildings re-functionalized into museums in Bursa, Turkey, were designed according to the principles of universal design. In other words, this study aimed to identify whether re-functionalized museums were open to the experiences of different groups of users, such as older adults, children, the disabled, etc.

The Concept of Universal Design

The Centre for Universal Design at North Carolina State University formulated seven principles under the leadership of Ronald L. Mace:

1. Equitable use
2. Flexibility in use
3. Simple and intuitive use
4. Perceptible information
5. Tolerance for error
6. Low physical effort
7. Size and space for approach and use (Dostoğlu, et al., 2009; Duncan, 2006).

Seven principles of universal design have been formulated to guide designers in enabling users to use spaces and products. Those principles move spaces and products be-yond certain standards and ensure that different characteristics do not deprive users of the opportunity to experience them. In other words, they allow architects to design spaces and products that appeal to a broader user base (Çepehan & Güller, 2020).

1. Equitable Use

Equitable use refers to a design that provides identical or equivalent means of use for all users with diverse abilities without segregation or stigmatization (URL-1).

2. Flexibility in Use

Flexibility in use refers to the process in which the design accommodates a wide range of individual preferences and abilities (URL-1).

3. Simple and Intuitive Use

Spaces and products should respond to different reading, comprehension, and grammar characteristics and offer information and ease of use, regardless of users' individual characteristics (URL-1).

4. Perceptible Information

Perceptible information refers to the process in which the design communicates in-formation to users, regardless of ambient conditions or their sensory abilities. It is important to provide users with alternatives that present information through different language, colour, texture, and shape options or different methods (audible, tactile, pictorial, etc.) to adapt to their characteristics (URL-1).

5. Tolerance for Error

Tolerance for error is a process in which spaces or products should consider hazards and errors and offer solutions accordingly (URL-1).

6. Low Physical Effort

Low physical effort refers to the process in which spaces and products minimize repetitive actions and sustained physical effort and allow users to maintain a neutral body position (URL-1).

7. Size and Space for Approach and Use

Size and space for approach and use refers to the process in which places or products provide appropriate size and space for approach, reach, manipulation, and use regardless of users' body size, posture, or mobility (URL-1).

It is critical for each user (disabled or not) to access the entire space and experience it without assistance (Kurak Açıcı, et al., 2018). In this sense, the principles of universal design help users experience spaces. Museums should bear cultural, social, and historical codes and allow all users to experience them. Therefore, architects should take the principles of universal de-sign into account when designing museums. Legal regulations and know-how allow architects to adhere to the principles of universal

design in new museums. However, it is difficult for them to comply with those principles when designing re-functionalized museums. This study focused on re-functionalized museums within the scope of the principles of universal design and examined whether they allowed users with different characteristics to experience them.

Material and Methods

This study consisted of four stages.

In the first phase, a literature review was conducted on the seven principles of universal design, with a focus on how museums refunctionalized according to these principles can be evaluated. The universal design principles established by The Centre for Universal Design at North Carolina State University served as the foundation for this review. These principles ensure that spaces and products are evaluated in ways that appeal to a broader range of users and can be used without discrimination. While these criteria guarantee that the design is universally accessible, they also act as guidelines for designers to integrate features that meet the needs of diverse user groups into design decisions (URL-1). The evaluation based on these principles seeks to determine whether museums can be experienced by different user groups.

In the second phase, refunctionalized museums in the center of Bursa were identified, and a literature review was conducted on these buildings. This provided insights into both the original functions of the historical buildings and the functional changes they have undergone. Based on the results of the first and second phases, data collection tools were developed. Seven key topics were identified for data collection and evaluation:

1. Accessible route
2. Building entrances
3. Horizontal circulation
4. Vertical circulation
5. Spaces
6. Wet areas
7. Information boards and signs

These categories allowed for the evaluation of the space from the immediate surroundings of the museums, ensuring that various units contributing to user experience were considered. While grouping the spaces, national and international guidelines as well as academic studies were referenced (Çağlayan Gümüş, 2020; Imrie & Hall, 2003; Sungur Ergenoğlu, 2013; URL-2).

In the third phase, spatial measurements were taken in the refunctionalized museums. This phase allowed for the assessment of the current situation, providing data on whether the museums could be experienced by users with diverse characteristics. Measurements and relevant information were recorded on data forms.

In the fourth phase, the data were analyzed according to universal design principles. The museums were rated on a scale from 2 to 0 (2 = fully meets the criteria, 1 = partially meets the criteria, 0 = does not meet the criteria) based on whether they have the necessary arrangements and dimensions to accommodate users with different characteristics. The evaluation also determined whether the museums met spatial requirements for user groups such as the elderly, children, and individuals with disabilities, as outlined in various standards (TS 9111, 2024; TS 12576, 2017; ADA, 2010; Neufert & Neufert, 2012). In this way, problems with the principles of universal design were identified, and recommendations were made. The data of the study is based on measurements and user experiences are excluded from the scope of the study.

Study Area

Bursa is an 8500-year-old city that hosted many civilizations throughout history, such as Romans, Byzantines, Seljuks, and Ottomans. Bursa is also an important city for the Republic of Turkey. It contains cultural assets in the UNESCO World Heritage List and examples of civic and industrial heritage (URL-3). Bursa has a rich cultural background with some historic buildings re-functionalized into museums.

Bursa has 15 buildings re-functionalized into museums by the state or private enter-prises. Measurements and on-site determinations were not performed in three museums because two were under renovation (Hüsnü Züber House Museum and Turkish Islamic Arts Museum), and the other was inaccessible due to the pandemic (Forestry Museum). Therefore, these three museums were excluded from the sample. Moreover, Sultan's Mansion, Merinos Energy Museum, Bursa Living Culture Museum, Seventeenth-Century Ottoman House Museum, and Ataturk's House did not undergo any alterations in their plan setups, spatial organizations, and furnishings. In other words, they are preserved passively. Therefore, these museums were also excluded from the sample. Consequently, this study focused on seven museums (Figure 1).

Figure 1.
Map of Bursa and Locations of Museums

This section addressed the characteristics of Bursa City Museum, Merinos Textile Industry Museum, Karagoz Museum, Bursa Health History Museum, Tophane Vocational and Technical Anatolian High School Museum, Muradiye Quran and Manuscripts Museum, TOFAŞ Anatolian Cars Museum, and Uluumay Ottoman Folk Clothing and Jewellery Museum.

Bursa City Museum

Bursa City Museum is one of the three administrative buildings in the city centre during the Republic period. The building, which was used as the Bursa Courthouse for 75 years, was evacuated in 2001 when the institution moved to another building. Later, the building has been turned into a city museum. Consisting of a basement and two floors, the museum exhibits artifacts that reflect the urban memory and culture. It also hosts artistic and cultural activities open to the public (workshops, conferences, exhibitions, etc.) (URL-4) (Figure 2).

Figure 2.
Bursa City Museum

Merinos Textile Industry Museum

Merinos Textile Industry Museum operates in the Merino Wool Institution, which was the last factory opened by Mustafa Kemal Atatürk in 1938. The museum is in the Merinos Atatürk Congress and Culture Centre campus, with numerous facilities (congress and fair areas, catering units, etc.). The building has been serving as a museum since 2011 (Alagöz, 2017).

The museum is on the first and second floors of the building. The exhibition areas in the museum consist of four main sections that illustrate the transformation of the wool into yarn (URL-5) (Figure 3).

Figure 3.
Merinos Textile Industry Museum

Karagoz Museum

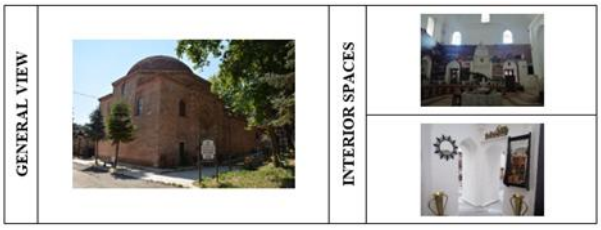
Karagoz and Hacivat are the lead characters of the traditional Turkish shadow play, popularized during the Ottoman period. They are considered the symbols of Bursa. A transformer building was first converted into a Karagoz House in 1997 and then into the Karagoz Museum in 2007. The museum introduces the shadow play to both tourists and local people. It consists of two floors. It has a showroom, where shadow plays are held. It also has a Karagoz-Hacivat gallery, a puppet gallery, a special library, and a painting workshop (URL-6) (Figure 4).

Figure 4.
Karagoz Museum

Tophane Vocational and Technical Anatolian High School Museum

The 560-year-old Çandarlı İbrahim Pasha Bath was re-functionalized into Tophane Vocational and Technical Anatolian High School Museum in 2016. The museum is a one-story building located in the garden of Tophane Vocational and Technical Anatolian High School, one of the city's prominent educational institutions established in 1868 as a reformatory to protect poor orphans. The museum provides information about the school's history (URL-7) (Figure 5).

Figure 5.
Tophane Vocational and Technical Anatolian High School Museum



Muradiye Quran and Manuscripts Museum

Muradiye Quran and Manuscripts Museum is one of the most important parts of the Muradiye Complex, which was included in the UNESCO World Heritage List (2014). The building has an Ottoman early period madrasah plan type with a portico, an open court-yard, and an iwan. It consists of fourteen student cells around a square courtyard, two intermediate iwans, and a large iwan. Muradiye Madrasa, which is used as a museum today, is an important institution for Turkish-Islamic geography. It underwent restoration in different periods. It was handed over to Bursa Metropolitan Municipality in 2014 and converted into a museum in 2018. The rooms and the portico are used as an exhibition hall. The covered courtyard hosts workshops and various activities. The bath in the campus, where the museum is located, was also restored in 2008. It is used as a center for people with physical disabilities (URL-8) (Figure 6).

Figure 6.
Muradiye Quran and Manuscripts Museum

TOFAŞ Anatolian Cars Museum

TOFAŞ Anatolian Cars Museum is located in an area of 17.000m², which includes four different buildings spread over different levels. One of those buildings is an old silk factory that started to be used as a museum in 2002 (URL-9) (Figure 7).

Figure 7.
TOFAŞ Anatolian Cars Museum

Uluumay Ottoman Folk Clothing and Jewelry Museum

The Madrasa of Şair Ahmet Pasha, dating to the 15th century, was re-functionalized into Uluumay Ottoman Folk Clothing and Jewelry Museum in 2004. The building is made of cut stone and brick. It has a rectangular plan, except for the main iwan. The madrasah consists of a classroom, covered with a single dome, just across the entrance, porticoes with pointed arches and mirrored vaults on both sides of the rectangular courtyard, and eleven cells and an iwan at the back (URL-10) (Figure 8).

Figure 8.
Uluumay Ottoman Folk Clothing and Jewelry Museum

Results

The spatial measurements and assessments were examined under seven headings:

1. Accessible route
2. Building entrances
3. Horizontal circulation
4. Vertical circulation
5. Spaces
6. Wet areas
7. Information boards and signs.

Evaluation of Bursa City Museum with Universal Design Criteria

Bursa City Museum is located in the square where the Atatürk Statue is, an important landmark of the city centre. The museum has no parking lots. Access to the museum is possible via public transportation, but the roads in its vicinity are not suitable and accessible for users with different characteristics. There are differences in elevation between the museum and the main transportation axis. The ramps do not offer the same level of experience and alternatives to users in terms of the principles of equitable use and flexibility in use. Moreover, the route to the museum via this axis is not suitable for users with different perceptual characteristics in terms of the principle of simple and intuitive use. Directions from the immediate surrounding to the museum are not suitable for users with different perceptual characteristics. The museum does not satisfy the principle of tolerance for error because there are no detailed solutions, such as stairs and anti-slip bolt-down plates with the right colour and material. The lack of those solutions may cause accidents. Users cannot pass over the stairs and ramps connecting the elevations on the route without assistance, indicating that the route to the museum fails to satisfy the principles of low physical effort and size and space for approach and use.

At the entrance of the building, there are alternative solutions for physically disabled users and children, but there are no tactile surfaces for visually impaired users. The building entrances partially consider users with different abilities, and therefore, they partially satisfy the principle of flexibility in use. The museum does not offer different language and alphabet options. In this sense, the building entrances partially meet the needs of users with different abilities. In other words, they fail to satisfy the principles of simple and intuitive use and perceptible information. The stairs at the building entrance have anti-slip strips, which is consistent with the principle of tolerance for error. However, the stairs fail to satisfy the principle of tolerance for error because they have no railings of different heights, and the ramp edges have no parapets of appropriate height. The ramp slope at the building entrance is not suitable for users with different characteristics. This shows that the building entrances partially satisfy the principles of low physical effort and size and space for approach and use.

The venues in the museum have platforms that support horizontal circulation. Therefore, it supports the principles of equitable use and flexibility in use for users with different physical and perceptual characteristics. However, the museum fails to satisfy the principles of simple and intuitive use and perceptible information because it has no tactile surfaces on the floors and no language options on the guide signs. The museum has the right floor material and ramps that connect to the platforms, which is positive in terms of the principles of equitable use and flexibility in use. However, the ramp slopes and material do not comply with the principles of tolerance for error and low physical effort. In addition, the gaps between the guardrails and the handrail forms can cause accidents, which contradicts the principle of tolerance for error. The manoeuvring areas and ramps also fail to satisfy the principle of size and space for approach and use.

The building has an elevator, satisfying the principles of equitable use and flexibility in use. However, the stairs, another element that provides vertical circulation, do not offer options for visually impaired individuals or children. Moreover, the elevator has no voice-controlled system and has a door that closes too soon. Therefore, it fails to satisfy the principles of simple and intuitive use and perceptible information. The museum also fails to satisfy the principle of tolerance for error because it has no tactile surfaces associated with vertical circulation. The height and the diameter of the handrail on the stairs are not suitable for users with different characteristics, which contradicts the principle of size and space for approach and use. The elevator is large enough and has user panels at different heights, satisfying the principle of size and space for approach and use.

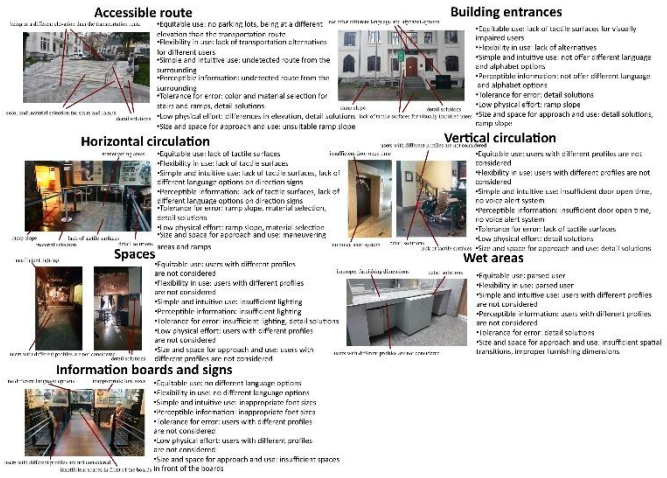
The spaces of the museum fail to satisfy the principles of equitable use and flexibility in use in terms of users with different characteristics. The exhibition areas and other units (e.g., administration and wet areas) do not take into account visually impaired individuals, children, and elderly users. The spaces are too dim-lit for users with impaired vision to perceive artifacts and even inter-space relations, which is inconsistent with the principles of simple and intuitive use, perceptible information, and tolerance for error. Moreover, the exhibition, administrative, and auxiliary spaces are problematic in terms of the principle of size and space for approach and use.

The spaces in the museum do not provide alternatives in wet areas for users with different physical characteristics, which contradicts the principle of equitable use. Although the building has accessible toilets, they are segregated. The wet areas have the necessary signs and indicators, making it easy for users to access them. However, the building offers insufficient facilities for users with different characteristics. Therefore, it fails to

satisfy the principle of simple and intuitive use and perceptible information. The wet are-as have no tactile surfaces for people with visual impairments and children. Moreover, the pieces of furniture have sharp corners. Therefore, the wet areas fail to satisfy the principle of tolerance for error. However, they satisfy the principle of low physical effort. The doors do not allow users on wheelchairs to reach the accessible toilet cabins, which is inconsistent with the principle of size and space for approach and use. The washbasins and toilet bowls are also problematic for people with physical disabilities, children, and older adults.

The building has information boards and signs in different languages. However, it does not have enough information boards and signs for visually impaired users. The museum also does not have different language options for the exhibition. Therefore, it does not satisfy the principles of equitable use and flexibility in use. It partially satisfies the principles of simple and intuitive use and perceptible information because the font sizes and shape-ground relationships need to be more perceptible by users with different competencies. These problems prevent users from experiencing the spaces, contradicting the principle of tolerance for error. Moreover, users who cannot get enough information about spaces and artifacts find themselves in a situation where they have to make more effort, which is in contrast to the principle of low physical effort. The manoeuvring areas in front of some information boards are problematic concerning the principle of size and space for approach and use (Figure 9).

Figure 9.
Analysis of Bursa City Museum according to universal design criteria



Evaluation of Merinos Textile Industry Museum with Universal Design Criteria

The campus where Merinos Textile Industry Museum is located was granted an achievement award by the Historical Cities Association in 2007. One part of a factory on the campus was re-functionalized into Merinos Textile Industry Museum, which is located inside the Atatürk Culture and Congress Centre. The access to the museum is via the entrances at different points of the campus and at different levels. Although the parking features and different routes within the campus are convenient for users, there are no tactile surfaces along the entire route. Therefore, the museum does not adequately satisfy the principles of equitable use and flexibility in use. The museum does not offer alternative access options for users with different characteristics, which is inconsistent with the principles of simple and intuitive use and perceptible information. The access routes have obstacles that may pose an accident risk for visually impaired individuals, children, and the elderly, which contradicts the principle of tolerance for error. The location of the accessible route satisfies the principle of low physical effort. The sidewalks and parking lots offer suitable alternatives for users with different characteristics, which is in line with the principle of size and space for approach and use.

The building entrance is below ground level, with stairs and ramp options. However, there are not enough tactile surfaces, making it difficult for some users to enter and navigate the museum. Therefore, the building does not entirely satisfy the principles of equitable use and flexibility in use. Although the building entrance is adequately lit, there are no direction signs for the entrance. Hence, it fails to meet the needs of users with different characteristics in terms of the principles of simple and intuitive use and perceptible information. The stairs have anti-slip strips. The width, slope, and manoeuvring area of the ramp comply with the regulations. However, the stairs and the ramps do not have hand-rails. The stairs have too high piers, which makes accessibility difficult. The floor material of the ramp is not suitable for users with different characteristics. Therefore, they only partially satisfy the principles of tolerance for error, low physical effort, and size and space for approach and use.

As for horizontal circulation, the museum does not offer alternative solutions in corridor widths and manoeuvring areas for users with different characteristics, which is inconsistent with the principles of equitable use, flexibility in use, and size and space for approach and use. The floor does not have tactile surfaces for visually impaired users, which is in contradiction with the principles of simple and intuitive use and perceptible information. The columns prevent horizontal circulation, which also disagrees with the principle of tolerance for error. The columns also affect the route negatively, which does not agree with the principle of low physical effort.

The building has an elevator, which satisfies the principles of equitable use and flexibility in use. However, the stairs cause problems for different age groups and users with different physical abilities in terms of vertical circulation. Therefore, the stairs partially satisfy the principles of equitable use and flexibility in use. The stairs, elevator directions, and distinguishing features are partially suitable for the principles of simple and intuitive use and perceptible information. The stairs have anti-slip strips, and the elevator has a voice alert system. However, the stairs and the elevator are partially consistent with the principle of tolerance for error for three reasons. First, there are no tactile surfaces. Second, there are no handrails at different heights on either side of the stairs. Third, the door of the elevator closes too soon. The museum satisfies the principle of low physical effort. However, the elevator cabin dimensions are not suitable for users with different characteristics, which is in contradiction with the principle of size and space for approach and use.

The artifacts displayed in the museum fail to satisfy the principles of equitable use and flexibility in use because they are positioned in such a way that they block each other's views, making it difficult for users to see and sense them. The colons also make it hard for users to experience the spaces. As for administrative units, the museum satisfies none of the principles entirely regarding the circulation of users in the spaces.

The wet areas discriminate against users with different characteristics. The accessible toilet is segregated, which is inconsistent with the principle of equitable use. There is no guidance with tactile surfaces for visually impaired users, which

disagrees with the principles of simple and intuitive use and perceptible information. The museum also fails to satisfy the principle of tolerance for error due to similar reasons and insufficient supporting elements in the accessible toilet. The wet areas do not take into account different age groups or users with different physical characteristics. This shows that the museum fails to satisfy the principles of low physical effort and size and space for approach and use.

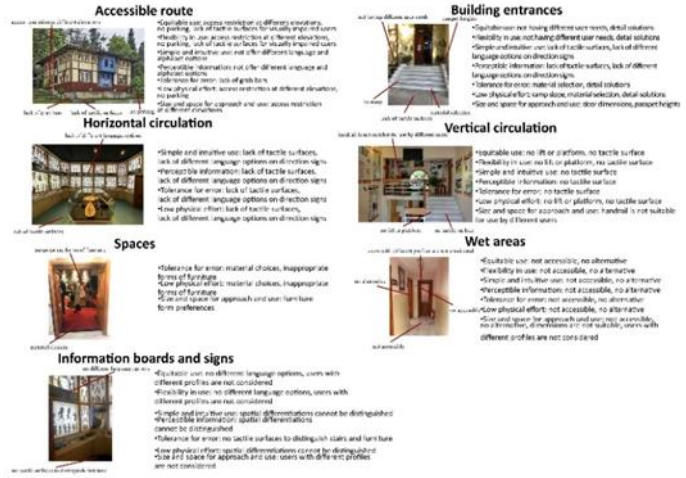
The information boards offer different language or audio narration options, agreeing well with the principles of equitable use, flexibility in use, simple and intuitive use, and perceptible information. However, there are no embossed letters or tactile surfaces for visually impaired users, which is in contradiction with the principle of tolerance for error. Moreover, some artifacts block the view of the information boards, which is not suitable for the principles of low physical effort and size and space for approach and use (Figure 10).

Figure 10.
Analysis of Merinos Textile Industry Museum according to universal design criteria

Evaluation of Karagoz Museum with Universal Design Criteria

Karagoz Museum is higher than the access level, and the main entrance of the building is accessed via stairs. The sidewalk is low enough, but there are no links between the levels for users with different competencies. The museum has no parking space, which is a minus concerning the principles of universal design. These parameters show that the museum does not comply with the principles of universal design in terms of accessibility. The difference in elevation at the entrance is suitable only for healthy adults. The stairs have no flexible solutions, such as anti-slip strips, tactile surfaces, and ramps. There are no instructions for the entrance. Moreover, the museum has insufficient lighting and information boards. Therefore, the museum satisfies none of the principles of universal design. As for horizontal circulation, the museum offers alternatives for users with different characteristics. The door passages and maneuvering areas are partially suitable for different users. However, the tactile surfaces and the information-sharing methods fail to help users comprehend the space, which is in contradiction with the principles of simple and intuitive use, perceptible information, tolerance for error, and low physical effort. The museum consists of two floors. As for vertical circulation, only healthy adults can use the stairs. Users with different characteristics cannot move from one level to another to experience the museum. The spaces provide users with partially equitable use and flexibility. The spaces provide information and ease of use that enable users to experience them. This is also related to the dimensions of the spaces and the ease of the plan scheme. As for the materials and furniture, the museum fails to satisfy the principles of tolerance for error, low physical effort, and size and space for approach and use. The toilets fail to meet users' needs, which contradicts the principles of universal design. They are not accessible to users with different characteristics and do not provide solutions in terms of size and space. The museum lacks sufficient information boards and signs for spatial concerns and exhibition materials. The information boards and signs do not allow users with different characteristics to experience the museum. The size of the texts on the information boards is insufficient. Moreover, short users, children, or visually impaired users cannot access the information on the information boards. Users cannot distinguish the spaces because there are no tactile surfaces, which disagrees with the principle of tolerance for error (Figure 11).

Figure 11.
Analysis of Karagoz Museum according to universal design criteria



Evaluation of Tophane Vocational and Technical Anatolian High School Museum with Universal Design Criteria

Tophane Vocational and Technical Anatolian High School Museum is accessed through the high school garden. The sidewalk is unsuitable for users regarding size, alternatives, and route information. The museum has a parking space at the main gate of the high school. However, users need to take a long walk to get to the museum. In terms of accessibility, the museum partially satisfies the principles of equitable use, flexibility in use, and size and space for approach and use and fails to satisfy the principles of simple and intuitive use, perceptible information, tolerance for error, and low physical effort. The entrance is compatible with the principles of equitable use, flexibility in use, and low physical effort. However, the doors are not wide enough, which is in contradiction with the principle of size and space for approach and use. The museum offers no alternatives for users to sense the entrance and comprehend the spatial information. Therefore, it fails to satisfy the principles of simple and intuitive use, perceptible information, and tolerance for error. As for horizontal circulation, it has some transitions between its spaces. However, the transitions, the size of the maneuvering areas, and the heights of floors between the transitions are unsuitable for equitable use, flexibility in use, and size and space for approach and use. Moreover, the museum offers no alternative solutions for horizontal circulation. It fails to satisfy the principles of simple and intuitive use, perceptible information, and low physical

effort. The flooring material may pose a hazard to users, which is inconsistent with the principle of tolerance for error. There are transitions between the levels. However, the stairs that connect the levels are unsuitable for users with different characteristics. In fact, they pose a danger even to healthy adults because there are differences between riser heights. Therefore, the transitions fail to satisfy the principles of universal design. It is difficult for users with different characteristics to experience inter-space relations and artifacts. Users of different age groups and those with different physical or perceptual skills should have difficulty perceiving the artifacts and accessing information. This shows that the museum fails to satisfy the principles of universal design. The museum has no toilets, which is problematic not only for users with different characteristics but also for healthy adults. It is even hard for healthy adults to read the information boards. Moreover, the information boards do not have embossed letters or language options, and therefore, fail to comply with the principles of universal design (Figure 12).

Figure 12.
Analysis of Tophane Vocational and Technical Anatolian High School Museum according to universal design criteria

Evaluation of Muradiye Quran and Manuscripts Museum with Universal Design Criteria

There are no problems on the sidewalk that leads to the main entrance gate. However, there are problematic points between the bus stop and the museum. The museum has no parking space for the disabled, which disagrees with the principles of equitable use, flexibility in use, tolerance for error, low physical effort, and size and space for approach and use. The main entrance level is accessed via stairs and ramps. The riser heights are not fixed, and the ramps are higher than what is specified by regulations. The entrance fails to satisfy the principles of equitable use, flexibility in use, low physical effort, and size and space for approach and use. Moreover, the stairs have no anti-slip strips and railings, and the door is made of glass, which is potentially a risk for accidents. Therefore, the entrance fails to satisfy the principle of tolerance for error. The museum has no tactile surfaces and no sufficient lighting, which is unsuitable for the principles of simple and intuitive use and perceptible information. The exhibition elements in some spaces disrupt horizontal circulation. Therefore, they partially satisfy the principles of equitable use, flexibility in use, and size and space for approach and use. The museum offers no options for vertical circulation, which is inconsistent with the principles of simple and intuitive use, perceptible information, tolerance for error, and low physical effort. Different levels have spaces, but the ramps between the levels are insufficient and even increase the risk of accidents. In addition, the museum does not take any precautions against the difference in elevation that is too high between some levels. The museum fails to satisfy the principles of universal design in terms of vertical circulation. The exhibition sites are unsuitable for the principles of universal design. The museum offers no solutions for users to access information about the artifacts. There is not enough information for visually impaired users. The exhibition sites pose a risk for accidents. The museum has an accessible toilet, which is de-signed for users in wheelchairs but not for users with different characteristics, such as children and visually impaired users. The information boards are improperly lit and do not contain sufficient information. Therefore, the museum fails to satisfy the principles of universal design (Figure 13).

Figure 13.
Analysis of Muradiye Quran and Manuscripts Museum according to universal design criteria

Evaluation of TOFAŞ Anatolian Cars Museum with Universal Design Criteria

Although TOFAŞ Anatolian Cars Museum is in close proximity to public transportation, there are no adjustments (route, sidewalk, etc.) for visually impaired individuals. Therefore, the museum fails to satisfy the principles of universal design. There is a parking lot on the campus, but pedestrian access from the parking lot to the buildings and be-tween the buildings is problematic. The ramps are insufficient in terms of both sizes and materials. The entrances to the building partially satisfy the principles of equitable use and flexibility in use. The entrances have ramps, which are, however, insufficient in terms of material, size, and supporting factors, such as side rails. The building provides horizontal circulation through a platform. However, the platform has no defined borders and offers no options at the landing point. The route that determines the circulation does not offer alternatives for users with different characteristics. Neither the campus nor the building offers sufficient solutions for level differences, suggesting that they fail to satisfy the principles of universal design. The spaces do not allow users to experience and perceive the museum and the artifacts. The heights and alternatives of the display elements are not suitable for users with different characteristics. The museum has only one accessible toilet, which is, however, designed poorly. The accessible toilet is not accessible from other buildings, which is problematic concerning the principles of universal design. The information boards and signs do not satisfy

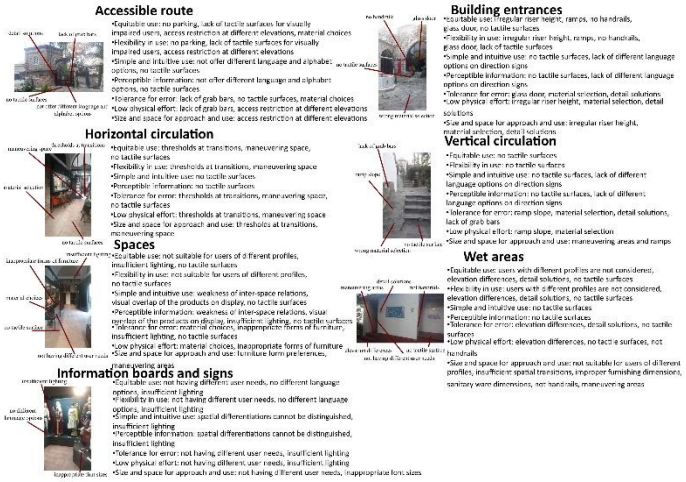
the principles of universal design (Figure 14).

Figure 14.
Analysis of TOFAŞ Anatolian Cars Museum according to universal design criteria

Evaluation of Uluumay Ottoman Folk Clothing and Jewellery Museum with Universal Design Criteria

Uluumay Ottoman Folk Clothing and Jewellery Museum has no parking space. It is accessed via public transportation. However, the sidewalk in the immediate vicinity is unsuitable for users with different characteristics. The museum is located on a sloping site. It is accessed via stairs and ramps. However, the risers are too high, and the stairs have no handrails. The ramp at the entrance has many problems, including its slope, material, etc. Therefore, the museum's entrance fails to satisfy the principles of universal design. As for horizontal circulation, the doors have thresholds. The thresholds and the maneuvering areas fail to satisfy the principles of universal design because they are unsuitable for users with different characteristics and even pose a risk for accidents. There are no solutions that connect the spaces at different levels. The spaces are too narrow for users to experience the artifacts. Therefore, the spaces only partially satisfy the principles of equitable use and flexibility in use. The museum offers no solutions in terms of wet areas. The information boards and signs also do not satisfy the principles of universal design (Figure 15).

Figure 15.
Analysis of Uluumay Ottoman Folk Clothing and Jewellery Museum according to universal design criteria



Users with different characteristics cannot experience the re-functionalized museums fully. The museums offer solutions for users with disabilities, but those solutions do not help them experience the spaces without assistance and discrimination. Merinos Textile Industry Museum offers the most solutions that help users experience it. On the other hand, Uluumay Ottoman Folk Clothing and Jewellery Museum is the most limited museum in terms of user experience (Table 1). These headings provide general guidelines and may vary depending on the nature and discipline of your research. The Discussion section is an important opportunity to highlight the importance and contributions of your research, and it is important that you clearly explain the meaning of your findings.

Table 1.
The evaluation of the re-functionalized museums in terms of the principles of universal design

	Universal Design Principles	Bursa City Museum	Merinos Textile Industry Museum	Karagoz Museum	Tophane Museum	Muradiye Quran and Manuscripts Museum	TOFAŞ Anatolian Cars Museum	Uluumay Ottoman Folk Clothing and Jewellery Museum
Accessible route	Equitable use	0	1	0	1	1	0	0
	Flexibility in use	0	1	0	1	1	0	0
	Simple and intuitive use	0	0	0	0	1	0	0
	Perceptible information	0	0	0	0	1	0	0
	Tolerance for error	0	0	0	0	1	0	0
	Low physical effort	0	2	0	0	1	0	0
	Size and space for approach and use	0	2	0	1	1	0	0

Table 1.
The evaluation of the re-functionalized museums in terms of the principles of universal design (continued)

	Universal Design Principles	Bursa City Museum	Merinos Textile Industry Museum	Karagoz Museum	Tophane Museum	Muradiye Quran and Manuscripts Museum	TOFAŞ Anatolian Cars Museum	Uluumay Ottoman Folk Clothing and Jewellery Museum
Building entrances	Equitable use	1	1	0	2	1	1	0
	Flexibility in use	1	1	0	2	1	1	0
	Simple and intuitive use	1	1	0	0	0	1	0
	Perceptible information	1	1	0	0	0	1	0
	Tolerance for error	1	1	0	0	0	1	0
	Low physical effort	1	1	0	1	0	1	0
	Size and space for approach and use	1	1	0	1	0	1	0
Horizontal circulation	Equitable use	1	0	1	0	1	0	0
	Flexibility in use	1	0	1	0	1	0	0
	Simple and intuitive use	0	0	0	0	0	0	0
	Perceptible information	0	0	0	0	0	0	0
	Tolerance for error	0	0	0	0	0	0	0
	Low physical effort	0	0	0	0	0	1	0
	Size and space for approach and use	0	0	1	0	1	1	0
Vertical circulation	Equitable use	1	1	0	0	0	0	0
	Flexibility in use	1	1	0	0	0	0	0
	Simple and intuitive use	1	1	0	0	0	0	0
	Perceptible information	1	1	0	0	0	0	0
	Tolerance for error	0	1	0	0	0	0	0
	Low physical effort	1	2	0	0	0	0	0
	Size and space for approach and use	1	1	0	0	0	0	0
Spaces	Equitable use	0	1	1	0	1	0	1
	Flexibility in use	0	1	1	0	1	0	1
	Simple and intuitive use	0	1	1	0	0	0	0
	Perceptible information	0	1	1	0	0	0	0
	Tolerance for error	0	1	0	0	0	0	0
	Low physical effort	1	1	0	0	1	0	0
	Size and space for approach and use	1	1	0	0	1	0	0
Wet areas	Equitable use	0	0	0	0	1	0	0
	Flexibility in use	0	0	0	0	1	0	0
	Simple and intuitive use	1	0	0	0	0	0	0
	Perceptible information	1	0	0	0	0	0	0
	Tolerance for error	0	0	0	0	0	0	0
	Low physical effort	2	0	0	0	1	0	0
	Size and space for approach and use	0	0	0	0	1	0	0
Information boards and signs	Equitable use	0	2	0	0	0	0	0
	Flexibility in use	0	2	0	0	0	0	0
	Simple and intuitive use	0	2	0	0	0	0	0
	Perceptible information	0	2	0	0	0	0	0
	Tolerance for error	1	1	0	0	0	0	0
	Low physical effort	0	0	0	0	0	0	0
	Size and space for approach and use	0	0	0	0	0	0	0
EVALUATION TOTAL		22	37	7	9	20	9	2

*2=fully complies with the criteria, 1= partially fulfils the criteria, 0=does not fulfil the criteria.

Discussion

Repurposing is one of the most effective ways of breathing new life into historic buildings and helping them stand the test of time. When architects repurpose historic buildings that have become idle over time for different reasons, they take into account many criteria, such as space setup, environmental factors, etc. Most historic buildings are re-functionalized into museums or art galleries to make sure that they appeal to a broader user base. However, architects should keep in mind that children, the elderly, or people with physical disabilities will also visit museums. Therefore, they should repurpose old buildings in a way that they offer solutions for users with different characteristics without losing originality. Museums nurture their users culturally and socially. In return, users develop a sense of belonging to the society in which they live. According to the International Council of Museums' (ICOM) definition of museums in 2022, museums should be open to the public, accessible, inclusive and representative of sustainability and diversity (Museum Definition, accessed on 6 July 2024). When repurposing old buildings, architects and designers should not only focus on accessibility but also on inclusiveness. Therefore, they should make sure that their designs comply with the principles of universal design.

In accordance with legal regulations, many institutions and organizations design public environments and buildings for physically disabled users. In the study of Yi et al. in which they examined the design indicators of sports facilities for the disabled, they stated that guidelines should be developed for the use of sports facilities for the disabled and that these facilities should be usable by everyone (Yi et al., 2022). However, repurposing does not involve the construction of a building from scratch. Therefore, regulations are sometimes challenging for designers interested in repurposing historic buildings. It is seen that the historical buildings that have been re-functionalized as museums are not sufficient for the use of the physically disabled (Aras, 2020). Marín-Nicolás et al. analysed the accessibility improvement index of urban areas in Murcia Region of Spain, which contain cultural heritage elements with different functions (Marín-Nicolás et al., 2023). In the study conducted within the scope of this article, seven re-functionalized museums were examined in the context of universal design principles in order to determine whether their functions and designs allow access not only for disabled users but also for users with different characteristics.

This study focused on seven re-functionalized museums in Bursa, Turkey, within the context of the principles of universal design. The study investigated whether the museums satisfied the principles of universal design under seven headings: accessible route, building entrances, horizontal circulation, vertical circulation, spaces, wet areas, and information boards and signs. The results show that the museums fail to satisfy the principles of universal design in terms of accessible routes, entrances, ramps, horizontal circulation, vertical circulation, toilets, and display elements. Although the museums offer some options for users with different characteristics, they fail to satisfy the principles of universal design (Table 2).

Table 2.
Points to be adjusted for buildings repurposed as museums

Museums	Accessible route	Building entrances	Horizontal circulation	Vertical circulation	Spaces	Wet areas	Information boards and signs
Bursa City Museum	SA MES	SA MES	SA MES	MES	SA MES	MES	MES
Merinos Textile Industry Museum	MES	SA MES	SA MES	MES	SA MES	MES	MES
Karagoz Museum	SA MES	MES	SA MES	MES	MES	SA MES	MES
Tophane Vocational and Technical Anatolian High School Museum	SA MES	MES	SA MES	SA MES	SA MES	SA MES	MES
Muradiye Quran and Manuscripts Museum	SA MES	SA MES	MES	SA MES	MES	SA MES	MES
TOFAŞ Anatolian Cars Museum	SA MES	SA MES	SA MES	SA MES	MES	SA MES	MES
Uluumay Ottoman Folk Clothing and Jewellery Museum	SA MES	MES	SA MES	SA MES	SA MES	SA MES	MES

** (SA: Spatial Arrangement, MES: Material and Equipment Selection should be reconsidered)

This study highlights that re-functionalized museums should offer solutions in their functions and designs suitable for users with different competencies. The museums have some improvements for individuals with physical disabilities. We think that authorities should consider our results and identify the design flaws and loopholes in the museums.

Conclusions

Museums are spaces where users with different physical and mental characteristics come together. When designing these spaces, necessary adjustments should be made not only for accessibility but also for inclusivity. Architects should consider users with different characteristics when repurposing historic buildings into museums. Within the scope of this study, on-site measurements and assessments were conducted by the researcher in the museums located in the city where the sample was taken, and the inclusivity status of the historic buildings repurposed as museums was examined in conjunction with universal design criteria. Obtaining data regarding the experiences of museum users through interviews was excluded from the study's scope.

The results show that the solutions developed in these museums focus only on certain user groups (people with physical disabilities, the elderly, children, etc.) and segregate them from healthy adults. Re-functionalized museums should adhere to the principles of universal design: equitable use, flexibility in use,

simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use. When repurposing historic buildings into museums, architects and designers should consider the extent to which these buildings respond to spatial changes required for users with different characteristics and offer alternative solutions related to the inclusive design approach (Figure 16).

Figure 16.
Considerations in the design of historical buildings repurposed as museums according to universal design criteria

Architects should consider the museum as a whole and design it with an inclusive approach in accordance with the principles of universal design. Solutions provided piecemeal or through a single unit do not allow users with different characteristics to experience museums without assistance. They should choose modern equipment and materials that do not damage the building and can be removed if the building is re-functionalized again in the future. Authorities should introduce legal regulations and conduct inspections to ensure that the measures and solutions are suitable for users with different characteristics in the context of the principles of universal design.

The results of this study indicate that the historic buildings repurposed as museums do not comply with inclusivity standards and do not fully satisfy the principles of equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use. Museums should serve users with different characteristics to ensure the principle of equitable use. They should undergo spatial arrangements to ensure the principle of size and space for approach and use. They should have the right circulation, exhibition areas, and toilet arrangements to ensure the principles of tolerance for error, low physical effort, and simple and intuitive use. Architects should use removable or modifiable material and equipment to satisfy the principle of flexibility in use. If architects consider these principles and make arrangements accordingly, they can design egalitarian and inclusive museums for users with different characteristics. Moreover, architects interested in repurposing historic buildings into museums should maintain structural integrity and aesthetic and function-al harmony. It should be emphasized that the solutions applied for the experience of different users should be handled in a way that does not disturb the authenticity of the historical building and with a reversibility approach. This will allow users with different characteristics to enjoy museums. Thus, the understanding of belonging and conservation, which will ensure that historical buildings will reach future generations with a sustainability approach, will be able to reach a wider group.

Table 3 presents the design strategies developed in accordance with universal design principles for historical buildings that have been refunctioned as museums. Based on these strategies, it is anticipated that new proposals can be formulated regarding spatial organization, material selection, and detail solutions, and that these proposals may be further evaluated through studies focusing on user experience.

Table 3.
Design strategies developed in line with universal design principles of historical buildings re-functionalized as museums

Spaces	Universal Design Strategies
Arrangement of Accessible Route	Equal Access: It is essential that access to the museum is provided equally for all users. When it is possible for everyone to use the same route, this should be preferred, and when it is not possible, equivalent and non-blocking alternatives should be offered. Avoiding Discrimination: It is a fundamental principle to avoid discrimination for all users. Access arrangements should ensure that everyone can access the museum on equal terms. Appropriate Arrangements: Sidewalks and car parking areas should be appropriately arranged to ensure that users with different characteristics can easily access the museum. These arrangements should provide access without segregating users. Relationships between Levels: Arrangements should be made in the immediate vicinity of the museum, taking into account the elevation differences between public transport, car parks and pedestrian access routes. These arrangements should ensure that all users can easily reach the museum. Information Vehicles: Various information tools should be used around the museum to facilitate access to the museum. These tools should be designed in a way to facilitate the orientation and information of the users to the museum. Understandable Approach: When approaching the building, it should be ensured that its relationship with its immediate surroundings is understandable for users with different physical or perceptual characteristics. This should be supported by clear, distinct and comprehensible signage and signposting to facilitate access to the building for all users.
rrangement of Building Entrances	Providing the Right to Choose: The design should ensure that users with different characteristics have a variety of usage options. This should provide the freedom to choose according to their individual preferences in access and usage patterns. Adaptation to Different Characteristics: The design should include solutions to adapt to the different physical and perceptual characteristics of users. This should ensure that all users can use the building entrance comfortably and safely. Correct and Careful Use Measures: Necessary measures should be taken to ensure the correct and careful use of the design. This should include orientation, information and security measures to ensure that the entrance is safe and accessible. Adaptation to User Speed: The design should be able to adapt to the speed of different users. This ensures that the entrance area is designed in accordance with their dynamic use and that users have a comfortable and safe experience when entering. Arrangements that do not damage the façade and are reversible: The entrance arrangements to be made as a result of the change of function should not damage the façade of the building and should be designed with the principle of reversibility in mind. This should include the development of solutions that can be restored when necessary while preserving the authenticity of the historic building.

Table 3.
Design strategies developed in line with universal design principles of historical buildings re-functionalized as museums (continued)

Spaces	Universal Design Strategies
Arrangement of Horizontal Circulation	Elimination of Unnecessary Complexity: In design, unnecessary complexity should be eliminated. Circulation areas should be simple and clear so that users can easily find their way around the space. User Expectations and Intuitions: The design should be created by taking into account the expectations and intuitions of the users. It should be aimed that users can easily find their way in the natural flow. Literacy and Language Skills: The design should be prepared by taking into account the literacy level and foreign language skills of the users. Visual signs and simple, clear directions should be used. Densification of Information Organization: In the design, the information layout should be condensed and used in order of importance. Critical information should be emphasized and placed in a remarkable way. Effective Stimuli: Effective stimuli should be activated during and at the end of the museum experience. This should be supported by signs, announcements and audio-visual elements that facilitate the orientation of users within the space. Comprehensible signage and signposting to facilitate access to the building for all users.
Arrangement of Vertical Circulation	Various Information Methods: Different information methods should be used in the design. Pictorial, audio and tactile information options should be provided so that all users can access the information they need. Understandable Information: It should be ensured that the information presented in museums is at maximum comprehensibility. Information texts should be simple, clear and understandable, and complexity should be avoided. Identifiable Elements: The elements used in the design should be defined in such a way that they can be easily distinguished from each other. This can be achieved through effective orientation and guidance markings. Solutions Suitable for Emotional Constraints: The design should also provide appropriate solutions for users with emotional limitations. This should be achieved by introducing solutions that are better than existing techniques or tools. Contrasts between Information and Environment: Adequate contrasts between the essential information and its environment should be used to ensure that the required information is differentiated to a discernible degree. This ensures that the information is distinct and easily recognizable.
Arrangement of Spaces	Maneuvering Spaces: Maneuvering space should be provided for circulation and experience between exhibits. This includes leaving sufficient space for visitors to move freely and examine the exhibits comfortably. Safe and Accessible Elements: Elements used in the design should be arranged to minimize hazards and errors as much as possible. The most frequently used elements should be accessible, while dangerous elements should be eliminated, isolated or protected. Protection against Hazards: The design should have protection features against possible hazards and errors. Warning measures should be taken when necessary and the safety of visitors should be ensured. Precautions for Work Requiring Attention: In the design, limiting measures should be developed for tasks that require attention. This provides a safe and comfortable experience by minimizing distractions for visitors. Reversibility Principle: The arrangements to be made in museums should be designed according to the principle of reversibility. This includes ensuring that the changes made can be reinstated when necessary and providing flexibility.
Arrangement of Wet Areas	Natural Body Structure Compatibility: The design should allow users to use comfortably with their natural body structure. Wet areas should be organized so that people with different body structures can use them comfortably and safely. Reasonable Use of Force: The design should enable users to use a reasonable amount of force when using wet areas. The force required to open and close doors, taps and other equipment should be kept to a minimum. Minimizing Repetitive Movements: Repetitive movements in wet areas should be minimized as far as possible. The design should be optimized to enable users to complete their work with fewer repetitive movements. Reducing Physical Exertion: The design should be optimized to reduce long-term physical exertion. Ergonomic solutions should be offered so that users can comfortably use wet areas without experiencing fatigue. Solutions Suitable for Different User Profiles: In wet areas, solutions suitable for the needs of different user profiles should be developed. Design should be made by considering the needs of various user groups such as the disabled, the elderly and children. Reversibility Principle: In the spatial arrangements made during the re-functionalization process, it should be ensured that the installation solutions comply with the principle of reversibility. This should include that the changes made when necessary should be easily reversible and provide flexibility.

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