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Inspiring Contemporary Architecture Through the Sustainable Adaptive Reuse of Heritage Structures

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ABSTRACT

The paper considers many different comprehension viewpoints while discussing the inspiration behind reuse. The definitions of reuse as they relate to sustainable architecture will be addressed in the introduction. The first chapter defines reuse as material reuse, and it analyses how reuse may act as an inspiration for sustainable architectural design. The second chapter discusses reuse in the context of conversion and highlights the importance it is to handling this issue seriously. The chapter describes sustainable architectural reuse driven by idea and religion, and it discusses four theories about approaches to conversion that are illustrated with instances. In the third chapter, it is discussed how or reusing sustainable architectural materials can serve as the inspiration for new architectural concepts. In the fourth chapter, the idea that reusing architecture means giving it the formal appearance of past architectural forms is discussed. Consequently, the postmodernism of the 20th century and the historical styles of the 19th century both reflected this. In the fifth chapter, "Reuse the idea," the concept of the medieval mázhaus and Socrates' home is referenced, along with the Ideal City of Chaux and Ricardo Bofill, to recycle at the idea level. The inspired architecture that embraces reuse at several levels of meaning is discussed in the sixth chapter, "Reuse as a Concept," and it becomes significant for objectifying the work's ideological core. The work's findings and main points are succinctly summarized in the paper's conclusion, which also provides a subjective assessment of the problem.

KEYWORDS: Reuse, sustainability, values, Waste material, architectural design, building examples,

INTRODUCTION

Architecture can be inspired by reuse on many different levels of understanding and implementation. Examples include reusing building materials, reusing functions or conversions, reusing structural elements, reusing form or historicism, reusing ideas or adopting an older concept, and reusing common energy today as recuperation. Reuse can refer to a range of processes, including material recovery, biological or chemical conversion to repurpose a material (see note at the end of the introduction), or vegetation reuse of biological residues in the soil. However, reuse can also refer to adaptation for a new use, to transformation, for example in the form of a building's conversion. It also has the meaning of reuse and return, even in the abstract, such as the reuse of a concept or idea, or linguistic and literary or poetic media. Reuse can also refer to a specific kind of repair or readying a material for another use, such as rebuilding a structure. Reuse money in the financial sector refers to making investments in sectors that have a guaranteed rate of return. Reuse can also mean going back to a particular place in a cycle. Reuse can also mean returning something to its original state, recovering a picture, or restarting a program, according to the dictionary.

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The final aspect of reuse is the process of extracting useful material from garbage for use in human production, such as the manufacture of building materials. In general, reuse is considered: "the process of processing used objects or materials so that they can be reused" (Della Summe

REUSE OF MATERIAL

MATERIAL CYCLES

Construction waste is a direct result of architecture, specifically the building industry. Whether or not a substance is reused determines whether a cycle is closed or open. In a closed material cycle, the energy used to construct the building, for example, in the form of materials, is not wasted once they are gone but is instead recycled through the building's revitalization or dismantling into recyclable components and materials for new construction. McDonough and Braungart developed the Cradle to Cradle design paradigm, which is based on an infinitely regenerative system with no waste, in response to the closed cycle. The open material cycle wastes energy that is essentially wasted and is not ecological. Following the building's valuable usage, it is demolished and the energy used to construct it is not recovered, leaving behind just non-recyclable waste that requires extra energy to get out. A new building is constructed on the site of the demolished one, necessitating the use of energy from the outset for the material's extraction, processing, and transportation as well as for the building itself.

EXAMPLES OF RECYCLED MATERIALS FOR CONSTRUCTION FROM THE PAST

Reusing building materials has been a part of architecture for as long as it has existed. It wasn't until the twentieth century that it was scorned and dismissed as unworthy of being a source of advancement. However historical experience demonstrates that this kind of rejection has turned into a poisonous feature of architecture. This makes it even more crucial to [go backward] and restore some ideals that are inextricably linked to construction material reuse. to go back to the values of ecology, architecture, culture, and society. By using older materials, we not only lessen the ecological impact of the construction industry but also show respect for the generations that came before us and maybe even for ourselves.

Rome and other original ancient towns provide historical examples of the reuse of building materials. A large number of its past historic monuments were gradually demolished and their materials—especially their stone—were recycled to build medieval, Renaissance, and Baroque structures. The historic ruin sites were turned into a concrete quarry. Similar things happened to relatively well-preserved structures, like the well-known Flavian Amphitheatre.

Even while we now find it challenging to demolish a historic city in this way, the practice is inspirational for today's environmentally conscious architecture because it conserves energy, natural resources, transportation, and labor.

Reuse or conversion of the buildings itself is another way that European towns are showing their ongoing development. Many of these conversions would seem quite radical to us now, even depreciating the original design by removing its architectural or urban core, as in the case of Split's Diocletian's Palace. However, despite the addition of medieval homes, the medieval rebuilding of the Roman amphitheater in Arles preserved the environment's domination of space and shape, which it still does today.

Figure 1: The ancient Roman amphitheatre in Arles, France, here in its current state, in medieval times retained its special composition despite added housing construction. Photo: Matúš Kiaček

CURRENTLY, BUILDING MATERIALS ARE RECYCLED IN ARCHITECTURE

Contemporary architecture is once again becoming interested in reusing building materials, especially for cultural values and ideational motives. The ideational reasons may include the intentional connection of the proposed building with the historical one, by appropriating its material. The material takes on the architecture's properties, which are then transferred to the new architecture through reuse.

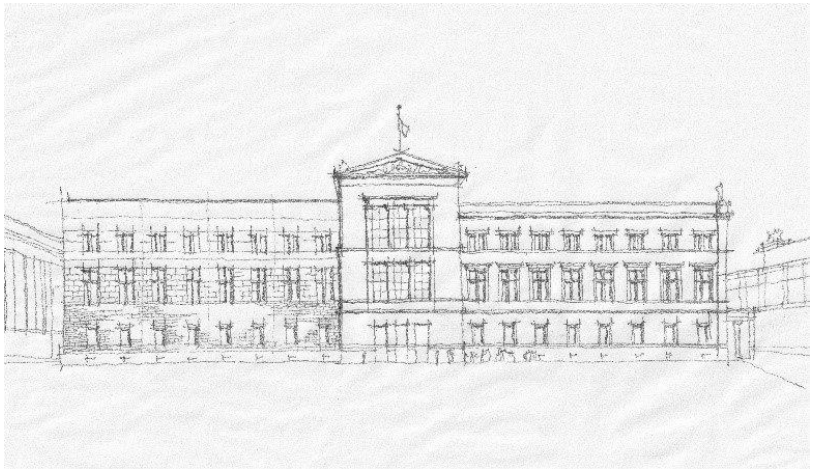

Figure 2: Reconstruction of Neues Museum in Berlin, left wing newly built of recycled bricks by David Chipperfield.

The history of architecture includes unplastered brick, which has seen significant technological advancement. But with time, a lot of the structures made of it fell into disrepair and were abandoned. Reviving them and reusing the bricks themselves have garnered increasing attention in recent times. If the building's renovations are no longer financially advantageous, its bricks may be recycled for use as building materials. As a result, the

heritage of earlier architecture—or what it might have represented—is partially transferred to the contemporary building that is built upon it. In addition, it supports ecological and cultural sustainability and validates the continuum of development.

Reclaimed brick is becoming more and more popular for use in new construction. One example is the unassuming family home designed by Wrzeszcz Architekci in Poznan, Poland. The surrounding rural environment with thick forests and agricultural landscapes, along with the ruins of historically characteristic German barns with brick façade, served as inspiration for the architects. These barns stand out from the others in the neighborhood because of their brick facades with exact architectural elements and harmonious proportions. They were immediately included in the design by the architects. They took apart a barn in the area and used the bricks to construct a new home for the family." "This became the key idea, which brought about significant change in the design approach in the field of architecture and sustainability," notes Wrzeszcz Architekci. The architects think that, in addition to being discussed and inspirational, historic buildings can be recycled and used as a basis for new construction. The site and its architecture have a unique aura that is preserved by the historical materials. Good workmanship is included in traditional brickwork, confirming the validity of the construction. "Recycled bricks from an abandoned building give it a new life and add architectural qualities to the new building."

Figure 3: Old Brick New House in Poznan, Poland, recycled brick with the volume composition of local German barn by Wrzeszcz Architekci. Photo: Przemyslaw Turlej.

Among ceramic materials, fired tiles require less cleanup after disassembly and can be recycled more easily than other types. It mostly appears in Asian works by Wang Shu and in "terracotta" countries of Europe, such as those by Arthur Franco in Spain. Using construction waste from the site, the 8B Nave's renovation transformed a former slaughterhouse. He constructed interior walls and dividing structures with varying levels of transparency using disassembled tiles. "This project seeks to understand architecture as an intellectual, cultural, and ethical experience."

Thanks to its special qualities of strength, durability, adaptability, accessibility, ease of handling, and, last but not least, aesthetics, concrete is today the most widely used building material. That being said, it is also the most environmentally harmful due to its manufacture, which accounts for 8% of global carbon dioxide emissions. When combined with steel

reinforcement, it is inflexible and challenging to disassemble and recycle. However, reinforced monolithic concrete can be recycled and "dismantled" by slicing it into blocks or slabs using a unique method. Using specialized magnets, even reinforcements made of cast steel can be removed and repurposed. However, the procedure is costly, technologically difficult, and needs transportation to an appropriate workspace. Reuse also necessitates the use of additional cement, water, and electricity. As a result, the environmental friendliness of such reuse is frequently questioned. When substantial quantities from a single source are recycled and utilized for less quality-demanding construction projects like roads, it makes sense. Using crushed concrete, such as gabion shape, is a more intriguing architectural inspiration.

Stone is the finest and most resilient substance due to its characteristics and given attributes. Because of its durability, it might be a sustainable material, but the environmental effects of mining, processing, and shipping it are too great. Because of its intensity and volume, stone quarrying as it was done in the past is essentially unsustainable today. However, stone that has already been extracted through quarrying, from building sites, or industry leftovers, can be recycled. Making terrazzo out of it is an intriguing and recently rediscovered technique that considerably lowers the quality criteria for the source stone. This is on display in the Slovak National Gallery and Neues Museum.

REUSE AS CONVERSION AND ITS PRINCIPLES

Proper resource management is essential for both sustainable growth and the health of urban creatures. These resources include land and space, infrastructure, and the building stock, or the architecture now in place. It should receive more attention because, in contrast to architecture that is presently being constructed, it makes up the majority of the city's building stock. The majority of buildings have adequate structural and spatial flexibility and are open to new ideas, uses, and expressions.

Is it not a painful irony that more environmentally and energy-acceptable architecture is constructed by demolishing original architecture? If there is such a waste of materials, energy, and resources before any modern eco-architecture, can it be beneficial? Even though reusing the original architecture will require more energy resources, wouldn't it be more environmentally friendly?

In recent years, several conferences and studies have addressed building conversions. Different approaches are based on specific principles. Four of them are presented in a clear comparison in the Perić and Šijaković article Reuse Architecture: The Redefinition of Reuse Principles in the Context of Sustainable Architectural Design: [8] Intervention, Insertion, Installation (by Brooker & Stone), Add-on, Inside-Out, Change Clothes (Feirreis & Klanten), Addition, Transformation, Conversion (Jäger) and Coexistence, Imposition, Fusion (Rogić).

INTERVENTION, INSERTION, INSTALLATION

A new architectural intervention and the original architecture form the basis of the "Intervention-Insertion-Installation" idea. Reuse techniques are categorized into three groups based on how much a structure differs from the original in terms of construction, space, and expressiveness.

The original architecture is altered during intervention, but its expressive, spatial, and structural supremacy are maintained. The old and new are mutually dependent even though

the interventions are distinct and subordinate since they are an essential component of the overall image. Herzog & de Meuron's Museum Küppersmühle is one such.

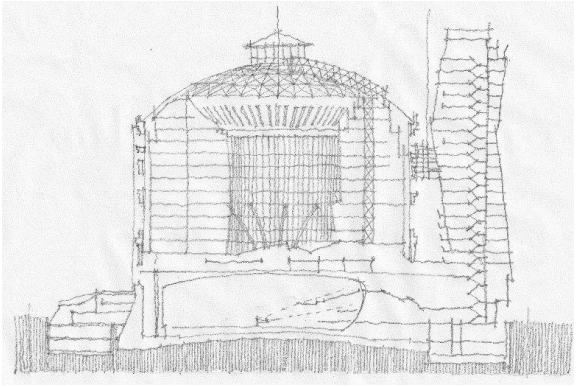

Figure 4: Gasometer in Vienna, Austria, inserted inner architecture maintaining the original architectural envelope by Coop Himm

Figure 5: Elbphilharmonie in Hamburg, Germany, independent look and concept of installed superstructure by Herzog & de Meuron. Source: https://www.baunetzwissen.de/glas/objekte/kultur/elbphilharmonie-inhamburg-4962491

ADDITION, TRANSFORMATION, & CONVERSION

The primary tenets of Jäger's classification of "recycled architecture" are the interventions' maturity and quality. The glass café designed by Hans-Joachim Neukäter among the ruins of the Zeughaus is an example of how new architecture is introduced into the old while remaining distinct and autonomous architecturally. This is known as the addition principle. As Tadao Ando has demonstrated with Punta della Dogana, transformation is more vigorous than addition, obfuscating the structural and geographical boundaries between the new and the old. Together, the ancient and new construction blend harmoniously and yield to the revitalized area. It is not possible to classify conversion as a third distinct category. In actuality, it is challenging to define the entire classification because it is predicated on highly abstract criteria.

COEXISTENCE, IMPOSITION, FUSION

The foundation of coexistence is the simultaneous existence of the new and the ancient, as appropriated by their formal image, structural, and material differences. Imposition gives more weight to the new than the old, paying little attention to the original architecture. Fusion is the appearance of one cohesive architectural piece where the original and new materials and construction are virtually indistinguishable from one another. Two levels of analysis were conducted by Branislava Rogič: tectonic and spatial-compositional. In the end, she developed four ideas: "Tectonic fusion," in which new and old construction and materials combine to form a single architecture; "Tectonic coexistence," in which the materials and structures of the old and new architectures function independently; "Spatial composition conservation," which involves maintaining the original spatial concept and allowing it to influence subsequent interventions; and, lastly, "Spatial composition transformation," which involves altering the spatial composition.

SUMMARY OF REUSE CONCEPTS AS CONVERSIONS

"... it can be concluded that the most environmentally sustainable reuse intervention will be one which fully exploits the host building, inducing as minimal change as possible, given that the conditions of the host building allow it" From an ecological perspective, the most effective conversion is the one that keeps as much of the original materials and structures as possible. This is because it lowers the energy costs associated with production and construction while increasing the energy efficiency of the building.

RELIGIOUS AND IDEOLOGICALLY MOTIVATED CONVERSION

Following the fall of the Eastern Roman Empire in 1453, Hagia Sofia, the Temple of Holy Wisdom in Constantinople, underwent a transformation into a mosque marked by the erection of four minarets and the plastering over of internal murals that depicted Christian subjects. The architecture's composition, spatial organization, and overall expression did not significantly alter in spite of the shift in religion or ideology.

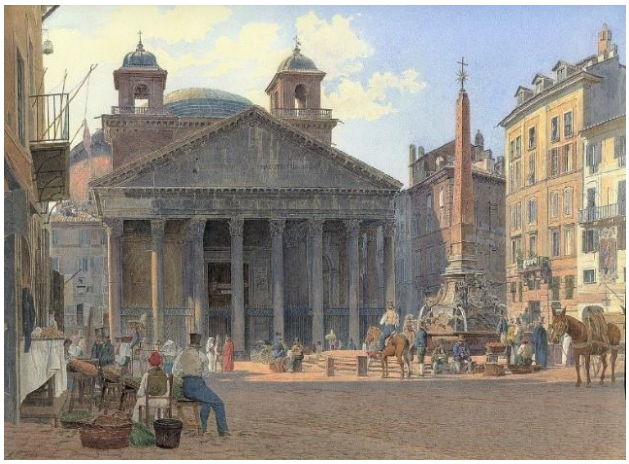

Figure 6: Ancient Roman Pantheon, Rome, with added bell towers from the 17th century, as a Christian church. Painting by Jakob Alt. Source: https://www.ArchDaily.com/802201/ad-classics-romanpantheon-emperor-hadrian

On the other hand, the Great Mosque of Córdoba, Andalusia, was built in the middle of an eighteen-nave space, and as a result, underwent a significant Christianization following the

Christian victory in the Iberian Peninsula. Although there was a religious conversion here as well, the original architecture's composition was considerably altered. It is more of an objectification of ideological victory than reuse. The Munich House of Art is a creative example of architectural reuse. Originally the House of German Art and created by architect Paul Ludwig Troost as the first example of Nazi German architecture, it evolved into a major ideological propaganda weapon. The show promoted the Nazi idea of art, which was justified by the equivalent dishonor of "degenerate" art, particularly avant-garde, even if the structure represented imperial architecture. As of right now, the museum has no permanent collection and only displays modern and contemporary art. The Jewish artist Mel Bochner's donated piece "Joys of Yiddish" is placed on the front colonnade's entablature as a tribute to the Hebrew words that have been eradicated from German society.

REUSE OF ELEMENTS AND PRODUCTS

REUSE OF CONSTRUCTION ELEMENTS

Reuse of building structures can be seen on the walls of Europe’s medieval cities. When a city's fortification system lost its functional significance it was not only pulled down, but also often used for new construction. Both approaches can be seen in Bratislava. On one hand the southern walls were pulled down to establish free public space on Hviezdoslav Square, inspired by Vienna’s Ring; on the other hand, new burgher houses and workshops were added on the northern and western walls.

It is also inspiring to recycle a smaller architectural element that is important for the concept. By its meaning, the recycled element can become the basic idea of a new architectural concept or a significant part of it. Most of these are elements whose value is in objectifying an important idea, memory, or religious idea, for instance when a new church is centred around an older preserved element, altar, baptistery, or tomb of a saint, or a chapel, bell tower, etc.

REUSE OF ART ELEMENTS

The reuse of artistic materials is under a special category since, among other things, they are primarily of artistic significance. Their reinstallation enhances new or even old architecture artistically in addition to reusing an architectural element. One example is the modernist Church of Saint Joan of Arc (1979), designed by architect Louis Arretche in Rouen, Normandy. The installed Gothic stained glass windows from the church destroyed by war carry a powerful idea despite its modernist design, construction, material, and form.

Figur7: Church of Saint Joan of Arc, original Gothic stained glass windows as main idea of the new architectural concept by Louis Arretche.

Church of Saint Joan of Arc, original Gothic stained glass windows as main idea of the new architectural concept by Louis Arretche. Photo: Matúš Kiaček FORM REUSE The historicist architectural styles of the nineteenth century clearly objectify the reuse of form. Historicist styles were not only inspired by the expression mediums of former styles, but also directly took on their stylistic architectural elements, compositional principles, and expression. Whether with the romantic neo-Gothic of the Feigler family, or other eclectic styles of the neo-Romanesque style or the neo-Renaissance and neo Baroque of Fellner and Helmer that architecturally and culturally unified the lands of the monarchy, or the architecture of Bratislava's Kittler and Gratzl, the old design was restored.

FORM REUSE

The nineteenth-century historicist architectural movements blatantly objectified form reuse. Historicist architectural forms immediately adopted the expressive aspects, compositional principles, and stylistic architectural elements of earlier styles, in addition to drawing inspiration from them. The old design was revived, whether it was through the romantic neo-Gothic architecture of the Feigler family, other eclectic neo-Romanesque styles, the neo-Renaissance and neoBaroque of Fellner and Helmer that unified the lands of the monarchy architecturally and culturally, or the Kittler and Gratzl architecture of Bratislava.

Figure 8: Eclectic villa, Bratislava, recycled Baroque and Renaissance architectural forms by Ferdinand Kittler and Karl Gratzl

In the same direction, twentieth-century postmodernism brought back past styles in a hazier manner while retaining the expressive core, though frequently reworked through unconventional shape modifications, deformations, and combinations, as demonstrated by Ricardo Bofill. As in the project Les Espaces d'Abraxas (1978), Bofill adopts forms and elements, but he also permits himself to double-break the shattered pediment, erect a glass pillar, or break it in the midst of the shaft.

Reuse of form is a suitable means applied by architects in modern interventions in the historical structure and reconstruction of older buildings. It is variously understood, from strict copies of the original form as in neo-styles, through modified imitations and stylizations, to slight references and abbreviations.

REUSE THE IDEA

Idea reuse is most prevalent in architecture, art, culture, and society at large. It also occurs in a wide variety of forms and depths of expression. Reusing a work's concept and idea is often referred to as inspiration, however it basically only involves repurposing the idea and changing it to fit new circumstances. The Renaissance is defined as a return to a certain stage of the evolutionary cycle, reuse the philosophy, social structure, culture, and artistic expression of classical antiquity. The Renaissance was a revival of the notion, the timeless image of the period, as opposed to the neo-styles of the Long Century. Similarly, Classicism restores not only the ancient image of architecture and art, but especially of thinking and, in France, the model of civil society. Despite seemingly formal copying, Classicist art, particularly painting and music, is innovative and very different from the ancient image.

The Ideal City of Chaux (1795) project greatly influenced Claude-Nicolas Ledoux, who adopted the idea of the old theater even though the city itself had nothing to do with a theater. In a similar vein, despite developing apartment structures, Ricardo Bofill revitalizes the Roman theater in Les Espaces d'Abraxas (1978). In response, Otto von Spreckelsen takes up the idea of the Arc de Triomphe and modifies it to create the Grande Arche de la Fraternité (1989), which serves as a bicentennial and triumphant emblem of the French Revolution.

The reuse of the Socrates' house concept brought us the ecological and undemanding sustainable architecture of a detached house, akin to the zeml'anka (underground shelter) idea or medieval town house type. A sustainable idea known as "Mázhaus" combines work and living in one location to reduce space and transportation needs. In this instance, reuse can also be somewhat defined as a rebirth or partial return to a previous way of life.

REUSE AS A CONCEPT

WANG SHU

The concepts and works of Wang Shu are distinguished by their processing skill, reuse of materials, genius loci, and traditional craftsmanship as sources of inspiration. According to him, reuse materials is an inherent aspect of design and is necessary for sustainable building to respect the environment, culture, and society without overcrowding it with unnecessary garbage. In addition to reuse, Wang Shu's designs significantly revitalize ancient Chinese architectural forms and principles.

Museum Of History In Ningbo

Figure 9: Museum of Ningbo, Ningbo, China, and the reuse of construction waste, craftsmanship, and the embodied idea of mountain as symbol of return to nature by Wang Shu. Source: https://www.ArchDaily.com/942622/wang-shus-works-oncontemporary-chinese-architecture-with-recycled-materials

The museum is situated in a rapidly expanding area of Ningbo, where the city's heavy urbanization has completely erased the area's maritime identity. The idea is centered on the notion of a mountain, which is a Chinese symbol of nature and man, and how tradition is artistically brought back to this metropolis. The facade, which is made of recycled building detritus from local historic architecture that has been dismantled, and raw concrete, complements the concept of the mountain. It is constructed from leftover materials like concrete, bricks, and terracotta tiles. The museum's architecture draws inspiration from both the conceptual reuse of the local identity and traditions as well as from the reuse of building materials.

STUDIO BKPŠ MARTIN KUSÝ AND PAVOL PAŇÁK

The Slovak National Gallery

The Slovak National Gallery's reconstruction is noteworthy for its breadth, methodology, and conceptual and tangible connections between architectural ideas. Reuse embedded notions along with their design and material is its primary goal.

The surface of the courtyard has been covered with a finely crushed version of the original stone paving. In a similar vein, certain subpar stone tiles and components are being recycled and added to the limestone park as benches and installations. Refurbished original sheet metal tiles are also being used as part of the rebuilding; their reuse and reuse keep the structure authentically connected to its past. Additionally, the tiles are purposefully combined and repurposed as cladding, maintaining the original materiality but giving the facade a new color pattern. The plaster facade of the northern barracks is being removed, and the hand-made brickmasonry, which has been rearranged by hand-worked stones, bears witness to the building's and the complex's construction history.

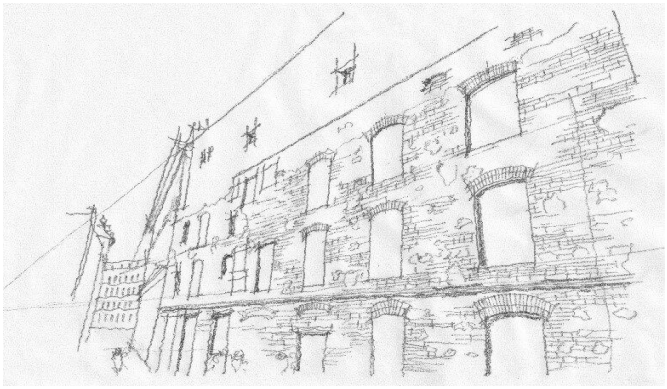

Figure 10: Reconstruction of the Slovak National Gallery in Bratislava, original Baroque masonry stripped of plaster, reflecting its construction history and inputs by BKPŠ.

Museum Of The Slovak National Councils In Myjava

Figure 11: Reconstruction of Museum of Slovak National Councils in Myjava, with preserved interior, spatial concept and materiality by BKPŠ. Source: https://www.archinfo.sk/diela/obcianska-stavba/rekonstrukciaarealu-muzea-slovenskych-narodnych-rad-v-myjave.html

The Museum of the Slovak National Councils' rehabilitation project demonstrates how original materials can be recycled on-site and in their original condition. According to Henrieta Moravčíková, the brutalist internal wall, exposed concrete, rough plaster, stone cladding, and wood paneling have all remained in their original state, needing only modest repairs. This emphasizes the preservation of the original ambiance and materiality. The comparatively modest contribution to support the reuse of architecture and its materiality and authenticity is the most inspiring.

CONCLUSION

In conclusion, in this article, the author has tried to show that reuse in architecture does not consist not only of the technological process of processing waste material into reusable material in construction, as is commonly held but comprises a much broader level of

meaning. Reuse can be an inspiration for architecture not only through the use of recycled material, but also by reprocessing architecture through converting it, by taking over forms or inspiring elements, and, last but not least, taking over and developing an important and inspiring idea and processing it into a concept. The author holds that such a view of reuse in architecture, or even in art and culture in general, is far more inspiring and beneficial than a narrow focus on the issue of material processing, which is of rather secondary assistance in materializing an idea. The notion and conviction that some values are significant and should be preserved serve as the basis for reuse. In addition to being generally aesthetic, cultural, social, and ideological, these values are ecological. Reuse serves as an inspiration for conserving ideals, according to the author. Because we are simultaneously pursuing motifs like preserving the identity of the building, its materiality, and ideology, as well as environmental and distinctive motifs arising from both current requirements and the architect's personality, the author believes that the reuse of architecture, including reconstruction and conversion, is worthy of special attention. The biggest challenge is likely bringing all of the motifs together harmoniously, which is why a lot of architecture is demolished rather than restored. It is inconceivable to construct sustainable design, recycle garbage and old materials, and then demolish structures that require a certain amount of energy and potential values. Because creating without considering what has been made is unsustainable from an environmental, cultural, and social standpoint, it is crucial to address reuse holistically in architecture as well as in other creative endeavors

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