

The Relationship Between Form and Function in the Architecture of the Second Half of the 20th Century

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Abstract

The relationship between form and function is probably one of the greatest areas of tension and conflict in architecture, and probably every architect or architectural theorist has already dealt with it. It has been and continues to be the cause of debates and discussions, some of them emotional. The way in which this area of tension is dealt with varies between individual architects and architectural movements. In the following, the relationship between form and function in four architectural movements of the second half of the 20th century will be analysed and compared by using one example of the same typology for each.

Introduction

The 20th century was characterised by many different architectural movements, the most important of which include the fading classical modernism of the 1950s and 1960s, postmodernism as a counter-reaction to modernism and a return to the past styles of architectural history, deconstructivism as a conscious break with everything that had gone before and, finally, contemporary architecture [1]–[3].

In contemporary architectural theory and practice, one of the central and most frequently discussed issues is the relationship between form and function. This concept has evolved from the original modernist slogan “form follows function” to more complex interpretations that recognise the independence of form and its ability to influence function. The second half of the 20th century, marked by the development of postmodernism, deconstructivism and other modern movements, offers rich material for studying this topic [4]. Although the theoretical basis is broad, in practice these relationships often reveal contradictions that require in-depth analysis, especially in public buildings that must serve changing functional needs. The problem of this research is to identify and analyse how the language of architectural form, often symbolic or sculptural, influences and shapes the functional use of spaces and the experience of visitors [5].

This research aims to analyse and compare the relationship between form and function in the architecture of the second half of the 20th century, looking at four representative cases of museum buildings. Museums were chosen as research objects in this article because their function is both clearly defined (to represent art) and, at the same time, flexible and open to interpretation, which allows for the study of the interaction of form and function in all its diversity.

To achieve this goal, the research tasks are set:

1. To conduct a theoretical analysis of the historical development of the concept of “form follows function” and its interpretations in the architectural theory of the second half of the 20th century, by conducting an analysis of relevant professional literature and reviewing museum design documentation.
2. To analyse the architectural forms and spatial solutions of four selected museum buildings, identifying the main design principles and their functional relevance. To record and analyse the information obtained from the observations for the needs of the study.
3. To survey respondents using a structured analysis. In each case study, focus on specific points: spatial structure and flow, choice of materials and their impact on perception, and the symbolic meaning of

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form compared to functional efficiency. To collect and analyse quantitative data from the respondent survey to assess users' perceptions of the harmony of form and function in the selected buildings. To create a discussion on the results of the case study and survey, comparing theoretical insights with practical observations.

The following questions are important for the discussion, which will be addressed based on the results obtained:

- Are and how are modernist and postmodernist architectural styles reflected in the relationship between form and function?
- To what extent can the architect's creative freedom, when creating a unique form, affect the functional efficiency or user comfort of a building?
- To what extent do visitors' perceptions of the aesthetics of a building affect their ability to use its functional spaces?

This study will make an innovative contribution by combining theoretical analysis with empirical data to gain new insight into the complex relationship between form and function in contemporary architecture.

I. Research Methodology

The study uses a mixed methods approach that combines qualitative and quantitative methods. This approach is appropriate because it allows you to study the topic from several perspectives: from theory, from the architect's intention (using a case study) and from the user's experience (using a survey).

Case study method: This is a qualitative method in which four specific examples of museum buildings are analysed in depth. In this paper, the architectural form, materials, and spatial planning of each building and their relationship to its function are studied.

Relevance to the purpose and tasks: This method is directly related to the purpose of the study – to analyse the relationship between form and function. It allows us to fulfil the task of analysing the architecture of the selected buildings and discovering the unique characteristics distinctive of the architecture of the second half of the 20th century.

Survey: This is a quantitative method in which data was collected from 88 respondents, and the authors of the article use this data to obtain information about the spatial perception of users.

Relevance to purpose and objectives: A survey is important because it enables the task of analysing data on user experiences. It extends the research beyond theory and architects' ideas, providing an empirical evidence base from real people.

II. Definitions

First of all, a precise definition of the terms form and function is necessary for this consideration, as they are unfortunately often used imprecisely in everyday language as well as in architectural discourse [6]. The concept of form is certainly easier to define. According to the Cambridge Dictionary, form describes "the shape or appearance of something" [7]. Form, therefore, primarily describes the external shape of an object.

The concept of function in architecture is more difficult to define. In many European languages, the term function is derived from Latin, where *functio* means to perform [8]. The term function has found its way into everyday language, but also into almost all of science. It is worth looking at the use of the term function in architectural history.

A. Function with Gottfried Semper

The German architect and art theorist Gottfried Semper (1803–879) already dealt with the concept of function in his publication "The Style in the Technical and Tectonic Arts, or Practical Aesthetics", published in 1860–1863. For him, the "active relation of parts and wholes" [8], which means the active relationships of the individual components to each other, plays a decisive role. For Semper, the prerequisite for this approach is the decomposition of the object to be considered into its individual components [8].

An example form architecture is the column. Although this is an object of a larger system (building) with a function (load transfer), the column can also be regarded as a system of objects with its own functions. The chapter takes up the load and bundles it together; it is supported by the column shaft. The column shaft absorbs the loads of the chapter and transfers the loads downwards. It stands on the base. The base absorbs the loads of the column shaft and transfers them to the floor or other components. At the same time, the base supports the column shaft and capitals [9].

Different objects, each with individual functions, interact with each other to form a common system. All objects and buildings can be viewed according to this understanding of function.

B. Function with Ute Poerschke

Semper's theories have an influence on the present day. In her 2014 book "Functions and Forms", the architectural theorist Ute Poerschke deals with the concept of function as well. Considering the theories of Semper and others, she comes to three specific criteria for separating purpose and function. The first criterion is that of relation. Purpose and function are both terms of relation, but the object to be considered has different points of reference in these

two terms. For this purpose, the relational object is the subject that gives an object its purpose. The relation of an object with regard to function is a different object; it is about mutual influence. A higher-level, meaningful subject is not absolutely necessary for this approach [10].

The second separating criterion is the connection of the object to the whole. In terms of function, every object has only other objects as a reference point. Together, these objects form a higher-level system within which each object has its own position and meaning. In terms of purpose, this reference is irrelevant, since only the subject serves as the object's reference point [8].

The third characteristic of function is activity. An object, therefore, always plays an active role in relation to its neighbouring objects, determining the function. In the concept of purpose, the subject is in this active role; the object only serves as a passive fulfilment aid [10].

It is, of course, not always possible to make a precise distinction between purpose and function completely and clearly. In summary, however, it can be said that the concept of function in architecture is based on three criteria: relation (object-object), reference to the system and active role of the object.

C. Philip Wilkinson's Theory

In his book "50 Schlüsselideen Architektur" (50 Architecture Ideas You Really Need to Know), Wilkinson provides a summary to offer a precise answer to the theoretical analysis of form and function. Regarding the theoretical analysis of form and function, Wilkinson looks at it mainly through the ideas of functionalism and brutalism [1].

Wilkinson's book "50 Schlüsselideen Architektur" serves as the theoretical basis for the study, providing a clear insight into the main architectural theories and their development. The content of the book is directly related to the purpose of the study, as it explains how the relationship between form and function has changed throughout history.

In the Chapter Functionalism, the author analyses the fundamental principle of modernist architecture, "form follows function", which is attributed to Louis Sullivan [11] and further developed in the works of architect Ludwig Mies van der Rohe [12]. Wilkinson explains that this principle requires that the design and aesthetics of a building are directly derived from its practical needs. He explains how functionalism attempted to abandon superfluous ornamentation and focused on the logic of materials, construction and space to create efficient and rational structures.

In the Chapter Brutalism, Wilkinson describes brutalism as a branch of functionalism that emphasises the "truth" of building materials and structures. Brutalism emphasises the aesthetic value of the functional elements

of a building, such as exposed concrete, lighting, and piping, making them part of the design. Thus, the form (the rough, "brutal" concrete) serves not only function but also expresses the character and logic of the building.

Related concepts in other chapters: Although form and function are not discussed in separate chapters, Wilkinson also explores this idea in other chapters that trace its development.

In the Chapter Before Modernism, he describes how movements such as Arts and Crafts and Art Nouveau attempted to combine form with craftsmanship and natural motifs to create unique functional forms.

In the Chapter After Modernism, the author notes that postmodernism and deconstructivism (which have their own sections) began to criticise the strict dogma of "form follows function", returning to ornamentation, historical references and more playful forms that are not always functionally justified. This discussion is particularly relevant to this study of the second half of the 20th century.

Wilkinson's book serves well as a limited theoretical foundation, as it provides a clear and concise introduction to various topics. In the theoretical analysis of this article, this source can be used to 1) outline the ideas of classical functionalism and brutalism about form and function, 2) show how the strict rules of modernism developed in movements such as brutalism, and 3) justify the need to study the architecture of the second half of the 20th century, as this period is known for its departure from classical functionalist theory, which Wilkinson describes in his chapters on postmodernism and deconstructivism. Thus, Wilkinson's theory is useful in providing a historical and theoretical context for this study.

III. The Relationship Between Form and Function

In the early 20th century, discussions of form and function in architecture were central to modernist ideas. This concept was theoretically explored by several influential authors.

Louis Sullivan: He is the author of the famous principle "form follows function". Although he himself did not consider it a strict dogma, but rather an organic connection between the purpose of a building and its visual expression, his phrase became a manifesto of modernism [13].

Walter Gropius: As the founder of the Bauhaus, Gropius emphasised the role of social function and mass production in architecture. He called for the creation of buildings that were rational, efficient and without unnecessary ornamentation, serving human needs [14].

Le Corbusier: He popularised the idea of a "machine for living" (machine à habiter), emphasising that buildings should be designed as precise machines that serve their purpose. His theories influenced the design of not only

residential buildings but also public buildings, including museums [14].

While this study does not aim to provide an overview of all the ideas of researchers in the search for the relationship between form and function, here we will look at just a few examples that reflect the application of the theory to museum architecture [15]. Museum architecture served as an excellent field in which these theories could be applied and developed. There are two notable examples.

- Ludwig Mies van der Rohe is known for his approach, which he calls “universal space”. His most famous example in museum architecture is the Neue Nationalgalerie in Berlin (1968). This building is a pure glass and steel pavilion with minimal supporting structures, which creates a maximally open and flexible space. The main function of the building – to exhibit art – is achieved by creating a neutral background against which exhibitions can change without structural constraints. Here, function follows form, which is a space in itself [16].
- Le Corbusier designed several museum projects, such as the Sanskar Kendra Museum in Ahmedabad, India. His approach combined strict functionalism with organic, free-flowing forms [17]. Le Corbusier’s museum designs were functional and efficient, but their spaces created unique visitor experiences.

The work of these architects demonstrated that early 20th-century theories of form and function were not simply abstract concepts, but real, influential principles that transformed museum design, creating buildings that were both rational and efficient, as well as aesthetically pleasing and unique.

A. Form and Function According to Louis Sullivan

One of the most famous contributions to this debate was certainly made by the American architect Louis Sullivan (1856–1924) in his essay “The Tall Office Building Artistically Considered” from 1896, when he coined the phrase “form ever follows function” [11].

The basis for this assumption can be found in Sullivan’s personal philosophy of nature. For Sullivan, nature was the all-encompassing element in which all things, including architecture, are embedded. Therefore, according to Sullivan, the principles of nature also apply to architecture [11].

B. Form and Function According to Gottfried Semper

Gottfried Semper also dealt with the relationship between form and function in his publication “Style in the Technical and Tectonic Arts, or Practical Aesthetics”, which has already been mentioned here. In his publication, form and ornament play a much more active role in terms of function than in Sullivan’s.

Basically, for Semper, structure and function are closely linked, so the structure of a building follows the static necessity, or the function to be fulfilled [18]. In Semper’s view, however, simply fulfilling the function is not enough for the form.

The task of the form is to express the function [19]. Through their shape, the components should give the outside observer information about the function they fulfil and thus also about the forces that act within them [20, 36]. Ornaments can help to demonstrate and represent this function.

Semper distinguishes between two types of ornaments: those mentioned above, which clarify the function, and ornaments that reveal the purpose of a building, i.e., show the observer what the building was built for [20, 36, 37]. According to Semper, these two types of ornaments also differ by the places where they are attached and by the design elements they use. The ornaments that are intended to show the function of a component are only found on structurally or functionally necessary or statically loaded components. According to Semper, these ornaments are geometric motifs, for example, lines, grooves or edges, which illustrate the flow of forces through their direction [10]. The fluting of the column shafts, for example, belongs to these ornaments [18]. Despite countless pieces of evidence in the history of architecture, only 36.3 % agreed with Semper’s view of the explanatory effect of ornaments. At the same time, most respondents (92.1 %) consider the interaction between ornament and functional architecture to be impossible. This contradiction can be explained by the generally widespread imprecise definition of the term function (Fig. 1) of respondents in the survey. Inspired by the literature reviewed, the authors conducted a survey among young professional architects on the interrelationship between form and function in museum architecture. The survey was conducted remotely by sending questions to respondents via email in Germany and Latvia. A total of 88 responses were received.

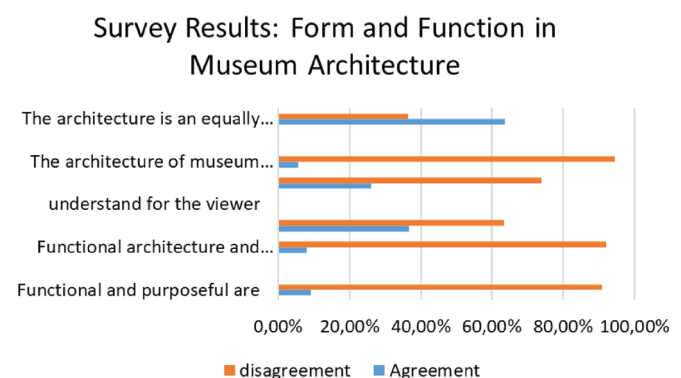


Fig. 1. Results of the survey [created by authors].

TABLE I

Results of the Survey on the Interrelationship between Form and Function in Museum Architecture [by the authors]

Statement (88 Answers)	Agreement	Disagreement
Functional and purposeful are synonymous in architecture	9.1 %	90.9 %
Functional architecture and ornamentation are not compatible	7.9 %	92.1 %
Ornamentation can make buildings easier to understand for the viewer	36.6 %	63.4 %
The architecture of a museum should centre on the exhibition	26.1 %	73.9 %
The architecture of museum buildings should fit thematically with the exhibition	5.6 %	94.4 %
Architecture is an equally important part of a museum besides the exhibition	63.6 %	36.4 %

C. Key Conclusions from Data Analysis

In this subchapter, the authors will explain the views of today's young architecture professionals, which correlate with the statements found in architectural literature and historical dogmas.

The attached diagram (see Fig. 1 and Table I) shows the respondents' responses to six different statements about the architectural relationship between form and function in the spatial structures of museums.

The following trends can be observed when analysing the diagram.

- A broad lack of consensus on a strict interpretation of functionalism: More than 90 % of respondents disagree with the statements that "functional and purposeful are synonymous in architecture" and that "functional architecture and ornament are incompatible". This shows that the respondents believe that function and aesthetics can coexist, differing from the dogmas of modernism.
- The importance of architecture and exhibition: More than 63 % of respondents agree with the statement that "architecture is as important a part of a museum as an exhibition", which reflects the fact that the audience appreciates buildings as works of art in their own right.
- Ornament as a tool: Although the dominant opinion is that ornament does not help to better understand a building, 36.6 % of respondents agree with this, which indicates the diversity of opinions on the importance of ornament in modern architecture.

Despite countless pieces of evidence in the history of architecture, only 36.3 % agreed with Semper's view

of the explanatory effect of ornaments [21]. At the same time, most respondents (92.1 %) consider the interaction between ornament and functional architecture to be impossible. This contradiction can be explained by the generally widespread imprecise definition of the term function.

While the structural-functional components are provided with the ornaments mentioned above, the spaces between these components, i.e., the unloaded and structurally neutral areas, are reserved for ornaments that show the purpose of a building [22]. These are designed pictorially or figuratively, for example, statues, reliefs and paintings. They depict allegories, portraits, tell stories or depict scenes to indicate the purpose of the building [20].

D. Conclusions About Form and Function

Form, function, purpose, and ornament therefore interact in complex ways and influence each other. We have now looked at four theories on this subject, and although Semper, Sullivan, Wilkinson and Poerschke lived and published in completely different eras and contexts, there are certain similarities and overlaps.

Form is the external appearance of an object. Purpose and function are different approaches; purpose considers the connection between the subject and object (builder and building). In order to consider function, it is necessary to break down a system into its individual components (objects). The concept of function has three aspects: relation of the individual objects to each other, relation of the individual objects to the system (wholeness), and active role of the objects in this system. The basic structure and form of a building or component is determined by static, functional or structural necessity. The task of the form is also to express the function or the course of forces for the observer. Ornamentation combines form, purpose and function. There are two types of ornamentation.

Ornaments on structural or constructive components show the function and the course of forces. Ornaments on structurally neutral or force-free components show the purpose of the building and the intention of the subject.

IV. Considerations of German Museum Buildings

Every era of architecture has its own forms of expression. This certainly includes the use of form, function and ornament. In the following, we will examine the extent to which the relationship between form and function – and thus also the use of architectural ornamentation [23] – differed between the individual architectural movements of the second half of the 20th century.

In each case, one museum will serve as an example of its architectural movement: the Neue Nationalgalerie

(1965–1968) in Berlin – modernism [24], the Neue Staatsgalerie (1977–1984) in Stuttgart – postmodernism [25], the Jewish Museum (1992–1999) in Berlin – deconstructivism [26], and the extension to the Deutsches historisches Museum (1998–2003) in Berlin – contemporary architecture.

A. Neue Nationalgalerie, Berlin – Modernism

The Neue Nationalgalerie (Fig. 2) in Berlin is certainly one of the most important museum buildings of the 20th century. It is an icon of modernism and a masterpiece of the architect Ludwig Mies Van der Rohe (1886–1969). The relationship between form, function and ornament will be examined here as a representative example of modernism.

The Neue Nationalgalerie basically consists of two parts. A basement that contains the supply and actual exhibition rooms, and a reception pavilion that stands on this basement. The basement is only recognisable from the outside as a stone-clad body, but it forms the base for the reception building. The reception pavilion consists of a large square steel roof that rests on a total of eight supports, two on each outer edge of the roof. Structurally



Fig. 2. Neue Nationalgalerie from outside [Ebener, M. (n.d.)].
Source: <https://www.bbr.bund.de/BBR/DE/Bauprojekte/Berlin/Kultur/NNG/neuenationalgalerie.html>].

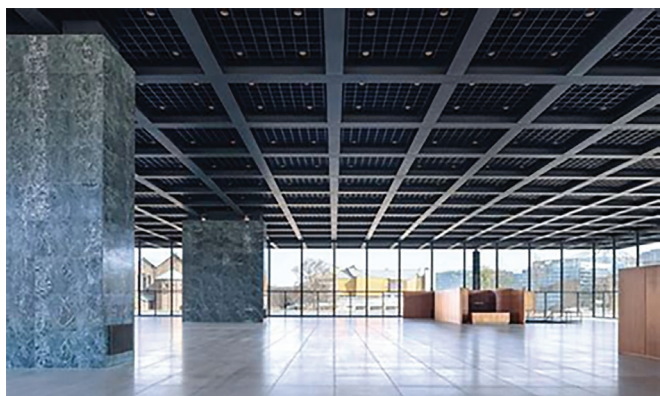


Fig. 3. Entrance Hall of the Neue Nationalgalerie
[Source: Jäger, J. & Marlin, C. (2021). *Neue Nationalgalerie: das Museum von Mies van der Rohe*. Deutscher Kunstverlag].

separated from this roof, the entrance hall encloses a non-standing wall made of glass [27]. The architectural design language is sober and clear. The roof is connected to the supports and the glass walls. The entire load is transferred via the supports. At the same time, the roof connects to the glass walls of the reception hall, but this connection is only necessary as a spatial closure, not structurally.

The glass wall is slightly moved inwards from the supports at the edge of the roof, creating a canopy. In relation to the whole, the roof has a distinctive aesthetic effect. The roof is statically extremely complex and has a 64-fold indeterminate system [27]. It is designed as a grid system because the weight of the roof is reduced by cutting out the cassettes on the inside of the roof.

This design makes the course of the statistical forces in the ribs that lead to the support in the grid system visible. The shape of the roof is therefore based on the static and functional requirements, such as the weight savings through the cassettes. In addition, the motif of the square cassettes also characterises the space in aesthetic terms. Form and function, therefore, go hand in hand in the roof construction; further ornamentation to illustrate the flow of forces according to Semper's theories is not necessary, as this is already done through the form.

The centre of the building is the large entrance hall (Fig. 3). It is formed by the roof, glass walls and the base and serves as a reception and entrance area. The hall has no use for a museum, but it is overlooked that it is itself a kind of exhibition, a part of the museum that is equal.

The Entrance Hall of the Neue Nationalgalerie (Fig. 3) is important to the exhibits and represents them to the outside world. The emptiness of the hall is only interrupted by low fittings for the cloakrooms, room dividers that shield the staircases and two large supply shafts for heating and technology. None of these fittings is statically or structurally necessary; they all end clearly below the ceiling. However, they are all designed with selected and fine materials, like wood veneers or dark natural stone slabs.

The basic structure of the Neue Nationalgalerie is based on static requirements. The framework that fulfils these functions is clearly visible to the viewer from the outside. The form of the museum is, therefore, largely based on its function. Nevertheless, the design succeeds in fulfilling the clarification of forces demanded by Gottfried Semper, without additional ornaments or unnecessary forms. The details that decorate the building, such as the coffered ceiling or the widening columns, all arise from the function; no ornament is artificially added. The only structurally unnecessary components are the built-in elements inside, which are, however, clearly recognisable as being free of force and statically unloaded. At the same time, they are the only components that are decorated with special and decorative materials. They serve to reinforce the impression of the museum as a noble and sublime body

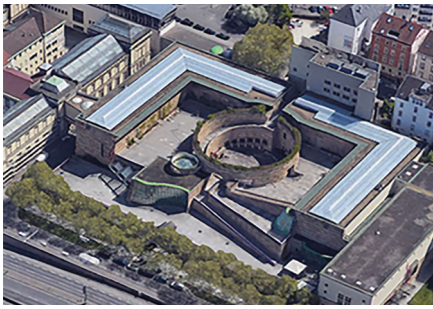


Fig. 4. Overview of the Neue Staatsgalerie, Stuttgart
[Source: Google Earth].

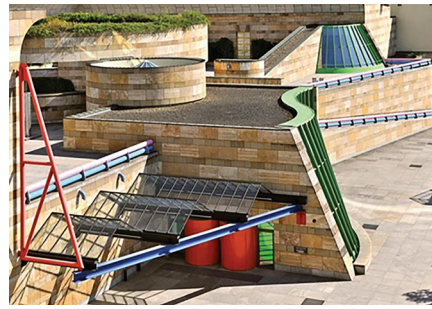


Fig. 5. Front facade. Entrance and ramp system
[Source: <https://www.afar.com/places/staatsgalerie-stuttgart>].



Fig. 6. Rotunda
[Source: https://peterlaustercommunity.de/l_f/uploads/1115044080/med_gallery_14_8_106797.jpg].

of art. In this way, they correspond almost exactly to the second type of ornament in Gottfried Semper's theory. However, Semper's figurativeness was replaced by the mere effect of the materials.

B. Neue Staatsgalerie, Stuttgart – Postmodernism

Although the foundation stone of the Neue Staatsgalerie (Fig. 4) in Stuttgart, designed by James Stirling (1926–1992), was laid in 1977, less than ten years after the completion of the Neue Nationalgalerie, both buildings are completely different in terms of style. The transition from international modernism to postmodernism is obvious. Numerous historicizing ornaments and stylistic quotations adorn this building, but these have been combined and reinterpreted in a new, previously unknown way. Their playful, humorous and sometimes ironic use represents a break with the strict seriousness of classical modernism [28].

The Neue Nationalgalerie in Stuttgart is the extension of the Alte Staatsgalerie, located directly next to it. It consists of a courtyard open to the street, around which the exhibition rooms are grouped on the first floor. The foyer and function rooms are located on the ground floor below. The building's hillside location allows a large cascade of stairs, ramps and entrances (Fig. 5) on the open side of the courtyard. The centre of the building is an open rotunda in the courtyard; the exhibition rooms on the upper floor all have similar proportions and are arranged in the form of an enfilade. They enclose the courtyard on three sides and sit on the ground floor, thus forming a kind of frame for the building. The exterior of the exhibition building is covered with a coloured striped natural stone cladding, with an oversized protruding cornice.

The complex-seeming system of ramps (Fig. 5) and staircases that open up the rotunda and the inner courtyard is interrupted by several curved glass curtains that let light into the ground floor. However, the facade actually seems too complicated and convoluted for this purpose; it is obvious that in this part of the building, the

form not only follows the function but is an end in itself. The stone cladding, with its historicizing formal language, suggests the purpose of the museum as a traditional storage place for works of art; but this association is alienated and called into question by the bright and vibrant colours of the metal components or the oversized protruding cornice.

The centre of the building is the rotunda (Fig. 6). However, this centre is not reserved for any special use or exhibition, as one might expect. Rather, it is an empty space. It is only broken up by a long ramp and a few window openings. Some of these are designed as segmental arch windows, thus evoking echoes of historical arcades. However, this effect is distorted by the gradual downward movement of the arches. Numerous other historic building ornaments raise expectations that are not fulfilled. A row of statues in the classical style stands somewhat lost in front of the windows, and in the middle, a portal made of Doric columns rises, half sunk into the ground [29]. On a closer look, it becomes clear that this column portal just encloses an emergency exit. The lower position of the portal reinforces this strangeness and the feeling of alienation; it seems to both sink and emerge from the ground – an irritating ambivalence.

James Stirling's Neue Staatsgalerie uses a diverse formal language and numerous architectural ornaments, which are deliberately chosen in a historicizing formal language [30]. The structure of the building and its static functionality are not clearly recognisable, and there are no ornaments to indicate the functions and tasks of the individual components. With the exception of the exhibition spaces, form does not follow function, but has to a taken on a life of its own and become its own end in itself. In accordance with Semper's theories, architectural ornaments indicate the purpose of the building by deliberately using historicizing forms to create an indeterminate atmosphere that we associate with monumentality but also with the past; both attributes of classic museum buildings. However, this association is alienated by deliberate inconsistencies, ambivalences

and exaggerations of the ornaments. Function, form and ornament are separated. The only existing connection is between the purpose/intention of the building and the ornaments, but this connection is also alienated. What is special here is the ambivalence: on the one hand, the use of historicizing quotations, on the other hand, the senseless or incorrect use; this is what creates the tension and thus also the appeal of the Neue Staatsgalerie.

C. Jewish Museum Berlin – Deconstructivism

The construction of the Jewish Museum Berlin (Fig. 7) was preceded by a long debate about the content and form of the museum. In 1989, a competition was held, which was won by Daniel Libeskind (1946). After the foundation stone was laid in 1992, the building was completed in 1999. The new building consists of a sharply shaped exhibition structure and an outdoor area thematically connected to it. A distinctive feature of the design is the narrative aspect of the architecture: within the building or in the outdoor area, there are numerous quotes, symbols, and allusions that refer to the history of Jews in Germany [26, 12].

The exterior appearance of the building is defined by its metal cladding. This facade is interrupted only by window strips, which irregularly cut through the facade. These windows do not provide any indication of the floor plan or the function of the rooms inside. Due to this design of the facade, the structural-functional layout of the museum is not visible from the outside.

The building, shaped in an irregular zigzag form (Fig. 8), is divided by a continuous element: a straight line cut through the building, creating a four-meter-wide gap, from which rooms are formed. These empty spaces are referred to as “voids” [26, 101]. They function as a negative space within the volume of the museum. As cross-floor voids, they allow for visual connections between the different levels. However, their role is not justified solely by this function; they have more symbolic than functional or structural significance. They symbolise the emptiness, the absence

of the Jewish population in Berlin after the NS-regime. They cannot be entered by visitors, thus intensifying their character as foreign and empty spaces [26, 102].

In the basement of the building, there are three intersecting, windowless corridors, each with a different meaning. They are an important part of Libeskind's narrative architectural concept. The Axis of Continuity serves as the entrance and connection to the exhibition. The Axis of the Holocaust leads as a narrowing, slightly ascending corridor to the so-called Holocaust Tower (Fig. 7, foreground left – light grey colour building). From the outside, it is a freestanding structure located in the museum's garden and can only be accessed underground through the corridor. The tower consists of a 24-meter-high hollow body, illuminated only by a narrow slit of light at a higher point [5, 103]. It has no practical use or function. As part of the narrative architecture, its design is intended to evoke an emotional response in the viewer and to remind them of past events. The Axis of Exile leads to the Garden of Exile (Fig. 7, foreground centre), which is only accessible underground via the axis. This garden consists of concrete pillars filled with earth, from which olive trees grow. These pillars, however, stand slightly tilted, giving the garden an atmosphere of unreality and strangeness. It symbolises the alienation of exile for many Jews [26].

The exhibition and the entire museum are strongly shaped by its architectural language. Through the narrative form of architecture, which aims to tell stories and evoke emotions in the visitor, the building becomes an equal, if not essential, part of the exhibition. This understanding of museum architecture is shared by 63.6 % of the respondents in the survey. The entire museum, through its outward appearance and its unusual form, conveys something alien and thus touches on a defining experience of Jews in Europe. The architecture is predominantly defined by its formal design, while efficient space usage and functionality play a secondary role behind this form. Due to the striking and impactful shapes of the architectural language, further decoration or ornamentation of the



Fig. 7. Exterior view of the Jewish Museum Berlin. Exhibition building and garden

[Source: <https://www.kakoi.de/wp-content/uploads/2004/10/juedisches-museum-berlin-1024x576.png>].

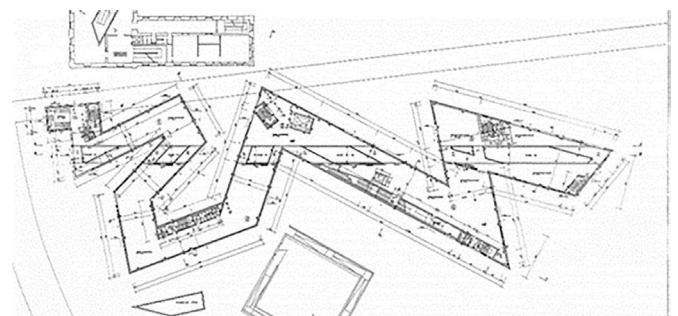


Fig. 8. Floorplan of the Jewish Museum with “voids”.

[Source: https://images.adsttc.com/media/images/5afa/58a3/f197/cc59/f700/001f/large_jpg/museum-plan-c-sdl-2280x1106.jpg?1526356125].

building is not necessary. The form is the key element in this architecture. This is a characteristic of the deconstructivism style, where buildings are not defined by their clear structural or functional clarity but by their form. The unusual shapes sometimes negatively impact the functionality of the spaces, but for deconstructivism, one could reverse the phrase “form follows function” to “everything follows form”. The buildings created in this way impress and, through their powerful impact on the viewer, enable narrative architecture in the same way as seen in the Jewish Museum in Berlin.

D. The Extension of the German Historical Museum, Berlin – Contemporary Architecture

When in 1990, the baroque historic Zeughaus in Berlin was selected as the new location for the German Historical Museum as part of the reunification process, additional exhibition space was required. The renowned architect Ieoh Ming Pei (1917–2019) was chosen to design the planned extension. Following his designs, the extension was built between 1998 and 2003 [31]. The extension is located on a triangular plot of land, separated from the rear facade of the baroque Zeughaus by a street (Fig. 9). It consists of three building parts: the multi-story foyer clad in glass; the nearly windowless exhibition building clad in limestone; and a rear section containing workshops. However, the workshop section is not prominent from the outside due to its position at the back of the complex. The glass facade is accentuated by a spiral-shaped glass stair tower, which significantly shapes the overall appearance of the building.

The exhibition building lies behind the entrance building, and on one side, it adjoins the workshop building. The largely windowless limestone facade allows the focus to remain on the interior exhibition space, which is designed in a simple, functional manner. The shape of the exhibition building is largely functional. The smooth facade of the exhibition building is clad in limestone, with the only ornament being a semi-circular, niche-like indentation. The limestone cladding can be seen as a reminiscence and reference to the numerous historical buildings in Berlin and the direct neighbourhood that are clad in stone.

Nevertheless, the architectural style of past epochs, which is reflected in the surrounding buildings, is not nostalgically taken up and idealised through mere copying, but instead is alienated by modern stylistic elements, such as the semi-circular niche [32]. History is thus integrated back into the modern building, but in a reinterpreted form, which reflects the museum’s role as a place for processing the past. Here, not an ornament, but rather the materiality itself serves as a reference.

Preceding the exhibition building is the foyer, which serves as the entrance and reception area of the building. It provides access to the other parts of the building. The glass main facade of the extension, which faces the back



Fig. 9. Extension building of the German Historical Museum. On the right, the Zeughaus building [Ansgar Koreng / CC BY-SA 3.0 (DE)].

facade of the Zeughaus, is simply rounded in shape. In relation to the baroque facade, a contrast is created with the glass facade, representing the present, the modern and open Germany. The public part – the foyer – is emphasised in this way and opens onto the street, which underscores the character of the foyer as a public meeting point. The glass wall is not a facade in the traditional sense but rather a kind of veil, which is why it appears devoid of ornamentation.

At the same time, the glass wall of the foyer allows a view of the opposite Zeughaus. The past is not shut off by the modern but rather remains visible. The view from the new building to the old one creates a certain continuity between past and present. The stair tower is undoubtedly the most defining element of the building. It facilitates the ascent from the second to the third floor. Despite its relatively insignificant function, its form is strikingly distinctive. It is located precisely at the junction between the foyer and the exhibition building, between modern glass architecture and historically inspired stone architecture. With its striking design, it blurs this junction, essentially connecting the two building parts as the most prominent accent. Its form does not necessarily follow the function, even breaking with the adjacent facade. The tower can be seen as an almost futuristic extension of the glass facade. In a way, the stair tower dissolves the already modern foyer into the future, spiralling upwards toward the sky. The stair tower thus becomes a kind of ornament, as it emphasises the museum’s self-conception and its purpose.

Together with the limestone facade and the entrance foyer, it symbolises the meeting of past (stone facade), present (glass foyer), and future (tower), made clear through the different architectural forms and facade designs. The extension can therefore be seen as a symbol of the purpose of the historical museum: engagement with the past and its reflection in a modern and open country that, without losing sight of its past, looks toward the future.

CONCLUSIONS

In this paper, based on the data provided, it is possible to identify four main theoretical positions regarding the unity of form and function in museum architecture. These theories illustrate the development of modernist principles and the changing public opinion.

A. Strict Functionalism

This theory is based on the principle “form follows function”, which assumes that the design of a building is directly derived from its practical needs. The results of the study show that this theory has lost popularity, as only 9.1 % of respondents agree that “functional and purposeful are synonymous with architecture”. This indicates that the majority believe that architecture can be functional without losing aesthetic value or a purpose that goes beyond simple utility.

B. Ornament as a Functional Obstacle

This theory, which stems from the modernist call to abandon ornament, argues that decorative elements interfere with the basic function and efficiency of architecture. The data shows that this view is widespread, as 92.1 % of respondents disagree with the statement that “functional architecture and ornament are compatible”. This result shows public disapproval and is a strong argument against unnecessary decoration in modern design.

C. Museum Architecture as an Independent Art Form

This is one of the central findings of the study. This theory believes that the museum building itself is a work of art and has just as much importance as the exhibits on display. The survey results support this view, as 63.6 % of respondents agree that “architecture is as important a part of a museum as an exhibition”. This shows that modern society values museums as hybrid experiences, where space and content are intertwined.

D. Thematic Independence

This theory states that the form of a museum building does not necessarily have to match the thematic content of exhibitions. The data clearly supports this view, as 94.4 % of respondents disagree with the statement that “the architecture of museum buildings should thematically align with the exhibition”. This allows architects to create universal and multifunctional designs that can adapt to different exhibitions over time. This theory reflects the importance of flexibility and adaptability in modern museum architecture.

Although each of the four museums presented here is unique, they are all products of their stylistic epoch. By looking at these museums, it is possible to gain results regarding some of the most important architectural trends of the second half of the 20th century. Our main focus is on the relationship between form, function and ornament.

The Neue Nationalgalerie by Ludwig Mies van der Rohe is a building of classical modernism. Its clearly recognisable and comprehensible basic structure is based on structural requirements. The form largely follows the function. All other decorative details, such as the cassette ceiling, arise from the fulfilment of function. What is special about the Neue Nationalgalerie in terms of the relationship between form, function, and ornament is its unity. This results in unusual simplicity and clarity.

This can be explained by Mies van der Rohe's saying that “less is more”, which sometimes became the guiding principle of international style and modernism. This “less” is made possible by the structural clarity and functionality that organise and visualise the buildings of this style. Ultimately, function determines form and form becomes ornament; function, form and ornament thus coincide in one building component.

Postmodernism that followed can be seen as a counterreaction or, as its name suggests, as overcoming modernism. In contrast to the strict predominance of function in modernism, here form has partially emancipated itself from function; there are forms without function and functions with unsuitable forms. The rotunda and the ramp system of the Staatsgalerie in Stuttgart are a good example of this. The detachment of form and function also means that the ornamentation that explains the functionality to the viewer is omitted. Instead, the building is supplemented by a multitude of ornaments that seem to explain the purpose of the building, but at second glance are used in a deliberately nonsensical or irritating way. In contrast to the clear structure of modernism, postmodernism deliberately confuses the viewer, offering him false clues and ambiguity. Modernism answers all questions in advance through its clarity; postmodernism poses them. By allowing ambivalence, overcoming the dominant position of function and embodying diversity, postmodernism gives its buildings warmth and a certain humanity. In James Stirling's monograph, architecture theoretician and historian Colin Rowe expressed reservations he had about the absence of a unifying facade on Stirling's addition to the Neue Staatsgalerie in Stuttgart (Fig. 5). He referred to it as an “Altes Museum without a facade.” Although he admired the project for the inventiveness of the plan and section, he lamented the absence of a singular face on a civic building type he believed should have one [34].

The form of the Jewish Museum Berlin is characterised by its unusual formal language. In this respect, deconstructivism continued the path taken by postmodernism of separating form and function. Form

dominates and determines everything in these buildings. Functional tasks or the structure of a building are no longer clearly recognisable, but are also not emphasised by ornamentation. This lack of clarity gives the buildings of deconstructivism something strange but also fascinating. This shapes the character and atmosphere, a phenomenon particularly utilised in the context of narrative architecture such as the Jewish Museum. In contrast to postmodernism, however, deconstructivism largely avoids ornamentation; the form takes over this task and becomes the building's ornament, which explains the purpose of the building.

The detachment of form and function can no longer be increased after deconstructivism, which is why, interestingly, the extension to the German Historical Museum sees a return to a closer connection between form and functionality. With the exception of the stair tower, the building is largely kept simple; structures and connections can also be clearly recognised from the outside. However, the stair tower breaks with this clarity; its design overshadows its lack of function or use. It can therefore almost be seen as a kind of architectural ornament that indicates the purpose of the building. However, this purpose is also not clearly recognisable; instead, its indeterminate design invites a dialogue with the viewer. It can be interpreted in many different ways.

The extension to the German Historical Museum is the most recent building in our survey and has echoes of all three previous epochs. The structural clarity of modernism, the ambiguous interpretability of postmodernism and the dominance of the form of deconstructivism. The building was designed in the last years of the 20th century. It indirectly reflects various architectural trends and intellectual approaches of the preceding decades. At the same time, it already marks the transition to the new millennium and the architecture of the immediate present.

Museum architecture does not require thematic alignment with exhibition content, enabling long-term spatial adaptability. Architectural styles shape the relationship between form and function, with modernism emphasising clarity, postmodernism embracing ambiguity, and deconstructivism prioritising formal expression. The role of ornament evolves – from functional integration to semantic complexity or complete formal substitution. Contemporary architecture seeks synthesis, combining stylistic elements to create spaces that are simultaneously functional, aesthetic, and open to interpretation.

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