Limits of Design and Technique: Lina Bo Bardi Staircases

Límites del diseño y la técnica: las escaleras de Lina Bo Bardi

Muammer Yaman
Ondokuz Mayis University. *mimar.myaman@gmail.com*
Esma Eroğlu
Erzurum Technical University. *arc.esmaeroglu@gmail.com*

Received 2024-05-08
Accepted 2024-09-24

To cite this article: Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." *VLC arquitectura* 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Abstract: Staircases, a part of architectural circulation and structure, can become a unique design value with the application technique that directs design and functionality. However, here, attention is drawn to the directive nature of the technique rather than its perception as a deterministic attitude in design. Bo Bardi's architectonic approach has placed her in a distinguished position among modern architects. The effect of the architect's staircase design and application technique on building tectonics is worth examining. Thus, this study aims to examine the staircases of Lina Bo Bardi, where design and technique are dissolved in integrity. Bo Bardi's staircases were examined in terms of meaning, form, function, and technique, with classification for material use. In this context, unique situations were observed in the design and technical applications of reinforced concrete, wood, and metal materials used in stairs. The fact that the place, technique, and the architect's thought guided the design turned the staircase into a symbolic value and has made the staircase the founding element of the space. This approach, which does not consider design and technique independently, creates a strong reference for today that structural elements such as stairs can be produced as symbols in space.

Keywords: Lina Bo Bardi; staircase; material; architectural design.

Resumen: Las escaleras, parte de la circulación y estructura arquitectónica, pueden convertirse en un valor de diseño único con la técnica de aplicación que dirige el diseño y la funcionalidad. Sin embargo, aquí se pone la atención en la naturaleza directiva de la técnica sobre su percepción como una actitud determinista en el diseño. El enfoque arquitectónico de Bo Bardi la ha colocado en una posición distinguida entre los arquitectos modernos, merece ser estudiado el efecto de diseño de la escalera y la técnica de aplicación empleados por la arquitecta en la tectónica de la construcción. Por lo tanto, este artículo tiene como objetivo estudiar las escaleras de Lina Bo Bardi, donde el diseño y la técnica se disuelven en integridad. Las escaleras de Bo Bardi fueron estudiadas en términos de significado, forma, función y técnica, con clasificación para el uso de materiales. En este contexto, se observaron situaciones únicas en el diseño y las aplicaciones técnicas de los materiales de hormigón armado, madera y metal utilizados en las escaleras. El hecho de que el lugar, la técnica y el pensamiento de la arquitecta guiaran el diseño convirtió la escalera en un valor simbólico y ha hecho de la escalera el elemento fundacional del espacio. Este enfoque, que no considera el diseño y la técnica de forma independiente, crea una fuerte referencia para hoy en día de que los elementos estructurales como las escaleras pueden producirse como símbolos en el espacio.

Palabras clave: Lina Bo Bardi; escalera; material; diseño arquitectónico.

INTRODUCTION

Staircases, defined as a series of steps that provide access to users by connecting the spaces between two floors,[1] are an important element of architecture with their guiding, dividing, and integrative features.[2] Staircases, which have been the subject of paintings, music, cinema, poetry, and stories throughout history, also have ontological and metaphorical equivalents. In this sense, it can be said that there is extensive literature on staircases, which are considered an architectonic element of architectural space in the context of functionality, technique, visuality, and meaning. Design and technical approaches to staircases developed over time have undoubtedly made this literature even richer. This development process continues with the topographically appropriate rock staircases of the prehistoric periods, the spiral and decorated staircases of the Gothic and Renaissance periods, the inviting staircases of the Baroque period, the rational staircases of the modern period, and today's staircases designed with contemporary constructions.[3] This paper aims to draw attention to the contribution of technique to design and meaning by focusing on Lina Bo Bardi's staircases, which have become a particularly representative element in the space. Bo Bardi's staircases have been approached from a perspective that highlights the technique and method of construction. In this respect, prominent examples were examined within the constraints of material, structure, and connection details, and the importance of technique in form, function, and meaning was emphasized.

LINA BO BARDI'S STAIRCASES

Before moving on to Bo Bardi's staircase designs, it is necessary to briefly evaluate her design approach. Bo Bardi's design method demonstrates a dynamic approach that considers geography, history, culture, social structure, and technology as a whole. This approach coincides with the years when regional forms were not seen as conservative manifestations of static cultural traditions that continued from one generation to the next and lacked innovation, or when the rigid formal phenomena of modernism began to dissolve.[4] After 1950, some European architects, such as Bo Bardi, managed to define a unique approach in the Latin American continent, called tropical modernism, which brought together both the local and the modern on a legitimate basis. In other words, these architects re-evaluated regionalism and the creative possibilities of modernism such as brutalism.[5] In this sense, modern materials and production systems have replaced primitive tools by preserving the deep structure, not the forms, of regional possibilities.[6]

Bo Bardi redefined Brazilian modern architecture by taking inspiration from the region's tropical climate and local language.[7] Especially her stairs, which have become the symbol of her modern designs, are the product of a tectonic success that promises "place, technique and the architect's original approach" together. From this point of view place; refers to a contextual approach to topography, climate, and culture. Technical; It includes application elements that can be explained by construction methods and technology. The architect's unique attitude is the designer's attitude. These concepts can also be expressed as the design codes on Bo Bardi's stairs. Kenneth Frampton, known for his important contributions to the concept of regionalism, also explained that the phenomenon of structure in architecture cannot be considered separately from the value judgments of architecture with the concepts of "*topos, tipos, tectonics*".[8] Bo Bardi's stairs have been conceived as special forms with "place, technique, and the architect's original approach" and have never been limited to a purely functional or formal issue.[9] Accordingly, the architect's staircase designs were classified and evaluated in terms of the creative possibilities of basic materials such as concrete, steel, and wood.[10]

Plastic organization of reinforced concrete staircases

Modernization in architecture after 1950 manifested itself with the participation of contextualist and regionalist elements in design. Contributing to the

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Figure 1. São Paulo Art Museum (MASP) and staircases (1968).

modernization of Brazil, Bo Bardi's unique approach to reinforced concrete is noteworthy in the relationship she created between material and form. In this regard, the influence of modernist-brutalist tendencies and the development of concrete systems and precast usage on the transformation of Bo Bardi staircases into plastic arts such as sculpture cannot be denied.

Designed by Bo Bardi in 1968 on Avenida Paulista, one of São Paulo's main avenues, the Museum of Art of São Paulo was built with a Brutalist approach, emphasising the use of reinforced concrete materials and modern techniques. Bo Bardi in the MASP project has succeeded in creating an architecture in harmony with nature, combining architecture, landscape and skyline.[11] The large rectangular mass, positioned parallel to the street, is built on two legs with a suspended system. The space created within the building integrates the street, the square and the museum into the public realm (Figure 1).[12] The public space created in a building with a large structural area is an aestheticized form of an attitude that makes maximum use of the possibilities of the material and displays the material as it is. The brutalist emphasis was made evident by painting the supporting columns in red and continuing this colour on the building elements in the interior. The mezzanine floor is reached from the ground floor with an L-shaped staircase right next to the load-bearing columns. Access to the two lower ground floors is provided from the mass located on the sloping land and below the square. The ramp-staircase, painted in iconic red, is located within this mass. The remarkable design of the structures in the art museum enabled the space to be transformed into an exhibition.

The staircases are designed in an X shape (scissors staircase) within the large exhibition hall (22 x 24 m). Red staircases are designed as separate circulation vehicles connecting the same floor. The red colured cantilever beams are supported from the ground and provide load transfer but do not transfer this load to the mezzanine floor. While a connection with the mezzanine floor is created only as circulation, staircases are not used in the mezzanine floor structural system design. Additionally, ramp staircases are designed as cross structural beams of the rising rectangular mass. In this case, balusters (without handrails) and staircases also painted in red were used as important structural elements (cantilever beams) to meet horizontal loads in the building load-bearing system (Figure 2).[13]

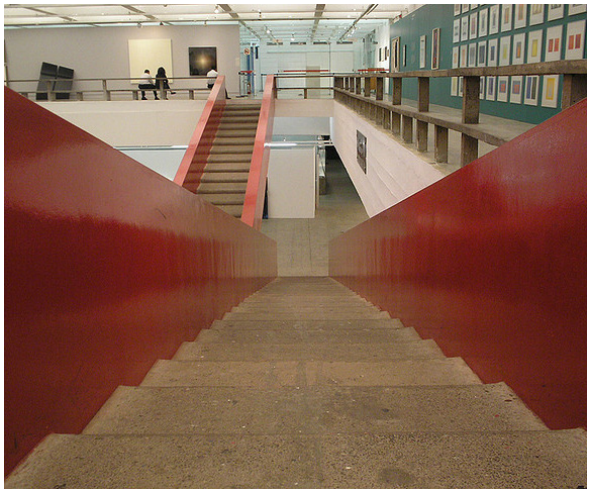


Figure 2. São Paulo Art Museum (MASP) and reinforced concrete staircases (1968).

Gregório de Mattos Theatre, which houses another example of a reinforced concrete staircase, is located where the Barroquinha Church is located in the historical Bahia region of the city of Salvador. The environment where the theatre is located has been subjected to extensive restoration and converted into a public space. Within the scope of the restoration, the church was transformed into a civic centre, the old performance hall became a movie theatre, and the abandoned building was refurbished into the Gregório Mattos Theatre. The only completed building was that of the theatre. It was designed with foldable and stackable wooden seats to accommodate a flexible schedule. The existing building was strengthened with a skeletal system, the roof was restored, and new structural elements were added to the theatre building. The architect's renovation approach is to add new elements to the historical environment. The staircase, which has become a remarkable centre in design, has been able to exist as a new form that adapts to the re-functional historical structure. The staircase of the building was designed with a spiral system around the vertical carrier, which is twisted in the centre (Figure 3).[14]

The vertical structural element and the cantilever horizontal elements jutting out of the structure carry the series of treads designed as a stepped soffit concrete. In her sketches of the staircase, Bo Bardi adds that the height and dimensions of the central vertical structural element depend on the buckling, which must be controlled by structural calculation.[15] The staircase transfers the static and dynamic loads on the ground and the upper floor slap beam to the building structure system. The staircase, designed in a 7 cm thick concrete stepped soffit is supported by cantilever elements that narrow in the plan and section. Starting from the ground level (0.00), the +4.70 m level can be reached with 30 risers by stairs. The first group of treads in a reinforced concrete staircase consists of rounded corners. On the upper floors, the staircase width (190 cm) was kept constant.[16] This particular kind of staircase exhibited a tectonic way of existence thanks to brutalist simplicity. Only a few balusters were designed and only serve as structural elements for the handrail. Steel balusters connect directly onto the upper surfaces of the treads (Figure 3).

Casa do Benin (1987), which contains another sample of a reinforced concrete staircase, is located in Praça do Pelourinho, in the Bahia region of Salvador, where renovation works are taking place. The historical building is located on a corner plot with three existing buildings from the 19th century. The slabs of the old building, which were about to collapse in a fire, were renewed and converted into reinforced concrete frames. In this structure, (which was used as the main building) Bo Bardi percieved the reinforced concrete slabs as an exaggeration and created a three-story atrium by drilling the floor slabs of the building. In other buildings, she preserved the facades and rebuilt the interior with a system of prefabricated elements. The oval-planned hut in the centre, designed from straw, is a semi-open area connecting three buildings (Figure 4). The conservational together with the innovative approach shown in the building is integrated with Bo Bardi's local attitudes in the hut design.[17]

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Figure 3. Gregório de Mattos Theatre (1986) site plan and staircase.

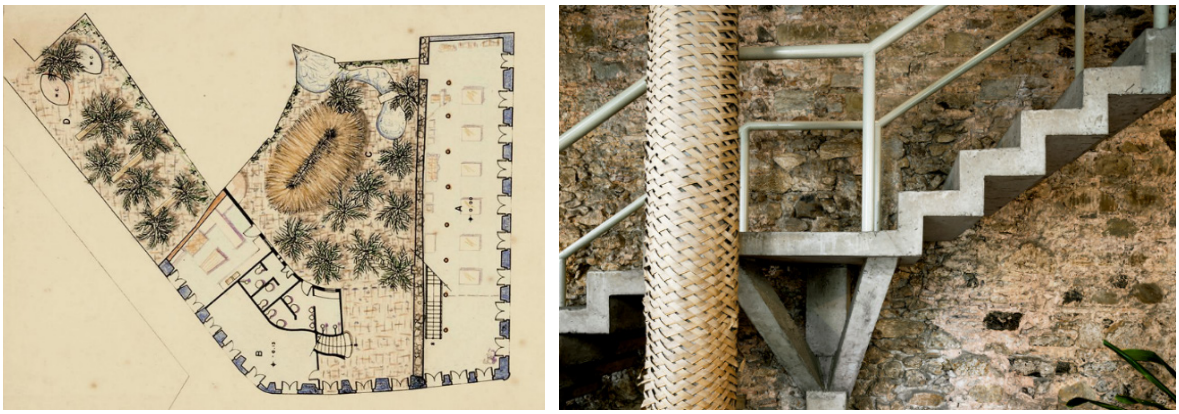


Figure 4. Casa do Benin (1987) plan and reinforced concrete staircase.

Reinforced concrete staircases connect the ground floor to the first and second floors. The staircase rising from the ground is designed to be straight with a landing. It is also designed as a stepped soffit concrete supported at three points by a vertical structural element rising from the ground in the landing section. As in the case of the Gregório de Mattos Theatre, the brutalist attitude was emphasized by leaving the surfaces of the staircases uncovered. Steel elements were preferred in handrails and balusters. Additionally, steel balusters directly transfer their load to the treads (Figure 4).[18]

In her reinforced concrete staircases, Bo Bardi preferred the technique of forming the treads with the main structural beams of the staircases. It is noteworthy that cantilever structures were used in reinforced concrete staircases. It has been

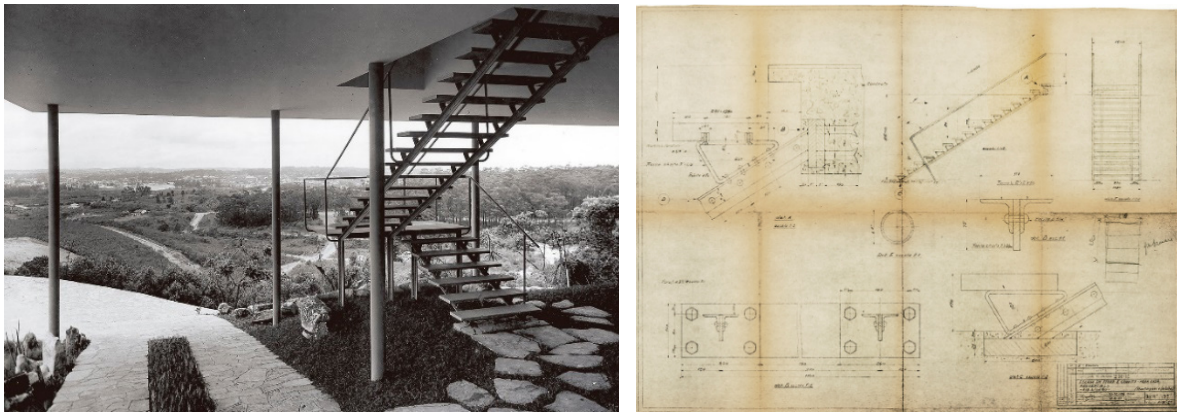


Figure 5. The Glass House (1951) steel staircase and drawings.

observed that Bo Bardi preferred not to use landings in her reinforced concrete staircases in general. This contributed to the perception of vertical circulation as uninterrupted and as a whole. The architect's choice of stepped soffit concrete also contributed to the shaping of the staircases, their plasticity, and light construction appearance. It seems that Bo Bardi is trying to interpret the innovations of modernism and the data offered by the place in a public space or a historical region. The architect was able to create an image for architectural design with the use of reinforced concrete material as it is and the staircase construction that pushes the limits of technical possibilities.

Lightweight construction of the metal staircases

It seems possible to encounter codes parallel to the design approach in Bo Bardi's steel staircases. This can be explained that the steel is widely used in architecture as a sustainable building material and allows prefabrication. The steel structure system allows for different forms and formations of treads and handrail designs. The ones that can be appreciated in The Glass House, one of Bo Bardi's first architectural designs, is one of the accurate samples of the application of the architect's design codes in the relationship between material and form.

Built in 1950 in São Paulo, Brazil, the Glass House (Casa de Vidrio) is located in a sloping, wooded area. It was raised from the ground floor by pilots and positioned on a sloping topography. The metal staircase stands out as a tool that allows the exploration of two worlds between earth and air, inside and outside, up and down.[19] Additionally, the steel staircase has become an iconic element that influences the building form. In photographs of the building, the staircase comes before the space as an image. What makes the staircase such an image is undoubtedly Bo Bardi's autonomous attitude in her form and technical approach (Figure 5).

The composite rigid frame structural system of The Glass House building is designed with reinforced concrete and steel materials. A staircase designed with light structural components is added to the system of the building. The asymmetrical T-shaped staircase is formed using double metal profiles. There are chamfered triangular ferrules and elevating elements on the steel profiles. Natural stone material (5 cm thick granite with special pins) was used on the treads of the staircase designed to have an open riser.[20] It is thought that natural stone materials were preferred because they are resistant to outdoor conditions and durable. There are handrails on the staircase and the baluster is

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Figure 6. SESC Pompéia (1987-1988) steel staircase.

connected to the stair structural system by welding at certain intervals. There is a landing of the staircase offering a wide view. In the part where the landing intersects with the stair descent and ascent line, the uprights provide load transfer to the ground. The end of the landing works as a cantilever in the staircase structural system using the uprights. In the load transfer of the staircase to the ground, it is formed as a foundation and the stair-ground relationship is specially defined (Figure 5).

SESC Pompéia, where a different sample of a steel staircase was designed, was built as a sports and cultural centre in an old factory in the area of industrial complexes in the Pompéia, São Paulo. The building consists of the renovation of the old factory campus and the addition of a water tower and two exposed concrete towers.[21] Eight pedestrian bridges designed with prestressed concrete technique between two multi-story concrete towers and openings that tear through concrete walls to create irregular spaces inspired by prehistoric caves are remarkable and iconic elements of the complex (Figure 6).[22] Another striking element of the building is the red spiral metal staircase located on one of the pedestrian bridges and multi-story towers.

The spiral staircase is supported by a steel tube element with a central circular cross-section. The treads are formed with steel sheets cantilevered from the tube. To give strength to the steel sheets, they are bent from two axes and used in U-shape. The treads transfer their load to the vertical tube by means of welding. To prevent slipping on the treads, textured steel sheets were preferred and anti-slip strips were used. Balusters are provided with vertical steel elements between the floors and the handrail rises by connecting to these elements. The staircase offers floor access to the users by creating intermediate transition landings on the floors reached (Figure 6).

Moreover, for the reinforced concrete staircase in Casa do Benin, Bo Bardi also designed a steel staircase. In Casa do Benin, the steel staircase connects the second floor to the third floor. The staircase, structured by two small circular-section metal tube elements, is designed with lightweight construction. The staircase is designed to transfer the load to the second floor slab and the third floor beam. The structural elements (tubes) are supported and connected with tension elements at the bottom. C-shaped risers are welded to the tube elements

Figure 7. Casa do Benin (1987) steel staircase.

rising with a slope. The treads are formed with textured metal sheets to prevent slipping. Circular-section metal handrails are connected to steel tubes from the sides by welding using intermediate elements (Figure 7).

In Bo Bardi's staircase designs, the flexibility and easy shaping of metal are reflected in its artistry. The decrease in element cross-sections in steel structural makes staircase constructions lighter. The light construction and open riser of the steel staircase create a transparent effect in the space. The use of welding in the connections of two different steel elements provides that the materials are perceived as a whole.

The transformation of a wooden staircase into an organic integrity

The use of wooden materials in staircase systems is similar to steel staircases in terms of design and application. The different variations that wood provides in construction systems and the conveniences brought by its technical properties are due to the fact that it is a natural and environmentally friendly material. The reason for the use of wood in the plastic of the stairs in the Casa Valéria building, one of Bo Bardi's early architectural works, reveals itself once again in the sustainable and innovative attitude based on design codes.

Casa Valéria was designed with an attitude that inspires nature on the water in its surroundings. The building was constructed using traditional construction techniques in complete harmony with nature. The exterior walls were covered with small pieces of stone and ceramics. The building plan followed an orthogonal scheme interrupted by a diagonal. This rational order contains vernacular elements through natural and artisanal means.[23] In the vernacular approach, we can include wall coverings, a porch roof covered with plants surrounding the building, load-bearing columns made of wood and a staircase. The staircase, which is included in the orthogonal plan scheme with its spiral shape and wooden material, connects the ground floor to the mezzanine (Figure 8).[24]

The staircase of Casa Valéria was designed as a spiral-rotational wooden staircase and was constructed with a central circular vertical structure. The cantilevered wooden elements emerging from the wooden vertical structure and positioned at an angle form the support elements for the treads. The wooden treads resting on the support elements were designed in a triangular shape. The angled cantilever elements were screwed to the vertical structural element from the side and reinforced with lower metal supports to support the treads. Head clearance was provided on the spiral staircase (220 cm). There is no baluster on the staircase. The handrail was formed with metal profiles with circular cross-section emerging from the wooden vertical support at certain intervals (Figure 9).

Another sample of Bo Bardi's wooden staircases is the Solar do Unhão Museum in Bahia. The museum is an art complex of historic buildings dating back to the 16th century, where Bo Bardi worked with Carlos Campos and Guarani Araripe. Extensively restored in the 1960s, the building was transformed into a documentation centre for popular art and technical studies.[25] The combination of multiple layers of historical buildings and modern industrial heritage with Bo Bardi's contemporary designs is striking. Bo Bardi represented the modern interpretation of

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

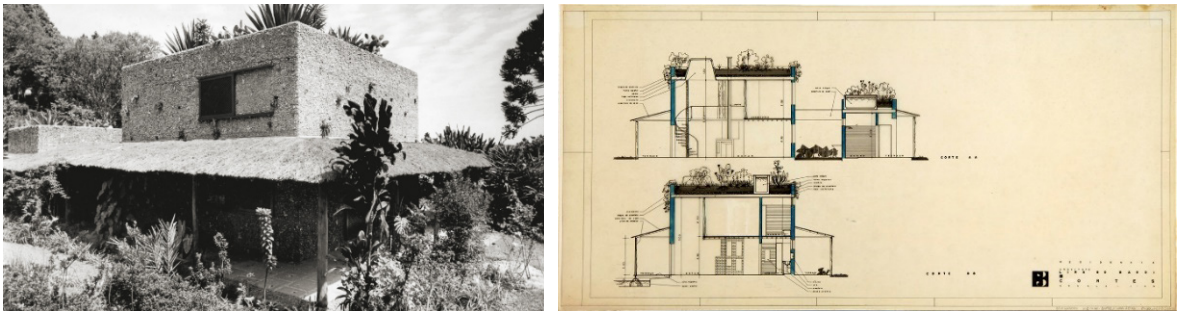


Figure 8. Casa Valéria (1957-1958).

historical continuity "*poetically*" in her own words, and did not seek to embalm the monument, but to integrate it to a large extent with modern life.[26] One of the striking elements of the complex is the independent wooden staircase located in the centre of the museum, which replaced the old staircase on the long side of the building. The positioning, shaping and technique of the staircase make it more of a central space than a building element. Aldo van Eyck described the staircase with its wide triangular treads and low risers as "*less like climbing and more like floating*".[27] Additionally, Bo Bardi brought together traditional and modern culture in the museum, giving the staircase an existential meaning and timeless vitality (Figure 10).

In the building, which was re-functioned and turned into a museum, a spiral -almost square-shaped- staircase (4.15 m × 4.75 m) was added to the exhibition hall later.[28] If the outer radius is used when going up and down the stairs, slow movement is possible due to the centrifugal effect; if the inner radius is used, fast movement is possible due to the centripetal force.[29] In the square plan system, 4 wooden vertical structural elements (30 × 30) are positioned at the corner points and 1 wooden vertical structural element (circular cross-section) is positioned at the central point. The wooden threads were supported with wedges on top of each other on the structural elements located at the central point and the static load was transferred by passing the diagonal connection formed between two wooden planks on the edges to the wooden element

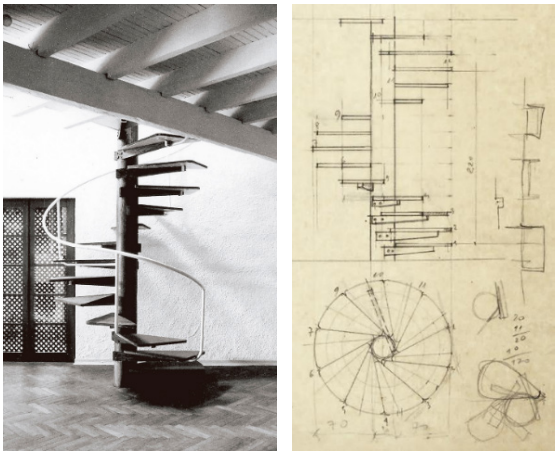


Figure 9. Casa Valéria (1957-1958) wooden staircase.

(10 cm thick). It was created by joining two pieces of wood together in the traditional method used in oxcart construction. The traditional construction technique applied by Bo Bardi directly refers to the connection of the wheels of the oxcarts.[30] There is no handrail or baluster on the wooden staircase (Figure 11).

Bo Bardi has reflected its geographically developed design approaches to the technical applications in wooden staircases. Additionally, the preference of vertical structural systems instead of the classical

Figure 10. Solar do Unhão Museum of Popular Art (1959) wooden staircase.

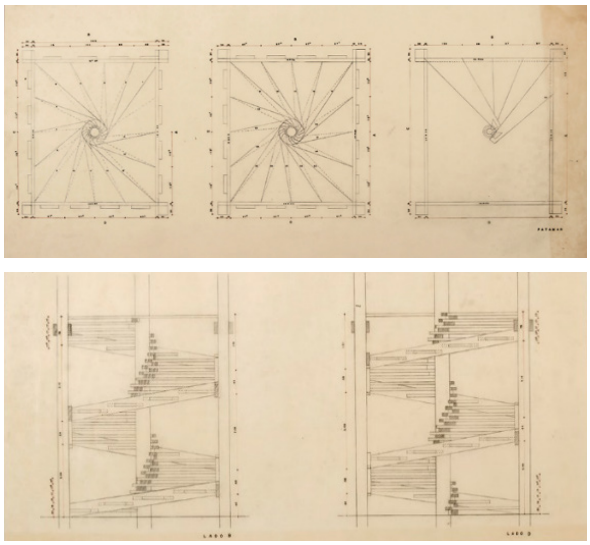


Figure 11. Solar do Unhão Museum of Popular Art (1959) wooden staircase drawings.

diagonal beam applications used in wooden staircase solutions differentiates Bo Bardi's wooden staircases. The connection details and technical solutions in wooden staircases can be read as a synthesis of traditional and modern.

ANALYSIS AND INTERPRETATION OF LINA BO BARDI STAIRCASES

Lina Bo Bardi, with her identity as an Italian-born Brazilian architect, realized the architectural design process between 1950-80 by emphasizing the staircase as the main element, reflecting both local and universal aspects in parallel with contemporary architects and modernism.[31] As a part of architectural design products, staircases transform the architect's attitude about a place into a design element that combines the architect's attitude with technique (Figure 12). In her architectural designs of different periods and places, Bo Bardi has eliminated the justification of the staircase as a mere vertical circulation and adopted the design of the staircase as an architectural element with multiple meanings.[32] This attitude is evident in the São Paulo Museum of Art, where there is an example of a reinforced concrete staircase, and in the wooden staircase of the Solar do Unhão Museum of Popular Art, which is an example of a different load-bearing material. The staircase of the Gregório Mattos Theatre exists with all its simplicity and brutalist effect, with an attitude that advocates the staircase to be revealed rather than hidden and to be seen as a representation of a transformation into plastic art. By using the mass weight of concrete in reinforced concrete staircases, she evaluated the staircase together with the structural design and reduced the element cross-sections. This is supported by the use of stepped soffit concrete in reinforced concrete staircases (Gregório Mattos Theatre and Casa do Benin) and the incorporation of the staircase into the structural system (São Paulo Art Museum). Wood and steel staircases have designs that are simple and highly visually transparent by questioning the lightness of the materials and the dimensions of the elements. The staircases with open risers and no baluster (basic handrail design) allow users to easily follow the fluidity of the space. The wooden staircase added to the Solar do Unhão Museum of Popular Art during the restoration process was used in the centre of the space with independent stage properties.[33] In the Casa Valéria

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

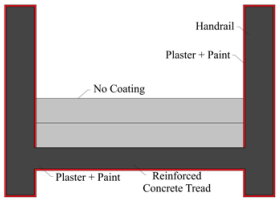
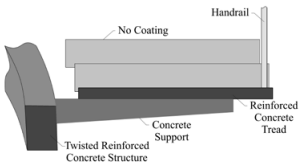
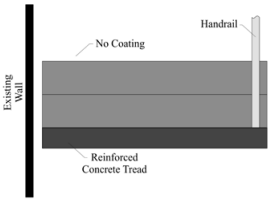
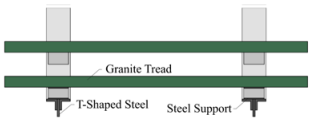
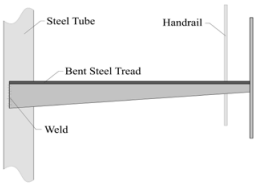
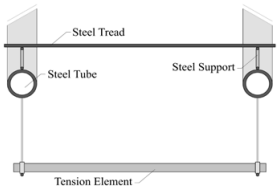
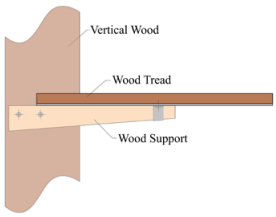
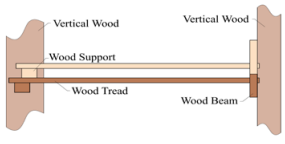
		São Paulo Art Museum (MASP), 1968, São Paulo	Gregório Mattos Theater, 1986, Salvador	Casa do Benin, 1987, Salvador
Reinforced Concrete Staircases	Form, Landing	X-Shaped Scissor - Straight Staircase, Without Landing	Spiral Staircase, Without Landing	Straight Staircase, With Landing
	Structural Systems, Materials	Cantilever System - Cast in Place Reinforced Concrete	Cantilever System - Stepped Soffit, Reinforced Concrete	Landing Supported Column - Stepped Soffit, Reinforced Concrete
	Baluster, Handrail	Reinforced Concrete Baluster, No Handrail	Steel Baluster, Steel Handrail	Steel Baluster, Steel Handrail
	Riser	Closed Riser	Closed Riser	Closed Riser
	Tread	Reinforced Concrete, No Coating	Reinforced Concrete, No Coating	Reinforced Concrete, No Coating
	Connection Details	Cast in Place	Prefabricated Concrete Connections	Prefabricated Concrete Connections
	Tread Details of Staircases			
		The Glass House, 1950, São Paulo	**SESC Pompéia, 1988, São Paulo**	**Casa do Benin, 1987, Salvador**
Steel Staircases	Form, Landing	Dogleg Staircase, With Landing	Spiral Staircase, Without Landing	Straight Staircase, Without Landing
	Structural Systems, Materials	T-Shaped Structural System - Steel	Tube and Cantilever System - Steel	Tube and Tension Structural System - Steel
	Baluster, Handrail	Steel Baluster, Steel Handrail	Steel Baluster, Steel Handrail	Steel Baluster, Steel Handrail
	Riser	Open Riser	Open Riser	Open Riser
	Tread	Natural Stone (Granite) No Coating	Steel Sheet	Steel Sheet
	Connection Details	Welded, Granite Pin, Elevating Element	Welded, Cantilever U-Shaped Steel Sheet	Welded, Elevating Element
	Tread Details of Staircases			
		Casa Valéria, 1958, São Paulo	**Solar do Unhão Museum of Popular Art, 1959, Bahia**	
Wooden Staircases	Form, Landing	Spiral Staircase, Without Landing	Spiral Staircase, Without Landing	
	Structural Systems, Materials	Central Cantilever Structural System - Wooden	Exterior and Central Structural System - Wooden	
	Baluster, Handrail	Steel Baluster, No Handrail	No Baluster, No Handrail	
	Riser	Open Riser	Open Riser	
	Tread	Solid Wood	Solid Wood	
	Connection Details	Wood Connection with Metal Supported Screws	Traditional Fitting Technique, Wedge Support	
	Tread Details of Staircases			

Figure 12. Analysis and Interpretation of Lina Bo Bardi Staircases.

building, which maintains the traces of a traditional attitude, the staircase going up around the centred vertical structure holding on to the diagonal is an appropriate example of homogeneity in the flow of architectural space.

It is seen that Bo Bardi uses contemporary technical possibilities in her staircase designs; prefabrication production and a preference for fast, practical, and local materials. This attitude of the architect also brings along the use of construction techniques appropriate to its identity by recognizing the material. Moreover, the sample of gaining strength by bending sheet material in SESC Pompéia and the use of traditional construction techniques in Solar do Unhão Museum of Popular Art show us that material connections are questioned. In Bo Bardi's staircase samples, the boundaries of material-form interactions are pushed to the limits, and the design products that emerge as a result of the loss of the mass weight of the staircase with the lightening of the material are seen.

CONCLUSION

In Bo Bardi's staircase designs, the determination of place, technique, and the autonomous attitude of the architect ensures that the staircase is perceived not only as a building element but also as a space and image. The contribution of the application technique of the staircases examined in terms of Bo Bardi's material classification to the spatial integrity cannot be ignored. It can be said that the spatial and functional features of the staircases, as well as their technical solutions and applications in system details, exist in a tectonic integrity. According to evaluations made, the architect's staircase design and application technical-detail system solutions are the product of a whole plastic organization. Bo Bardi defines architecture as a structural integrity and the effect of her staircases on the structure is visible. The architect evaluated the structure of the building with a romantic view, accepting it as poetry, and stated that it was an important aesthetic phenomenon for the building. In other words, the structure of the building should be designed in the same way as the architecture is designed. In the architect's designs, the material manages to reveal its existence in tectonic integrity with both structure technique and design. Lina Bo Bardi's staircase designs may be an answer to the questions of space, technique and the architect's autonomous attitude, which are still valid in today's architecture. As a result, it has been seen that design limits can be exceeded in Bo Bardi's staircases and the material can be used more freely through technique.

Notes and References

[1] Francis D. K. Ching, *A Visual Dictionary of Architecture* (New Jersey: John Wiley & Sons, 2012), 239.

[2] John Templer, *The Staircase: History and Theories* (Cambridge, MA: The MIT Press, 1992).

[3] For detailed information about staircases, you can refer to the following sources. *Catherina Slessor, Contemporary Staircase* (London: Mitchell Beazley, 2000); James W.P. Campbell and Michael Tutton, *Staircases, History, Repair, and Conservation* (New York: Taylor Francis Routledge, 2014).

[4] For detailed information about the emergence of critical regionalism, you can refer to the following source: Liane Lefaivre and Alexandre Tzonis, *Critical Regionalism: Architecture and Identity in a Globalised World* (Munich: Prestel Verlag, 2003).

[5] Sibel Bozdoğan, "Modern Mimarlık ve Tropik Coğrafyalar," *Mimarlık*, no. 372, (July-August 2013): 36-46.

[6] Steffen Lehmann, "Keeping the Existing: Lina Bo Bardi's Upcycling and Urban Renewal Strategies," in *Sustainable Lina: Lina Bo Bardi's Adaptive Reuse Projects*, ed. by Annette Condello and Steffen Lehmann (Cham, Switzerland: Springer, 2016), 51-70, https://doi.org/10.1007/978-3-319-32984-0.

[7] Lina Bo Bardi, *Stones Against Diamonds: Architecture Words Series 12* (London: Architectural Association Publications, 2012), 26; Lina Bo Bardi and Marcelo Carvalho Ferraz, *Lina Bo Bardi* (São Paulo: Fundação Lina Bo e P. M. Bardi, 1993), 158.

[8] Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge, MA: The MIT Press, 1995), 2-3.

[9] Renato Anelli, "A Flower between the Stone and the Crystal," *V!RUS*, no. 12 (2016), http://www.nomads.usp.br/virus/carpet_data/66/66en.pdf.

[10] Karl J. Habermann, *Staircases Design and Construction* (Basel: Birkhauser, 2003), 7.

[11] Mara Sánchez-Llorens and Fermina Garrido López, "Where Do We Step? The Horizon is on the Ladder: Landscapes that Lina Bo Bardi Created in Her Drawings," in *Architectural Graphics: EGA 2022*, ed. Manuel A. Ródenas-López, José Calvo-López, Macarena Salcedo-Galera (Cham, Switzerland: Springer, 2022), 404-14, https://doi.org/10.1007/978-3-031-04640-7_41.

[12] For detailed information about São Paulo Art Museum, see the following resources: Alan Blanc, *Stairs, Steps, and Ramps* (Oxford: Butterworth Architecture, 1996), 209-18; Silvio Oksman (ed.), *Plano de conservação da estrutura do MASP* (Los Angeles: The Getty Foundation, 2018), 16-27, https://www.getty.edu/foundation/pdfs/kim/masp_%20sao_paulo_port.pdf; Ana Tagliari, Wilson Florio, and Luca Rossato, "The Representation of Staircases in the Architecture of Lina Bo Bardi," *42nd International Conference of Representation Disciplines Teachers Congress of Unione Italiana per il Disegno* (Milano: Franco Angeli, 2021), 1188-97, https://sfera.unife.it/bitstream/11392/2463815/1/UID%202021%20RC_Atti%20Florio%20Rossato%20Tagliari.pdf.

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

[13] For the staircase design at the São Paulo Art Museum, see these resources: Alexandre Silva Cárdenas, *MASP: Estrutura, Proporção, Forma* (São Paulo: Editora da Cidade, 2015), 54-59; Luis Fernández-Galiano, ed., "Museo de Arte de São Paulo, 1957-1968, São Paulo (Brasil)," *AV Monografias*, no. 180 (2015): 46-57.

[14] For detailed information about Gregório de Mattos Theater, see the following resources: Zeuler de Almeida Lima, "The Faces of Janus: Modernism and Hybridisation in the Architecture of Lina Bo Bardi," *The Journal of Architecture*, no. 11 (February 2007): 257-67; Tagliari, Florio, and Rossato, "Representationof Staircases".

[15] Lima, "The Faces of Janus," 257-67.

[16] Tagliari, Florio, and Rossato, "Representation of Staircases".

[17] Luis Fernández-Galiano, ed., "Centro cultural Casa do Benin, 1987, Salvador de Bahía (Brasil)," *AV Monografias*, no. 180 (2015): 104-109.

[18] Tagliari, Florio, and Rossato, "Representation of Staircases".

[19] For detailed information about The Glass House, see the following resources: Fernández-Galiano, ed., "Centro cultural Casa do Benin, 1987," 104-109; Sol Camacho, "Casa de Vidro: More than Achitecture, A Cultural Manifesto," in *Lina Bo Bardi: Habitat*, ed. José Esparza Chong Cuy (New York: Prestel, 2020), 87-94; Sánchez-Llorens and Garrido López, "Where Do We Step? ," 404-14.

[20] Renato Anelli, *Casa de Vidro, Lina Bo Bardi Architect* (Los Angeles: The Getty Foundation, 2019).

[21] Lina Bo Bardi, Renato Anelli, and Vera Bader, *Lina Bo Bardi 100, Brazil's Alternative Path to Modernism* (Munich: Hatje Cantz Verlag Otsfildern, 2014).

[22] For detailed information about SESC Pompéia, see the following resources: Lima, "The Faces of Janus," 257-67; Agnese Codebò, "The Architect Weaving the City: Lina Bo Bardi's Praxis in the SESC Pompeia," *V!RUS*, no. 14 (2017), http://www.nomads.usp.br/virus/virus14/?sec=4&item=5&lang=en.

[23] Luis Fernández-Galiano, ed., "Casa Valéria P. Cirell, 1957-1958, São Paulo (Brasil)," *AV Monografias*, no. 180 (2015): 58-61.

[24] For detailed information about Casa Valéria staircase, see the following resources: Zeuler de Almeida Lima, "Lina Bo Bardi, Between Margins and Centers," *ARQTEXTO*, no. 14, (2019): 110-44, https://www.ufrgs.br/propar/wp-content/uploads/2023/06/05_ZL_entre-margens-e-centro_070210.pdf; Silvia Lopes Carneiiro Leão and Raquel Rodriques Lima, "Casa do Chame-Chame: Conexões com Cultura Local e Arquitetura Moderna Internacional," *13º Seminário Docomomo Brasil* (Salvador, Brasil, 2019).

[25] Renato Anelli, "Recycling and Restoration: Adding New Meaning to Historical Buildings through Minimal İnterventions," in *Sustainable Lina: Lina Bo Bardi's Adaptive Reuse Projects*, ed. Annette Condello and Steffen Lehmann (Cham, Switzerland: Springer, 2016), 97-160, https://doi.org/10.1007/978-3-319-32984-0.

[26] Lina Bo Bardi, "Critério Proposto para a Restauração do Solar do Unhão," in *Interpretações do Patrimônio: Arquitetura e Urbanismo Moderno na Constituição de uma Cultura de Intervenção no Brasil 1930-1960*, Ana Lúcia Cerávolo (São Carlos: EDUFSCAR, 2013), 197; Ana Lúcia Cerávolo, "Interpretações do Patrimônio: Arquitetura e Urbanismo Moderno na Constituição de uma Cultura de Intervenção no Brasil 1930-1960" (PhD diss., Universidade Federal de São Carlos, 2010), 300-306.

[27] Bo Bardi, Anelli, and Bader, *Lina Bo Bardi 100, Brazil's Alternative Path to Modernism*.

[28] Carla Brandão Zollinger, "O Trapiche à Beira da Baía: A Restauração do Unhão por Lina Bo Bardi," in *7º Seminário Docomomo Brasil*, Porto Alegre, Brasil (Docomomo Brasil, 2007). https://docomomobrasil.com/wp-content/uploads/2016/01/012.pdf.

[29] Magdalena Reches, "Dos escaleras y un teatro, 3 espacios rítmicos," *Arquitextos* 11, no. 122.02 (jul. 2010), https://vitruvius.com.br/revistas/read/arquitextos/11.122/3449.

[30] Luis Fernández-Galiano, ed., "Rehabilitación del Solar do Unhão, 1959-1963, Salvador de Bahía (Brasil)," *AV Monografias*, no. 180 (2015): 66-69.

[31] Sánchez-Llorens and Garrido López, "Where Do We Step," 404-14.

[32] Tagliari, Florio, and Rossato, "Representation of Staircases"; Lima, "The Faces of Janus," 257-67.

[33] Zollinger, "O Trapiche à Beira da Baía".

BIBLIOGRAPHY

Anelli, Renato. Casa de Vidro, *Lina Bo Bardi Architect*. Los Angeles: The Getty Foundation, 2019.

Anelli, Renato. "A Flower between the Stone and the Crystal." *V!RUS*, no. 12 (2016). http://www.nomads.usp.br/virus/carpet_data/66/66en.pdf.

Anelli, Renato. "Recycling and Restoration: Adding New Meaning to Historical Buildings through Minimal Interventions." In *Sustainable Lina: Lina Bo Bardi's Adaptive Reuse Projects*, edited by Annette Condello and Steffen Lehmann, 97-160. Cham, Switzerland: Springer, 2016. doi: 10.1007/978-3-319-32984-0.

Bardi, Lina Bo. "Critério proposto para a restauração do 'Solar do Unhão." In *Interpretações do Patrimônio: Arquitetura e Urbanismo Moderno na Constituição de uma Cultura de Intervenção no Brasil 1930-1960*, Ana Lúcia Cerávolo, 196-98. São Carlos: EDUFSCAR, 2013.

Bardi, Lina Bo. *Stones Against Diamonds, Architecture Words Series 12*. London: Architectural Association Publications, 2012.

Bardi, Lina Bo, Renato Anelli, and Bader Vera. *Lina Bo Bardi 100, Brazil's Alternative Path to Modernism*. Munich: Hatje Cantz Verlag Otsfildern, 2014.

Bardi, Lina Bo, and Marcelo Carvalho Ferraz. *Lina Bo Bardi*. São Paulo: Fundação Lina Bo e P. M. Bardi, 1993.

Blanc, Alan. *Stairs, Steps, and Ramps*. Oxford: Butterworth Architecture, 1996.

Bozdoğan, Sibel. "Modern Mimarlık Ve Tropik Coğrafyalar." *Mimarlık*, no. 372, (July-Agust 2013): 36-46.

Camacho, Sol. "Casa de Vidro: More than Achitecture, A Cultural Manifesto." In *Lina Bo Bardi: Habitat*, edited by José Esparza Chong Cuy, 87-94. New York: Prestel, 2020.

Campbell, James W.P., and Michael Tutton. *Staircases, History, Repair, and Conservation*. New York: Taylor Francis Routledge, 2014.

Cárdenas, Alexandre Silva. *MASP: Estrutura, Proporção, Forma*. São Paulo: Editora da Cidade, 2015.

Cerávolo, Ana Lúcia. "Interpretações do Patrimônio: Arquitetura e Urbanismo Moderno na Constituição de uma Cultura de Intervenção no Brasil 1930-1960." PhD diss., Universidade Federal de São Carlos, 2010. https://www.teses.usp.br/teses/disponiveis/18/18142/tde-04052011-151700/publico/DEFINITIVO.pdf.

Ching, Francis D. K. A Visual Dictionary of Architecture. New Jersey: John Wiley & Sons, 2012.

Codebò, Agnese. "The Architect Weaving the City: Lina Bo Bardi's Praxis in the SESC Pompeia." *V!RUS*, no. 14, (2017). http://www.nomads.usp.br/virus/virus14/?sec=4&item=5&lang=en.

Condello, Annette, and Steffen Lehmann. *Sustainable Lina: Lina Bo Bardi's Adaptive Reuse Projects*. Cham, Switzerland: Springer, 2016. doi: 10.1007/978-3-319-32984-0.

Fernández-Galiano, Luis, ed. "Lina Bo Bardi, 1914-1992." *AV Monografias*, no.180 (2015): 1-120.

Frampton, Kenneth. *Studies in Tectonic Culture : The Poetics of Construction in Nineteenth and Twentieth Century Architecture*. Cambridge, MA: The MIT Press, 1995.

Habermann, Karl J. *Staircases Design and Construction*. Basel: Birkhauser, 2003.

Leão, Silvia Lopes Carneiro, and Raquel Rodrigues Lima. "Casa do Chame-Chame: Conexões com Cultura Local e Arquitetura Moderna Internacional." *13º Seminário Docomomo Brasil*, Salvador, Brasil, 2019. https://doi.org/10.22533/at.ed.2922029041

Lefaivre, Liane and Alexandre Tzonis. *Critical Regionalism: Architecture and Identity in a Globalised World*. Munich: Prestel Verlag, 2003.

Lehmann, Steffen. "Keeping the Existing: Lina Bo Bardi's Upcycling and Urban Renewal Strategies." In *Sustainable Lina: Lina Bo Bardi's Adaptive Reuse Projects*, edited by Annette Condello and Steffen Lehmann, 51-70. Cham, Switzerland: Springer, 2016. doi: 10.1007/978-3-319-32984-0.

Lima, Evelyn Furquim Werneck. "Drawing and Design for Theatre Architecture: Lina Bo Bardi's Sketches for Five Venues in Brazil." *Theatre and Performance Design 3*, no. 4 (December 2017): 236-49. https://doi.org/10.1080/23322551.2017.1396065

Lima, Zeuler de Almeida. "The Faces of Janus: Modernism and Hybridisation in the Architecture of Lina Bo Bardi." *The Journal of Architecture*, no. 11, (February 2007): 257-67. https://doi.org/10.1080/13602360600787124

Lima, Zeuler de Almeida. "Lina Bo Bardi, Between Margins and Centers." *ARQTEXTO*, no. 14, (2019): 110-44. https://www.ufrgs.br/propar/wp-content/uploads/2023/06/05_ZL_entre-margens-e-centro_070210.pdf.

Oksman, Silvio (ed.). *Plano de Conservação da Estrutura do MASP*. Los Angeles: The Getty Foundation, 2018. https://www.getty.edu/foundation/pdfs/kim/masp_%20sao_paulo_port.pdf.

Reches, Magdalena. "Dos escaleras y un teatro, 3 espacios rítmicos." *Arquitextos 11*, no. 122.02 (jul. 2010): https://vitruvius.com.br/revistas/read/arquitextos/11.122/3449.

Sánchez-Llorens, Mara and Fermina Garrido López. "Where Do We Step? The Horizon is on the Ladder: Landscapes that Lina Bo Bardi Created in Her Drawings." In *Architectural Graphics: EGA 2022*, edited by Manuel A. Ródenas-López, José Calvo-López, and Macarena Salcedo-Galera, 404-14. Cham, Switzerland: Springer, 2022. https://doi.org/10.1007/978-3-031-04640-7_41.

Selby, Raphael. Brazilian Concrete: Researching Brutalist Architecture in Brazil (blog). https://brazilianconcrete.wordpress.com/tag/public-space/

Slessor, Catherina. *Contemporary Staircases*. London: Mitchell Beazley, 2000.

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702

Tagliari, Ana, Wilson Florio, and Luca Rossato. "The Representation of Staircases in the Architecture of Lina Bo Bardi." In *42nd International Conference of Representation Disciplines Teachers Congress of Unione Italiana per il Disegno*, 1188-97. Milano: Franco Angeli, 2021. https://sfera.unife.it/bitstream/11392/2463815/1/UID%202021%20RC_Atti%20Florio%20Rossato%20Tagliari.pdf.

Templer, John. *The Staircase: History and Theories*. Cambridge, MA: The MIT Press, 1992.

Veikos, Cathrine. "Living Architecture: Lina Bo Bardi and Albert Frey." In *Albert Frey and Lina Bo Bardi: A search for Living Architecture*, edited by Daniell Cornell and Zeuler Lima, 101-11.

Palm Springs: Palm Springs Art Museum, 2017.

Zollinger, Carla Brandão. "O Trapiche à Beira da Baía: A Restauração do Unhão por Lina Bo Bardi." In *7° Seminário Docomomo Brasil*, Porto Alegre, Brasil, 2007. Docomomo Brasil, 2007. https://docomomobrasil.com/wp-content/uploads/2016/01/012.pdf.

Images source

1, 3, 4, 5, 7, 8, 9, 11. Arquitectura Viva. All rights reserved. **2.** Flickr, user Juliana Magro. https://www.archdaily.com/537063/ad-classics-sao-paulo-museum-of-art-masp-lina-bo-bardi. **6.** By Raphael Selby. "SESC Pompéia, Lina Bo Bardi, 1977-1986, São Paulo." Brazilian Concrete: Researching Brutalist Architecture in Brazil (blog). https://brazilianconcrete.wordpress.com/tag/public-space/. Use permitted for this purpose. **10.** Springer International Publishing Switzerland 2016. Renato Anelli. "Recycling and Restoration: Adding New Meaning to Historical Buildings through Minimal Interventions." In *Sustainable Lina: Lina Bo Bardi's Adaptive Reuse Projects*, edited by Annette Condello and Steffen Lehmann, 97-160. Cham, Switzerland: Springer, 2016. https://doi: 10.1007/978-3-319-32984-0

Yaman, Muammer and Esma Eroğlu. "Limits of Design and Technique: Lina Bo Bardi Staircases." VLC arquitectura 11, no. 2 (October 2024): 61-75. ISSN: 2341-3050. https://doi.org/10.4995/vlc.2024.21702