

**Guidelines of Transferring Brutalist Architectural Styles from Mid-20th Century
To Furniture Design**

By

Jinquan Zhu

A thesis submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Master of Industrial Design

Auburn, Alabama
December 9, 2023

Keywords: Industrial Design, Furniture Design, Architecture Design, Form Study,
Material Study

Copyright 2023 by Jinquan Zhu

Approved by

Tin-Man Lau, Chair, Professor, Industrial Design
Rich Britnell, Professor, Industrial Design
Carlton Lay, Professor, Industrial Design

Abstract

This thesis explores how to transfer mid-20th century architectural styles into furniture design to create furniture that harmonizes with the architecture itself. This thesis discusses the concept of applying mid-20th century architectural elements and principles to furniture design and proposes guidelines to assist designers in better integrating this architectural style into their furniture designs. Research findings demonstrate the feasibility of transferring mid-20th century architectural styles into furniture design, resulting in furniture that complements that architectural style. Proposed guidelines include carefully selecting appropriate mid-20th century architectural styles, thoughtfully transforming this architectural style into furniture design, and seamlessly blending furniture with this architectural style. These guidelines aim to provide designers with the tools to successfully incorporate mid-20th century architectural styles into their furniture designs, resulting in furniture that harmonizes with the architecture.

Acknowledgements

I would like to express my most sincere gratitude and heartfelt thanks to Prof. Tin-Man Lau. In addition, the successful completion of this thesis could not be achieved without the care and help of all professors. I would like to thank Prof. Rich Britnell Lau and Prof. Rusty Lay for their guidance and help, they have done a lot of work on this topic and helped me to overcome one difficulty after another, many thanks to them! Special thanks to Doc. Elizabeth Topping for her professional advice on the thesis! I also received care and help from all my classmates in life and study, thank you!

Table of Contents

Abstract.....	2
Acknowledgements.....	3
Table of Contents	4
List of Figures	7
Chapter 1. Introduction	13
1.1. Problem Statement.....	13
1.2. Need For Study	13
1.3. Objectives of Study.....	14
1.4. Definitions of Terms	15
1.5. Assumptions.....	16
1.6. Scope and Limits.....	17
1.6.1. Scope.....	17
1.6.2. Limits	18
1.7. Procedure and Methodology	19
1.7.1. Literature review	19
1.7.2. Design guidelines development	19
1.7.3. Guideline application	19
1.8. Anticipated Outcomes.....	19
1.8.1. Design guidelines.....	19
1.9.2. Improved furniture design.....	20
1.9.3. Contribution to design history	20
1.9.4. Industry application	20
Chapter 2. Literature Review	22
2.1. Mid-20th century architectural styles	22
2.1.1. International Style.....	22
2.1.1.1. Overview.....	22
2.1.1.2. Key Characteristics	22
2.1.1.2.1. Three Principles	23
2.1.1.2.2. Surface Materials	47
2.1.1.3. Key Figures & Works	50
2.1.1.3.2. Le Corbusier.....	50
2.1.1.3.3. Ludwig Mies van der Rohe.....	53
2.1.1.3.4. Walter Gropius	56
2.1.2. Brutalism.....	58
2.1.2.1. Overview.....	58
2.1.2.2. Key Characteristics.....	59
2.1.2.2.1. Rough Surfaces.....	59

2.1.2.2.2. Repeating Forms	68
2.1.2.2.3. Unusual Shapes	72
2.1.2.2.4. Expression of Structure	77
2.1.2.3. Key Figures & Works	80
2.1.2.3.1. Le Corbusier	80
2.1.2.3.2. Alison & Peter Smithson	82
2.1.2.3.3. Ernö Goldfinger	84
2.2. Furniture Design in Mid-20 Century	86
2.2.1. International Style Related Furniture Design	87
2.2.1.1. Steel Furniture	87
2.2.2. Brutalism Related Furniture Design	93
Chapter 3. Guidelines	99
3.1. Materials & Surfaces	100
3.1.1. Choice of Material	100
3.1.1.1. Traditional Concrete	100
3.1.1.2. Resin-cement hybrid material	101
3.1.1.3. Cement board	102
3.1.1.4. Wood	103
3.1.1.5. Metal	104
3.1.2. Surface Patterns	104
3.1.2.1. Wood Grain Texture	104
3.1.2.2. Concrete "Corduroy"	105
3.1.2.3. Undulating Surface	106
3.1.2.4. Tie Hole Texture	107
3.1.2.5. Ratio of Coarse to Fine Aggregate	108
3.1.2.6. Wood Surface Texture	108
3.1.2.6.1. Carving Gouge	109
3.1.2.6.2. Router	109
3.1.2.6.3. Angle Grinder	110
3.1.2.6.4. Dremel	111
3.1.2.6.5. Yakisugi	111
3.1.2.7. Steel Cold Bluing	112
3.2. Color Palette	113
3.3. Form	115
3.3.1. Single Form	115
3.3.2. Multi-body Form	116
3.4. Guidelines Form	118
Chapter 4. Application	122
4.1. Planning	122
4.1.1. Materials Choices	122
4.1.2. Form Choices	122
4.1.3. Texture & Color Choices	123

4.1.4. Ideation & Final Decision.....	124
4.2. Manufacture Process.....	125
4.2.1. Building Inner Core for Concrete Support.....	126
4.2.2. Attaching Cement Board.....	127
4.2.3. Apply Cement Board Tape.....	128
4.2.4. Apply Cement Coating & Sanding	128
4.2.5. Process The Wood.....	129
4.2.6. Texture Carving.....	130
4.2.7. Yakisugi The Surface	130
4.2.8. Attach Secondary Seating	131
4.2.9. Assembly.....	131
Chapter 5. Conclusion.....	132
5.1. Conclusion	132
5.2. Further Research	133
REFERENCES	134
APPENDICES	140

List of Figures

Figure 1: Bauhaus School, Dessau, Germany (Gropius, 1926).	25
Figure 2: Barcelona Pavilion (Rohe, 1929)	26
Figure 3: Yard of Barcelona Pavilion (Rohe, 1929).....	27
Figure 4: Villa de Mandrot Outside (Corbusier, 1931).....	28
Figure 5: Villa de Mandrot Sketch (Corbusier, 1931).....	28
Figure 6: Volksstimme Building, Frankfurt, Germany (Lehr, 1929).	30
Figure 7: City Employment Office, Dessau, Germany (Gropius, 1928).	30
Figure 8: Workers' Houses, Hook of Holland (Oud, 1924).	31
Figure 9: Bauhaus School, Dessau, Germany (Gropius, 1926).	32
Figure 10: Huber Haus, Riehen, Switzerland (Schmidt, 1929).	33
Figure 11: Rotach Houses (Haefeli, 1928).....	36
Figure 12: Turun Sanomat Building, Abo, Finland (Aalto, 1930).....	37
Figure 13: House of Two Brothers, Brno, Czechoslovakia (Eisler, 1931).....	38
Figure 14: Electrical House at the Monza Exposition, Italy (Figini & Pollini, 1930).	39
Figure 15: Bata Shoe, Prague, Czechoslovakia (Kysela, 1929).	40
Figure 16: Van Nelle Factory, Rotterdam (Van der Vlugt, 1925).	41
Figure 17: Kunstverein, Hamburg, Germany (Schneider, 1930).	41
Figure 18: Single House & Double House at the Weissenhofsiedlung, Stuttgart.	43

Figure 19: Lenglet House, Uccle, Near Brussels (De Koninck, 1926).....	44
Figure 20: Double House, Brno, Czechoslovakia (Eisler, 1926).....	45
Figure 21: Fallingwater, Pennsylvania, U.S. (Wright, 1935).....	46
Figure 22: Fallingwater Sketch (Wright, 1935).....	47
Figure 23: Apartment House in Zurich (Haefeli, 1929).	48
Figure 24: Café Era in Brno, Czechoslovakia (Kranz, 1929).....	50
Figure 25: Villa Savoye, Poissy, France (Corbusier, 1931).	52
Figure 26: Villa Savoye Stairs (Corbusier, 1931).	52
Figure 27: Villa Savoye Stairwell (Corbusier, 1931).....	53
Figure 28: Farnsworth House, Plano, Illinois, U.S. (Rohe, 1945).....	54
Figure 29: Farnsworth House, Plano, Illinois, U.S. (Rohe, 1945).....	55
Figure 30: Bauhaus School, Dessau, Germany (Gropius, 1926).	56
Figure 31: Bauhaus School, Dessau, Germany (Gropius, 1926).	57
Figure 32: Perspective View of Bauhaus Building (Gropius, 1926).	57
Figure 33: Brick hose, Soho, London (Smithson & Smithson, 1952).....	60
Figure 34: National Theatre, London (Lasdun, 1960).	63
Figure 35: Azuma House (Ando, 1975).....	64
Figure 36: The Boston Government Service Center (Rudolph, 1962)	66
Figure 37: Stairs of The Boston Government Service Center (Rudolph, 1962)..	66
Figure 38: Christian Science Student Center (Rudolph, 1962).....	67
Figure 39: Christian Science Student Center (Rudolph, 1962).....	67

Figure 40: Habitat 67 (Safdie, 1967).....	69
Figure 41: Habitat 67 (Safdie, 1967).....	69
Figure 42: Nakagin tower (Kurokawa, 1972).....	70
Figure 43:Bank of Georgia (Chakhava, 1975).....	71
Figure 44: The Met Breuer (Breuer, 1966).....	73
Figure 45: Ronchamp (Corbusier, 1954).....	74
Figure 46: Inside of Ronchamp (Corbusier, 1954).....	75
Figure 47: Cultural Center of The Philippines (Locsin, 1966).	76
Figure 48:The Nordic Pavilion (Sverre Fehn, 1956).	77
Figure 49:The Nordic Pavilion (Sverre Fehn, 1956).	78
Figure 50: Kagawa Prefecture Office Building (Tange, 1958).....	78
Figure 51: Communications Centre in Kofu (Tange, 1962).....	79
Figure 52: Le Corbusier (Britannica,, n.d.).....	80
Figure 53: the Unité d’habitation (Corbusier, 1952).....	81
Figure 54: Alison & Peter Smithson (Gatley & King, 2017).....	82
Figure 55: Robin Hood Gardens (Smithson & Smithson, 1972).....	83
Figure 56: Ernö Goldfinger.....	84
Figure 57: Trelick Tower (Goldfinger, 1972).....	85
Figure 58: Wassily Chair (Breuer, 1925).....	88
Figure 59: PK25. Easy chair (Kjærholm, 1951).	90
Figure 60: Barcelona Chair (Rohe, 1929).....	91

Figure 61: DKR chair (Eames & Eames, 1951).	92
Figure 62: Diamond chair (Bertoia, 1952).....	93
Figure 63: K2 Chair (Panton, 1959).	93
Figure 64: Skyline cabinet (Evans, 1966).....	95
Figure 65: Wall-Mounted Faceted cabinet (Evans, 1975).	95
Figure 66: Apartment 59 (Kutucu, 2022).....	97
Figure 67: Apartment 59 (Kutucu, 2022).....	98
Figure 68: Apartment 59 (Kutucu, 2022).....	98
Figure 69: Pouring Cement (Guides, 2018).....	101
Figure 70: Pouring Resin-cement Mixture.	102
Figure 71: Cement Board Attached to Wood Frame.....	103
Figure 72: Hammered Steel (<i>Hammered Texture</i> , n.d.).....	104
Figure 73: Cast Concrete Texture (<i>Wood Grain Left in a Concrete Wall GL Barnhart Construction ...The Blog</i> , n.d.).....	105
Figure 74: Corduroy Texture (Rudolph, 1962).....	106
Figure 75: Azuma House (Ando, 1975).....	107
Figure 76: Tie Hole Texture (<i>Concrete Wall with Tie Hole Texture</i> , n.d.)	108
Figure 77: Groove Texture (Brown, 2013).	109
Figure 78: Router Carving (Brown, 2013).....	110
Figure 79: Grinding (Brown, 2013).....	111
Figure 80: Yakisugi (“Yakisugi (Shou Sugi Ban),” 2020).....	112

Figure 81: Steel bluing (Blacktail Studio, 2023)	113
Figure 82: Color Palette	114
Figure 83: Single Form (Zhu, 2023)	115
Figure 84: Single Form 2 (Zhu, 2023)	116
Figure 85: Multi-body Form (Zhu, 2023)	116
Figure 86: Multi-body Form 2 (Zhu, 2023)	117
Figure 87: Multi-body Form 3 (Zhu, 2023)	117
Figure 88: Guidelines Form	121
Figure 89: Materials	122
Figure 90: Forms	123
Figure 91: Color Palette	124
Figure 92: Ideations (Zhu, 2023)	124
Figure 93: Ideations 2 (Zhu, 2023)	124
Figure 94: Final Rendering.	125
Figure 95: Gluing Plywood.....	126
Figure 96: Attaching Cement Board.	127
Figure 97: Putting on Cement Board Tape.....	128
Figure 98: Skim coat the surface.	129
Figure 99: Process the wood.	129
Figure 100: Carving wood.	130
Figure 101: Yakisugi the wood.	130

Figure 102: Attaching the wood seating. 131

Figure 103: Assembly. 132

Chapter 1. Introduction

1.1. Problem Statement

Architecture and furniture design have historically been closely related fields, with many well-known architects also designing furniture. Various new architectural styles emerged in the 20th century, such as modernism, postmodernism, brutalism, etc., each with its own unique characteristics and design principles. However, compared with other architectural styles in the mid-20th century, research on how Brutalism architectural styles can be applied to furniture design is very limited.

This thesis aims to solve this problem by exploring and summarizing architectural styles of the mid-20th century, studying their characteristics, and providing guidance for designers to transform Brutalism styles, so that designers can design furniture with its characteristics through this guidance.

1.2. Need For Study

The mid-20th century saw a major shift in architectural styles, with many design movements emerging. This study focuses on two main architectural styles: International Style and Brutalism. These styles brought unique design principles, aesthetics, and materials that greatly influenced the design of buildings and spaces. However, research on how to best apply these mid-20th-century architectural styles to furniture design is limited.

This is an important question because furniture plays a vital role in shaping the

overall aesthetic and functionality of a space. When furniture doesn't match the architectural style, it can lead to inconsistencies and disjointed designs. Therefore, it is necessary to explore how to integrate mid-20th century architectural style into furniture design, so that the furniture can be integrated with the architectural space itself, creating a cohesive space atmosphere.

In addition to aesthetic considerations, there are also practical implications for designers, architects, and furniture makers. By providing guidelines for designing furniture in the style of mid-20th-century architecture, designers can improve the overall design and function of a space. By gaining a better understanding of how furniture fits into different styles of buildings and spaces, furniture manufacturers can also use these guidelines to create works that conform to different architectural styles, thereby meeting the needs of different groups of people for their products.

In short, the study of applying mid-20th-century architectural styles to furniture design is critical to creating harmonious and functional spaces, and has practical implications for designers, architects, and furniture makers.

1.3. Objectives of Study

The aim of this study, "Guidelines for transferring mid-20th-century architectural styles to furniture design", is to provide designers with practical and useful guidelines for integrating mid-20th-century architectural styles with the buildings themselves. This study conducts a comprehensive review of relevant literature and case studies on International Style and Brutalism, two architectural styles in the mid-20th century, in

order to analyze the characteristics of these architectural styles themselves and the relationship between existing cases of architectural principles in furniture and furniture design.

Aiming at these two architectural styles, this study starts with a literature review related to their history, characteristics, design principles, representative figures, and representative buildings. This provides a comprehensive understanding of the key features that define these architectural styles and their relevance to furniture design.

Subsequently, this study analyzes existing furniture that incorporates or applies these architectural styles to explore the limitations and future feasibility of current furniture in integrating architectural styles.

Based on the literature review and analysis, this study summarizes the characteristics of these architectural styles that can be applied to furniture design, giving advice on materials, colors, shapes and design principles.

Finally, the study applies the proposed guidelines to furniture design to evaluate their effectiveness and practicality in real-world scenarios. Ultimately, this thesis presents the design of a furniture piece that matches the architectural style of choice by using this guide.

1.4. Definitions of Terms

Architectural Style: A distinct type of architectural design characterized by a specific set of elements, materials, and forms that are recognizable and typical of a particular time period or geographic region (Curtis, 1983).

Aesthetics: The study of beauty and the perception of beauty, often applied to design and the visual arts (Hitchcock, 1966).

Béton Brut: A French term that translates in English to “raw concrete”. The term is used to describe concrete that is left unfinished after being cast, displaying the patterns and seams imprinted on it by the formwork (Beanland, 2016).

Cohesive Spatial Atmosphere: The overall feeling or atmosphere created by the combination of architectural and design elements within a space, resulting in a harmonious and integrated environment (“Atmosphere (Architecture and Spatial Design),” 2023).

Ergonomics: The study of how humans interact with their environment and the products within it, with the goal of creating products and spaces that are comfortable, safe, and efficient to use (Sparke, 1986).

Functionality: The ability of a design or product to perform its intended purpose or function effectively and efficiently (Chadwick, 2016).

Furniture Design: The art and science of designing furniture, including chairs, tables, cabinets, and other furnishings, that are aesthetically pleasing, functional, and comfortable (Mácêl, 2012).

1.5. Assumptions

Mid-20th century architectural styles have specific design elements that can be transferred to furniture design. This assumption acknowledges that not all design elements in architecture can be effectively translated to furniture design, but mid-20th-

century architectural styles targeted for this study have traits and design elements that can be transferred.

Mid-20th century architectural styles are still relevant to contemporary furniture design. This assumption acknowledges that design trends and preferences have changed over time, but mid-20th-century architectural styles continue to influence contemporary design.

The use of furniture can significantly affect the spatial atmosphere of a room or building. This assumption acknowledges that furniture is an integral part of interior design, and that the use of specific furniture and styles can greatly affect the overall ambience of a space.

1.6. Scope and Limits

This section will clarify the coverage of this thesis and the limitations of it.

1.6.1. Scope

This study focuses on mid-20th century architectural styles, focusing on International Style and Brutalism. This study aims to explore the history, key design elements, characteristics and aesthetics of these styles, and how they translate into furniture design.

This study will also examine the relationship between architectural styles and furniture design in the middle of the 20th century, as well as existing cases of applying architectural styles to furniture design, summarize the use of materials, colors, shapes

and design principles of selected architectural styles, and give a guide to how designers can incorporate these into furniture design. Since the guidelines provided by this study are suggestions on materials, colors, shapes and design principles, there are no restrictions on the selection of furniture.

This study is limited to two selected mid-20th century architectural styles and their portability to furniture design. This study does not explore other historical or contemporary architectural styles, nor does it consider cultural, social, or economic factors that might affect the portability of architectural styles to furniture design.

Furthermore, this study presents guidelines and design recommendations for designers, using examples of selected architectural styles, but does not provide comprehensive rules or formulas for transferring mid-20th-century architectural styles to furniture design. The guidelines are intended to be flexible and adaptable to individual design projects, not prescriptive.

1.6.2. Limits

The limitation of this thesis is that research is only focused on selected architecture styles in mid-20th century. Because the resource is limited to libraries and online information, the study might not be completely correct on all aspects.

The Guideline is only giving guidance about material choices, surface methods, and form choices, which will not include furniture manufacturing processes and ergonomics. The guidelines are also developed based on my understanding and analysis of selected architectural styles, which might not be agreed by everyone.

1.7. Procedure and Methodology

The section will cover the steps that will be done for designing these guidelines.

1.7.1. Literature review

The literature review is conducted by searching academic databases, online libraries, and relevant websites. The review includes peer-reviewed articles, books, conference papers, and other relevant literature related to selected architecture styles and furniture design.

1.7.2. Design guidelines development

The guidelines are based on the findings from the literature review and case studies. The guidelines are presented in a clear and concise manner and are adaptable to different design projects.

1.7.3. Guideline application

The guideline application involves selecting a furniture design project that reflects mid-20th century architectural style. The guidelines are applied to the furniture design project by following the steps outlined in the guidelines.

1.8. Anticipated Outcomes

Outcomes that could be produced through this thesis.

1.8.1. Design guidelines

The development of design guidelines provides a practical and useful tool for

designers to transfer mid-20th-century architectural styles to furniture design. The guidelines are adaptable to different design projects and promote the use of materials, colors, shapes, and design principles that reflect mid-20th-century architectural styles.

1.9.2. Improved furniture design

The application of the guidelines to a furniture design project will result in the creation of furniture pieces that successfully transfer mid-20th-century architectural styles. The furniture pieces will reflect the unique characteristics of mid-20th-century architecture and will appeal to users who appreciate the historical and cultural significance of mid-20th-century design.

1.9.3. Contribution to design history

The study contributes to the understanding and appreciation of mid-20th-century architectural styles and their influence on furniture design. The study provides insights into the design principles and material choices that were common in mid-20th-century architecture and how they can be adapted to furniture design.

1.9.4. Industry application

The study has practical implications for the furniture design industry, including furniture manufacturers and designers. The design guidelines developed in this study can be applied to a range of furniture products, helping manufacturers and designers to create furniture pieces that reflect mid-20th-century architectural styles and appeal to

consumers who value the historical and cultural significance of mid-20th-century design.

Chapter 2. Literature Review

2.1. Mid-20th century architectural styles

In this section, the research will be focused on International Style and Brutalism in mid-20th century.

2.1.1. International Style

Architectural style is developed during 1932 to 1960.

2.1.1.1. Overview

International style is defined by the Getty Research Institute (2004) as:

the style of architecture that emerged in Holland, France, and Germany after World War I and spread throughout the world, becoming the dominant architectural style until the 1970s. The style is characterized by an emphasis on volume over mass, the use of lightweight, mass-produced, industrial materials, rejection of all ornament and color, repetitive modular forms, and the use of flat surfaces, typically alternating with areas of glass.

2.1.1.2. Key Characteristics

This section includes the principles of International Style architecture and the surface materials that architects use the most to achieve the aesthetic appearance of this style.

2.1.1.2.1. Three Principles

Volume, regularity, and the avoidance of decoration are the three principles of International Style (Hitchcock, 1966), and most of the design decisions that will be provided in this section are made to enhance these principles.

2.1.1.2.1.1. Volume

International style architecture is all about creating a volume instead of the feeling of mass. There are two quotes said by Hitchcock (1966) from the book, *The International Style*, that describe this aesthetic principle the best: “The prime architectural symbol is no longer the dense brick but the open box” (p. 56); “Volume is felt as immaterial and weightless, a geometrically bounded space” (Hitchcock, 1966, p. 59).

Traditional buildings are using walls to support the weight and protect against the weather, but for international style, isolated supports, piers of metal or reinforced concrete, are the skeleton of the building, and walls are more like subordinate elements that cover the skeleton, protecting the inside from the weather.

2.1.1.2.1.1.1. Roofs

When designing the roof of International Style buildings, flat roofs including single slant roofs are the best choices in most scenarios because they are less massive and simpler than the gabled roofs usual on the buildings of the past. Just like the rule of creating continuing surfaces, flat roofs follow the same design language and will not break the harmony. In some cases, slanting roofs and round roofs are only acceptable if

there is no other way around (Hitchcock, 1966).

2.1.1.2.1.1.2. Windows

Windows are the most important things to consider when creating volume because these openings will break the continuous surfaces. However, without them, we can't see the "skeleton" inside, which will add a sense of heaviness to the building. Compared to the surface materials I talked about, a window is much more important since bad fenestration will destroy any surfaces with any materials (Hitchcock, 1966).

The number one rule is placing windows at the outer edge of the wall; this way the glass is at the same level of the wall surface and becomes part of it, not a hole in the wall.

The second rule is about the ordering of the openings in the wall surface. "The more consistently a surface is arranged, the more conspicuous will be its character as a surface" (Hitchcock, 1966, p. 60). The easiest way is having entire walls of transparent glass combined as one enormous window. When the window becomes the wall, then there is no window to break the wall surface. However, the frame of the window needs to be very light, which will not visually break up the surface into panels. Also, lighter window frames won't blend with inner support and break the boundaries between the

skeleton and the skin (see Figure 1).



Figure 1: Bauhaus School, Dessau, Germany (Gropius, 1926).

When it comes to frame choices, light simple frames made by durable non-corroding metal are very desirable. Wooden window frames are good as well, if architects can make them look light visually.

It is important to know that these “rules” are there to help people to understand the fundamentals of what to do to create volume, but just like drawing, after years of practicing and learning, rules are no longer important because you truly understand the essence of it. The expression is related to the general principles of surface of volume but not restricted by it.

2.1.1.2.1.1.3. Rules Are Only Tools

There are a lot of cases that lead architects to special applications where the construction is not the typical skeleton covered by protecting screen, for example, the Rohe’s Barcelona Pavilion by Mies van der Rohe (Figure 2 & 3) and Le Corbusier’s house at Le Pradet (Figure 4 & 5).



Figure 2: Barcelona Pavilion (Rohe, 1929)



Figure 3: Yard of Barcelona Pavilion (Rohe, 1929)

Clearly, Mies Van der Rohe didn't follow the principle of skin wrapping the skeleton, instead having a large area of opening. The volume is not closed but is visually completed by the edges of roofs and walls. At the same time, his embodiment of continuous surfaces can be seen from the slate walls: the texture is consistent, and the joints are neat. This semi-open international style is now quite popular and is based on the expansion and optimization of original principles.

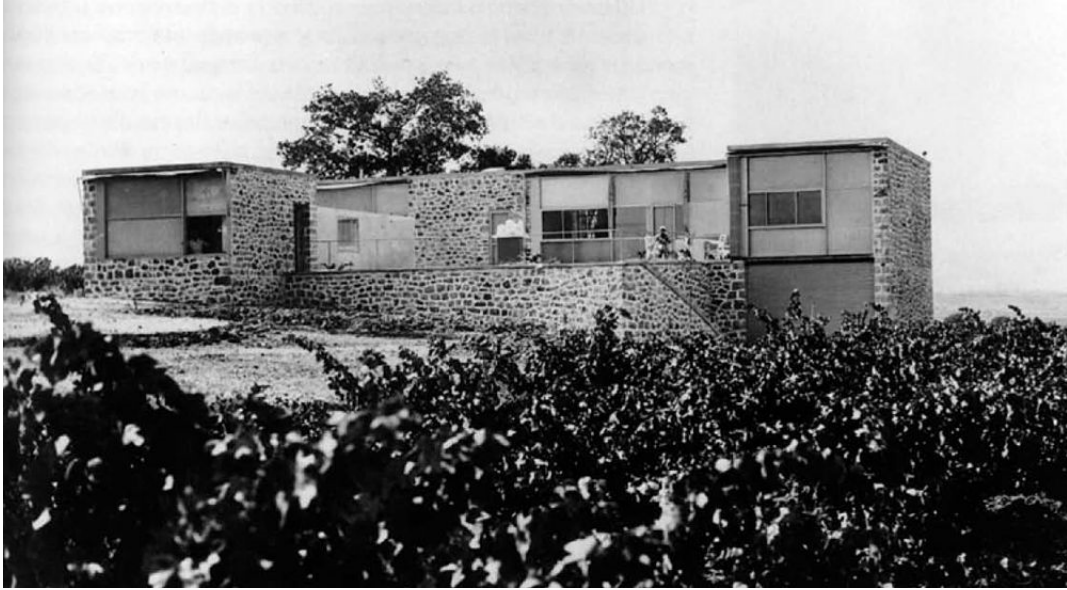


Figure 4: Villa de Mandrot Outside (Corbusier, 1931)

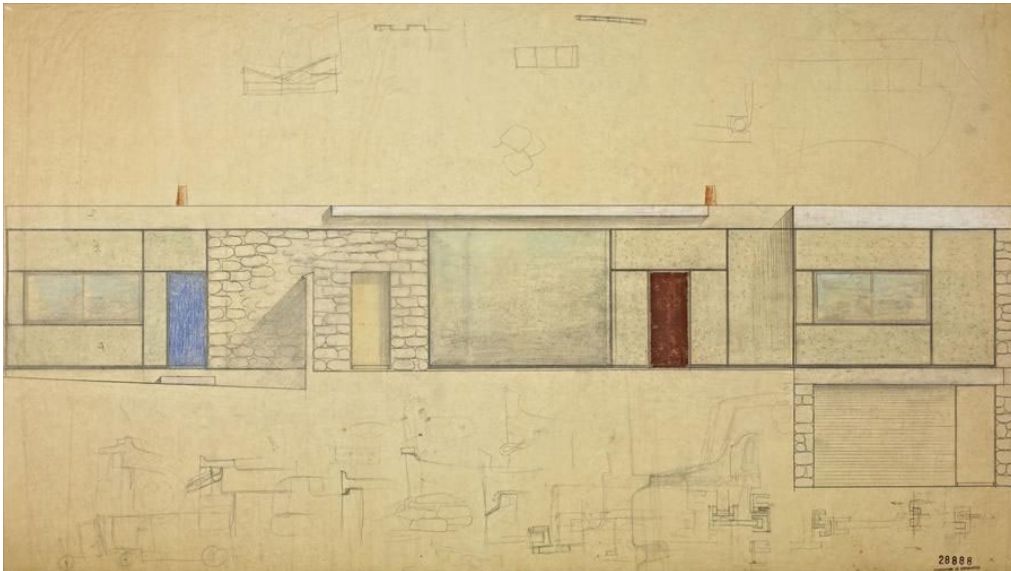


Figure 5: Villa de Mandrot Sketch (Corbusier, 1931)

When people look at the Villa de Mandrot, the first thing they will notice will probably be the rubble masonry walls, which are supposed to break the surface of volume rule due to the pattern. However, the large amount of glass balances them perfectly.

Although it is masonry walls support the structure instead of piers, Corbusier's arrangement of masonry walls gives the entire structure a sense of transparency and

rhythm. The interweaving use of masonry and glass eliminates the heaviness that would otherwise appear.

2.1.1.2.1.2. Regularity

The supports in skeleton construction are normally and typically spaced at equal distances in order that strains may be equalized. An underlying regular rhythm expresses in its design this characteristic orderliness of structure and this similarity of parts by an aesthetic ordering emphasizes the underlying regularity.

It is very important for International Style architecture to have every part in order according to an aesthetic principle. Regularity brings beauty, but regularity is not equal to standardization. Regularity has its rhythm, which separates itself far away from monotonous.

2.1.1.2.1.2.1 Interests

Absolute regularity is also approaching monotony. Hence, achieving a proper degree of interest is necessary.

Asymmetrical schemes of design are preferable aesthetically and technically because they heighten the general interest of the composition (Figure 6). Asymmetry can give people the impression of strong and positive, marked by emphasis on a real axis well off the center (see Figure 7). Also, different sections of the building can achieve different functions thanks to the asymmetrical design.



Figure 6: Volksstimme Building, Frankfort, Germany (Lehr, 1929).



Figure 7: City Employment Office, Dessau, Germany (Gropius, 1928).

Bilateral or axial symmetry is also allowed to be used when designing International Style architecture (Figure 8). A lot of architects who newly converted from traditional discipline to the International Style tend to use this method.



Figure 8: Workers' Houses, Hook of Holland (Oud, 1924).

Proportion is probably one of the most important parts that architects should work on in the design process (Hitchcock, 1966). In different views of a building, geometrical webs of imaginary lines separate the plane into diverse parts and harmonize the various elements into a single whole. How to organize these different parts and make them not only aesthetic but also serve functions is the key to success.

Some architects prefer to arrange all the elements of their design within a single bounding shape to emphasize to the utmost the unity of volume of the given building (Hitchcock, 1966). Some prefer a more extended articulation with more emphasis on the organic relation between the parts (see Figure 9). This way, the need for function is very easy to achieve.



Figure 9: Bauhaus School, Dessau, Germany (Gropius, 1926).

2.1.1.2.1.2.2 Functions

Regularity is relative and not absolute in architecture (Hitchcock, 1966). A lot of times buildings cannot be completely regularized because every floor may have different functions based on different needs. In every floor, rooms have different functions and need to be in different sizes as well. For architects, the prime problem is to figure out how to use regular construction and standardized manufactured parts to fulfill the irregular and unequal demands of function.

Most functions are not regular and usually differ from one another. Naturally, the expression of the multiple functions grouped in one building is not symmetrical. The International Style does not attempt to force irregular functions into a symmetrical shell. It focuses on adjusting the irregular functions to regular structure in a clear and consistent design (Curtis, 1983). Also, based on economic considerations, regularity of the parts and general structure has more advantages than irregularity.

Based on the different functions, every window would be of different shape and size, and placed without formal geometrical relation to the others. A good International Style architect can provide for all the varied functions which windows serve by means of windows of the same size, or at least built up of related units (see Figure 10).



Figure 10: Huber Haus, Riehen, Switzerland (Schmidt, 1929).

By placing these windows, the architect achieves a pattern adapted to the regularity of the underlying structure, which is both ordered and expressive. This pattern can be applied to other subjects of the building, which brings harmony and regularity to the whole design. Only in a few cases, the pattern can be absolutely regular without interfering with the provision for function. But it always will be relatively regular and generated based on different situations.

The development of the aesthetic possibilities of the International Style also happened in the use of oblique and rounded forms' plan and elevation (see Figure 8). Even though it clearly breaks the rule of regularity function-wise, curved and oblique

shapes often serve better than rectangular shapes in stairwells and water tank designs. Curved shapes give architects more possibilities to adjust the space to function, without interfering with the regular spacing of the isolated supports.

There is no doubt that non-rectangular shapes can bring a lot of positive visual interest to international-style architecture (Hitchcock, 1966). However, it is also a double-bladed sword that will cut you when you handle it wrong. Also, curved and oblique forms normally are not the cheapest solution to a given problem due to the construction difficulty.

When architects strictly follow the rule of regularity, they can only come up with ranges of equal-sized windows, unbroken patterns, etc. Therefore, only very dull buildings are produced. However, this is still better than those who have failed even to apprehend the existence of a principle of regularity (Frampton, 2020).

Storied construction naturally produces horizontally. Most functions require extended development in the horizontal plane. Rooms are usually broader than they are high and are most evenly illuminated by windows of the same proportion. Hence, the principle of regularity tends to increase the effect of general horizontally to achieve more functional possibilities (Curtis, 1983). However, readers need to know that horizontally is not a principle of the International Style but is purely from the function standpoint. If the function demands a vertical element, then it needs to be done.

Individuals who acknowledge International Style design is based on volume rather than mass and adhere to the principle of regularity can create architecture that is, at the

very least, aesthetically sound (Hitchcock, 1966).

2.1.1.2.1.3. Avoidance of Decoration

Decoration is not preferred in International Style architecture especially when the decoration adds no actual functions to the building itself. However, the avoidance of decoration doesn't mean no attention to details.

Decorations are considered as extra, but details are not. Fine details decorate a modern design just as did the functional columns and moldings of Greek and Gothic architecture (Hitchcock, 1966). The idiom "The devil is in the detail" is derived from "God is in the detail" attributed to the famous modern architect Ludwig Mies van der Rohe. In International Style, details are as important as the principle of regularity and volume.

2.1.1.2.1.3.1. Windows

Windows are a very important part of International Style architecture, and whether their details are reasonable is very important for the continuity of the surface and the principle of the volume. Thanks to industrial development and mass production models, it was possible to standardize the components of windows. This not only meets the aesthetic needs of International Style architecture but also conforms to the economic situation.

The design of the window frame has always been simple and slender. I think if the glass could be fixed without the need for a window frame, the International Style architects would choose that direction because it would better express the extension of

the wall.

2.1.1.2.1.3.2. Wall Capping

The details of the roof can have a huge impact on the International Style. Projecting cornices should be avoided unless there is a strict functional requirement. It will destroy the extension of the wall and add unnecessary detail (see Figure 11).



Figure 11: Rotach Houses (Haefeli, 1928)

However, if the capping is like the Rohe's Barcelona (Figure 2), totally flat with no extra details, and more of the roof plane is visible than merely the band projecting beyond the wall, then it will not break the continuity of the surface but boost the feeling of volume with the straight edges.

Remember, capping is nothing but the boundary surface of volume, and it is best made as inconspicuous as possible.

2.1.1.2.1.3.3. Supports

Where isolated supports pass up into a closed construction, most architects indicate the coherence of the posts with the skeleton of the construction above and not with its

covering surfaces (Hitchcock, 1966). This way the skeleton can remain visually independent, so it won't break the surface.

Round columns or piers are aesthetically and technically superior since they remain visually separate from the wall surface. In interiors, they interfere less with vision and circulation than square or oblong piers (Hitchcock, 1966). When it comes to the material, the actual metal pier is preferred due to its exceedingly light and elegant structure (see Figure 2).

In most cases, structures like bracing should disappear in the supported slab with no extra details (Figure 3). No matter in what kind of constructions, subsidiary detail should always follow the actual stresses of the construction, avoiding the symmetrical cushion shape of traditional capitals (see Figure 12) (Hitchcock, 1966).



Figure 12: Turun Sanomat Building, Abo, Finland (Aalto, 1930)

2.1.1.2.1.3.4. Parapets and Railings

Parapets and railings are important to consider as well.

The parapet often encloses the roof terrace just as the wall encloses the interior room space below. It is part of the "skin", which needs to be treated as a continuation of the wall surface (Hitchcock, 1966). This means the parapet needs to embrace the principle of surface and volume and be in scale with the structure as a whole (see Figure 13).



Figure 13: House of Two Brothers, Brno, Czechoslovakia (Eisler, 1931)

Railings and the horizontal surfaces will form grille patterns like window frames do to walls. That means the distance between each railing needs to be carefully designed to harmonize with the structure. A careful adjustment of the open patterned surface to the solid un-patterned surface of the walls is a mark of great design (Hitchcock, 1966) (see Figure 14).



Figure 14: Electrical House at the Monza Exposition, Italy (Figini & Pollini, 1930).

2.1.1.2.1.3.5. Lettering

Lettering is the nearest approach to arbitrary ornament used by the architects of the International Style. Since it has a real functional purpose in advertising and in indicating the use of different parts of a large building, it is allowed. In printing, legibility is a prime consideration. Fancy forms and unusual placement may be justified for their effectiveness in advertising, but they are breaking the rule of regularity and need to be avoided (see Figure 15).



Figure 15: Bata Shoe, Prague, Czechoslovakia (Kysela, 1929).

Clear un-serifed letter forms are most legible at a good scale and conform most harmoniously to the geometrical character of international style design.

Letters should be set forward from the wall surface or in silhouette above a roof, so they can decorate a building without breaking up the wall surfaces (see Figure 16 & 17).



Figure 16: Van Nelle Factory, Rotterdam (Van der Vlugt, 1925).



Figure 17: Kunstverein, Hamburg, Germany (Schneider, 1930).

Letter forms, the spacing of letters and words, color, lighting, materials, and the

relation of the scale of the inscription to the scale of the building all need to be applied with the principle of regularity, so they can serve as decoration instead of destruction.

Always remember: "Better none at all unless it be good" (Hitchcock, 1966, p. 87).

2.1.1.2.1.3.6. Color

In the use of color, the general rule is restraint.

There is some exploring on colors in Europe. Due to the influence of two different schools of abstract painting, as represented by Mondrian and Ozenfant, small areas of bright elementary colors were used in Holland and Germany. Large areas of more neutral color exist in France. In both cases, colors were artificial, and the majority of wall surfaces remained white (see Figure 18).



Figure 18: Single House & Double House at the Weissenhofsiedlung, Stuttgart.
(Corbusier & Jeanneret, 1927)

But still, natural surfacing materials and natural metal colors are preferred compared with artificial colors in most cases. By the way, when using stucco as surface material, even if it is mixed with paint to get a white or off-white color, it is still considered a natural color.

Dark neutral tone paint is good for metal, especially when painting window frames, as it will minimize the apparent weight and make it visually thin (see Figure 19).

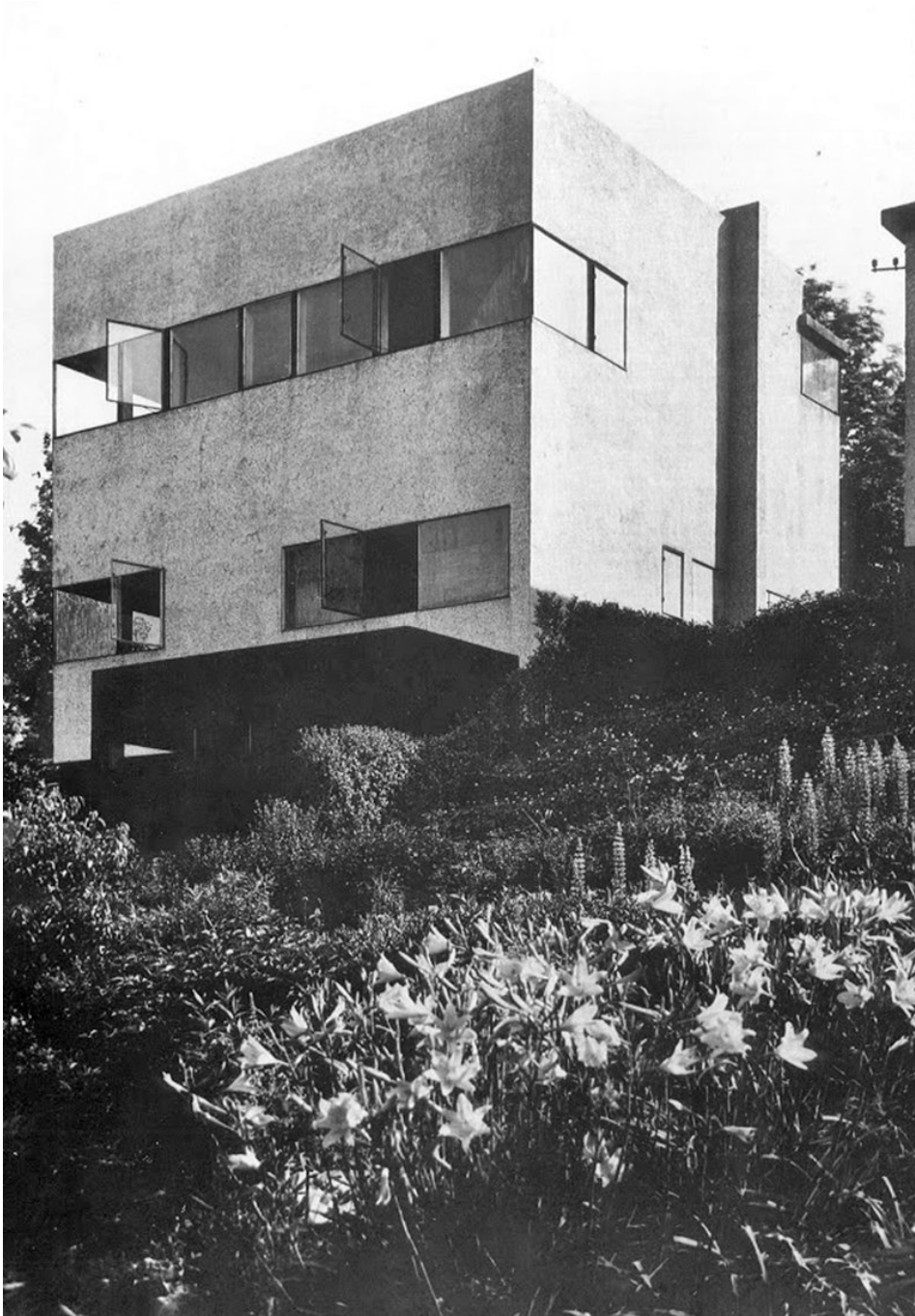


Figure 19: Lenglet House, Uccle, Near Brussels (De Koninck, 1926).

Patently artificial color makes a sharp contrast with natural surroundings. Light and neutral tones undoubtedly fit better with the natural environment. In Figure 20, it is very clear to see how the right part of this house contrasts with the surroundings, and how the left part blends into the environment. However, in cities that have fewer natural surroundings, small areas of brilliant color may be effectively contrasted with large

areas of neutral color from other buildings around.



Figure 20: Double House, Brno, Czechoslovakia (Eisler, 1926).

The earlier use of bright colors had value in attracting attention to the new style, but it could not remain pleasing. When the freshness is gone, it can become boring rapidly. In contrast, using a natural color tone is safer, better, and both technically and psychologically permanent (Hitchcock, 1966).

Color is a double-bladed sword; it can be used very successfully due to its nature of emphasizing strongly the effect of surface, but it breaks up the unity of volume. In comparison, using natural materials to create contrasts between different walls and fulfill structure and function needs is an easier and safer method.

2.1.1.2.1.3.7. Surroundings

Nature surroundings are also considered as decoration for modern architecture. They are a contrast and a background emphasizing the artificial values created by architects (Hitchcock, 1966). In a lot of famous architecture designs, the nature around the building eventually becomes part of the design.

Fallingwater, designed by Frank Lloyd Wright, a famous modern architect, showcases a great example of how the building and surroundings complement each other (see Figure 21).

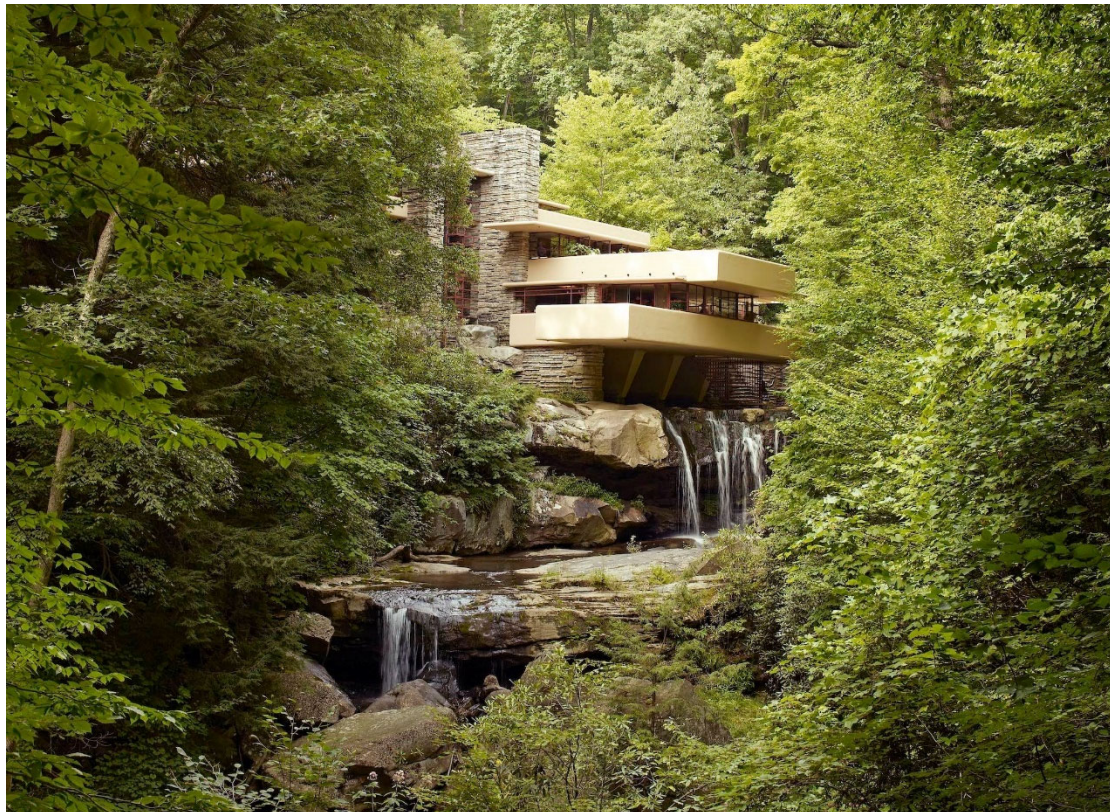


Figure 21: Fallingwater, Pennsylvania, U.S. (Wright, 1935)

You can clearly see that Wright included the environment as part of his design in his sketch (see Figure 22).

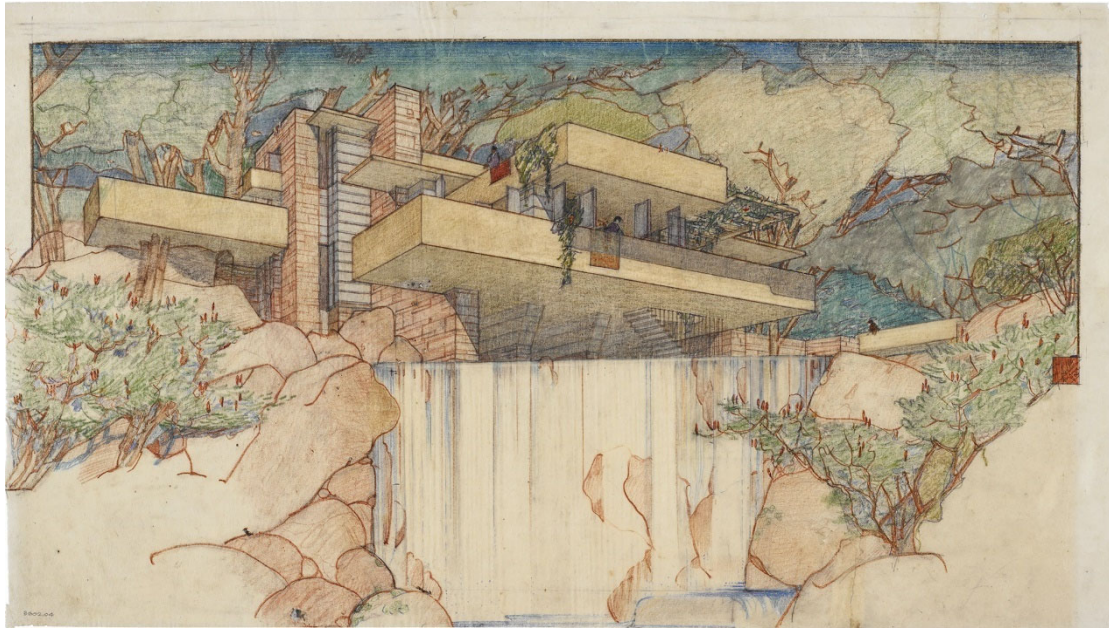


Figure 22: Fallingwater Sketch (Wright, 1935)

2.1.1.2.2. Surface Materials

The choice of surface material largely depends on whether it can make the whole plane have continuity, which has a decisive effect on whether the building can have a sense of volume without suggesting weight and mass like traditional buildings (Hitchcock, 1966).

Stucco, the most widely used material for surfacing, is excellent for creating continuous planes since no joint is needed. However, the nature of this material is likely to crack, so using this material on large constructions is better than on small buildings since the flaws will not be that noticeable. Also, rough stucco is likely to suggest mass and weight because the texture will reduce the sharpness of the building (see Figure 23). Hence the smoother the stucco is, the better sense of volume will show. But stucco is still not the best choice in a lot of circumstances (Hitchcock, 1966).



Figure 23: Apartment House in Zurich (Haefeli, 1929).

Brick, the most representative material of mass, which should not even be considered when constructing an international style architecture, can be used under some conditions. Hitchcock (1966), in the book *The International Style*, wrote, "The use of brick tends to give a picturesqueness which is at variance with the fundamental character of the modern style" (p. 66). Due to the pattern created by laying down bricks and the irregular color of bricks, it is difficult to present a clean and continuous surface. However, if the color of the mortar is close to the color of the bricks, the pattern might not be very evident. Also, because of the nature of bricks, the color of bricks will not change over time, and since they are not easily cracked, it is a better material choice than stucco for constructing large buildings.

Stones, granite, and marble are like bricks, in that they suggest a sense of mass and weight, but if they can be produced as plates, they can become suitable materials for

surfacing. Due to the higher price, they are better used for the construction of a monumental or luxurious character. When constructing with these materials, it is important to join plates together as seamlessly as possible and blend the grain to emphasize the continuity of the whole surface, avoiding convexities and concavities and symmetrical patterns because they will break the consistency as well (Hitchcock, 1966).

Wooden sheathing is also a great choice in some cases, especially in the United States since it can last for a long time after painting. Plywood panels are large and smooth, and they can be painted or left to show the grain. The nature of this material is good to create a continuous surface, but any enframement suggesting paneling which will break the surface needs to be avoided.

Glass bricks and glass plates are great surface materials as well. They can be used as windows. When using them on the surface with other surface materials, there are no window frames to “cut” windows out of the wall; thereby the continuity will remain (see Figure 24). The only downside of this material is its fragile nature, which can be a problem for permanent architecture.

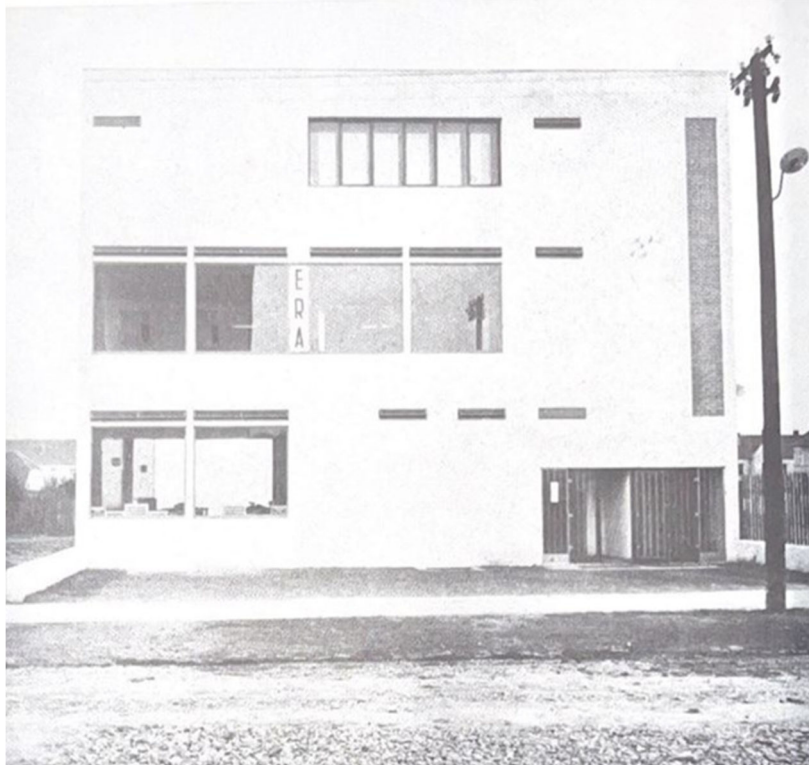


Figure 24: Café Era in Brno, Czechoslovakia (Krantz, 1929).

2.1.1.3. Key Figures & Works

2.1.1.3.2. Le Corbusier

Le Corbusier was A Swiss-French architect who played a pivotal role in the development of modern architecture. Le Corbusier's works are known for their clean lines, open interiors, and the use of pilotis (supporting columns). Villa Savoye (Figure 25) stands out as a significant contribution to 20th-century modern architecture. Completed in 1929, it marked a transformative point in Le Corbusier's career and the principles of the International Style (Gössel, 2007). Le Corbusier (2007) introduced "The Five Points of Architecture" as a set of essential elements for design, akin to Vitruvius' *Ten Books on Architecture*. Villa Savoye perfectly aligns with these points:

- Pilotis (supporting columns)
- Flat Roof Terrace
- Open Plan
- Ribbon Windows
- Free Façade

The house, seemingly floating above a forested backdrop, is supported by slender pilotis that blends into the tree line. The lower level, painted green, gives the illusion of floating volume (see Figure 25). Notably, the curved glass facade on this level accommodates the turning radius of 1929 automobiles, facilitating easy entry into the garage.

The living quarters, marked by ribbon windows on a stark white facade, maximized the natural light in all directions. Once inside, the spatial interplay between public and private areas becomes evident. Le Corbusier strategically places living spaces around a communal outdoor terrace, separated by a sliding glass wall, encouraging continuous movement between spaces.



Figure 25: Villa Savoye, Poissy, France (Corbusier, 1931).



Figure 26: Villa Savoye Stairs (Corbusier, 1931).



Figure 27: Villa Savoye Stairwell (Corbusier, 1931).

Villa Savoye exemplifies International Style architectural concepts, showcasing a harmonious blend of form and function and reimagining spatial relationships within the built environment. Using columns and green color on the bottom part of the building emphasizes a weightless volume.

2.1.1.3.3. Ludwig Mies van der Rohe

Ludwig Mies van der Rohe was a German American architect known for his famous dictum "less is more." Mies van der Rohe's designs often featured open spaces, the use of industrial materials, and a focus on the purity of form.



Figure 28: Farnsworth House, Plano, Illinois, U.S. (Rohe, 1945)

The Farnsworth House was built between 1945 and 1951 for Dr. Edith Farnsworth as a weekend retreat. This single-story house's frame and roof are supported by eight I-shaped steel columns which express the beauty of the structure. In between these columns are floor-to-ceiling windows around the entire house, and these windows are what achieve Mies' idea of combining residence with its natural surroundings. Mies intended to use these trees to provide shade for people's privacy.

Mies (1945) explained this concept in an interview about the glass pavilion stating, "Nature, too, shall live its own life. We must beware not to disrupt it with the color of our houses and interior fittings. Yet we should attempt to bring nature, houses, and human beings together into a higher unity" (p.43).

Mies raised the house 5 feet 3 inches off the ground to make the house look as light as possible on the land (see Figure 28 & 29), only allowing the steel columns to meet the ground and the landscape to extend past the residence. In order to accomplish this, the frames of the windows also provide structural support for the roof slab. This design

makes those wide steps slowly transcend off the ground as if they were floating up to the entrance. Aside from walls in the center of the house enclosing bathrooms, the floor plan is completely open.



Figure 29: Farnsworth House, Plano, Illinois, U.S. (Rohe, 1945)

This house expresses the beauty of the skeleton of architecture, using glass as a wall to visually maximize the feeling of volume. The regularity of those columns and steps boosts the rhythm of patterns. Finally, the roof slab and floor emphasize the continuation of the surface. It is truly a masterpiece combining all the principles of International Style.

2.1.1.3.4. Walter Gropius

Walter Gropius was a German architect and founder of the Bauhaus school; Gropius had a significant impact on the development of modern architecture. His works often embodied the principles of the International Style, emphasizing simplicity and functionality.



Figure 30: Bauhaus School, Dessau, Germany (Gropius, 1926).

The Bauhaus Building is the main building of the Bauhaus school, designed by Gropius, and reflects the functional and aesthetic principles of the International Style (Figure 30).

The structure consists of three wings interconnected by bridges (Figure 31). A large two-story bridge links the school and workshop areas, serving as the roof for the administration situated beneath it. The Bauhaus Building's comprehensive layout encompasses various facilities, such as instructional spaces, accommodations for both students and faculty, an auditorium, and offices.



Figure 31: Bauhaus School, Dessau, Germany (Gropius, 1926).

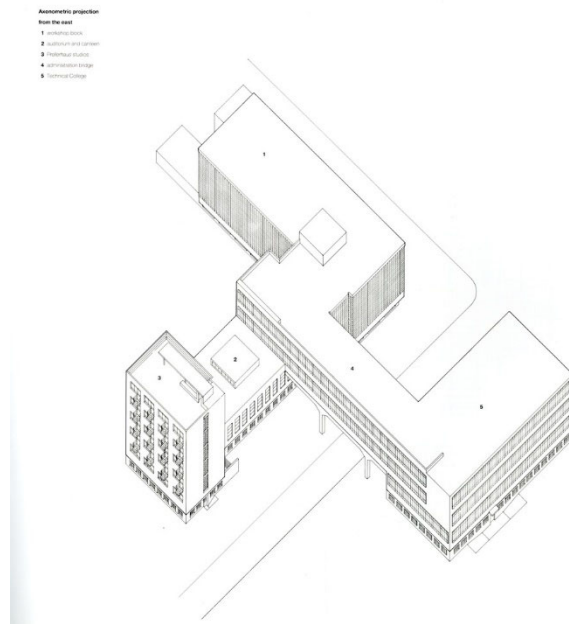


Figure 32: Perspective View of Bauhaus Building (Gropius, 1926).

The housing units and school buildings are connected through a wing to create easy access to the assembly hall and dining rooms. The educational wing contains administration and classrooms, staff rooms, a library, a physics laboratory, model rooms, a fully finished basement, raised ground floor, and two upper floors.

This architecture included so many functions that normal single-volume international-style design will never be able to deliver. Instead, with multiple different form volumes fused together, all the functions above are able to be fulfilled in this asymmetrical cohesive unity. At the same time, Gropius was able to emphasize the principle of regularity by arranging all those windows in a rhythmic way.

2.1.2. Brutalism

Brutalism is mainly developed during 1960 to 1970.

2.1.2.1. Overview.

Brutalism is a movement in modern architecture, and there are many stunning examples of Brutalism that emerged in the 20th century. The core of the term "brutalism" derives from the aesthetics of the residential unit which was designed by Le Corbusier in Marseille in 1952, as well as the incorporation of the term "béton-brut" to describe architectural designs using unfinished concrete (Sroat, 2005, p.1).

Brutalism emerged after World War II, out of ideas of functionalism and monumental simplicity. After the end of the war, urban reconstruction became the top priority. However, the European economy was completely paralyzed and faced huge crises; therefore, expensive materials like steel were not the best choice during that period. All the architects sought cheap materials to replace metal, which eventually resulted in concrete: a cost-effective, durable, and unique material.

There are two major parties of "Brutalism" in architectural history, which are

represented by Le Corbusier and Smithson. Both of them pursued the expression of the structure, materials, and functions of a building, as well as the use of materials, “rough” appearance, and unpretentious honesty (Altun, 2016, p.2).

2.1.2.2. Key Characteristics.

2.1.2.2.1. Rough Surfaces.

Raw, rough surfaces are often the first things that come to mind when Brutalist architecture is mentioned. Due to the particularity of materials and Brutalism's pursuit of de-decoration, Brutalist buildings generally retain the most unadorned appearance. And it is this special material selection and surface characteristics that create an unforgettable impression of Brutalism.

2.1.2.2.1.1. Bricks

Luis Kahn, a famous American architect once said, “You say to brick, ‘What do you want, brick? And brick says to you, ‘I like an arch.’ And if you say to brick, ‘Arches are expensive and I can use a concrete lintel over you, what do you think of that, brick?’ Brick says, ‘I like an arch’.” Kahn’s conclusion was, ‘It’s important that you honor the material you use.’” (Vidler, 2011, p. 34).

Even though Brutalism is synonymous with concrete, it started with bricks. The architect Peter Smithson used the term “Brutalism” for the first time in the publication of their brick house design in Soho in 1953 on *Architectural Design* (Vidler, 2011).

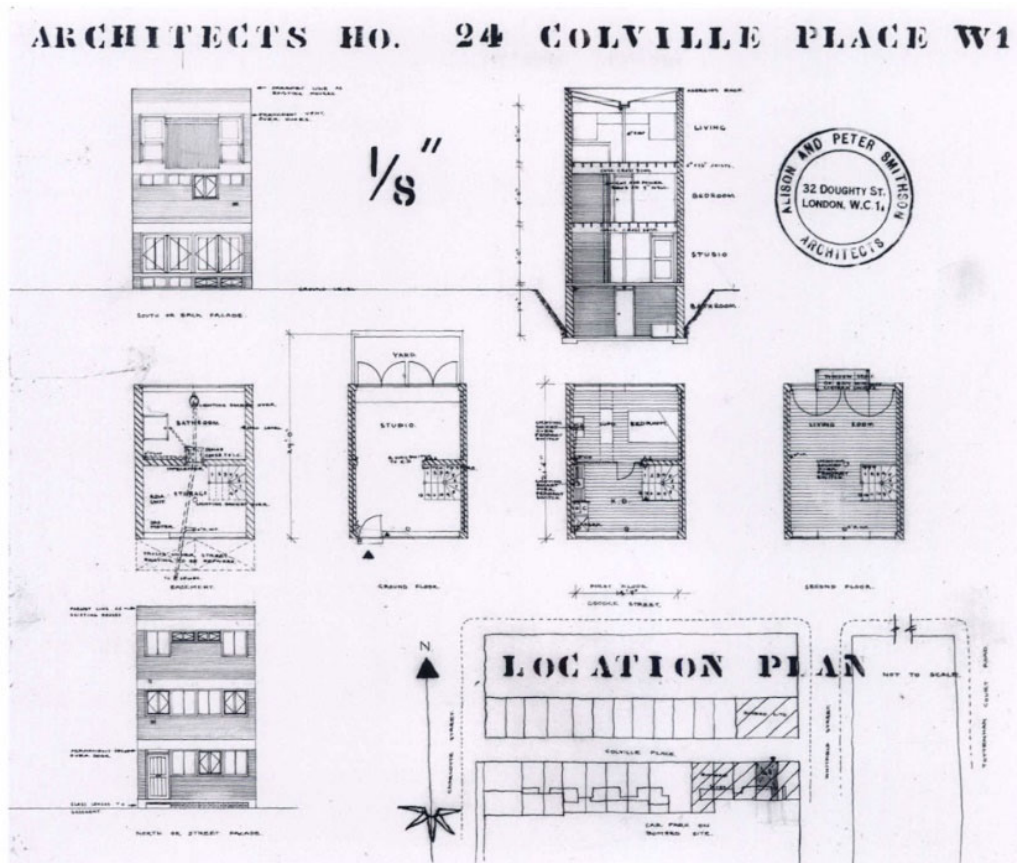


Figure 33: Brick house, Soho, London (Smithson & Smithson, 1952).

In an article, Henley (2017) wrote “It is our intention in this building to have the structure exposed entirely, without internal finishes wherever practicable. The contractor should aim at a high standard of basic construction as in a small warehouse” (p. 23).

Bricks are like a skeleton of this House in Soho and when it is fully exposed, it gives the observer a raw and rock-solid feeling. The pattern that is created by bricks stacked together enhances the feeling even more.

2.1.2.2.1.2. Concrete

From the book *Redefining Brutalism*, Henley (2017) says “Brutalism is concrete. The two are hard to separate in the collective psyche” (p. 6). However, like I mentioned,

if Brutalism started from bricks, then why were these early harbingers of New Brutalism overtaken by concrete buildings? The answer is economic. After the Second World War, building materials like steel were scarce, and concrete became one of the best choices to use. Also, concrete can be pre-formed as columns and beams by using molds, which brings more potential for craftsmanship (Henley, 2017). Besides the economic efficiency, concrete itself gives people a sense of honesty (Chadwick, 2016). The color and the texture seem always the same, but the sculptural opportunity of this material is unlimited. It is like Play-Doh for architects. Unlike bricks, concrete doesn't have a "messy pattern." Instead, it blends in and makes the building whole, like one giant creature standing on the ground.

2.1.2.2.1.3. Craft

One might think that Brutalism does not require any craftsmanship, as it seeks a no-frills, raw feel. However, it is not. There are many techniques to create different surface effects that architects desire.

The skill in molding concrete was to describe material effects, through concrete that is left unfinished after being cast, displaying the patterns and seams imprinted on it by the formwork. Auguste Perret first utilized rough-sawn timber boards to cast *béton brut*, which make concrete look like petrified wood (Henley, 2017). As Henley described, "Rough board surfaces using sawn boards, finished appearance depending on the nature of the cut. The grain effect can be accentuated by abrasive blasting the

formwork, or by soaking the timber in water or in a weak ammonia solution” (p. 46).

According to Gage’s 1970 *Guide to Exposed Concrete Finishes*, rough textures are achieved through planning and craftsmanship, not a lack of attention to detail.

When Denys Lasdun designed the National Theatre in London in the 1960s, he used multiple techniques and maximized the possibility of utilizing concrete. For the ceremonial parts of the structure, he used a pale grey in-situ concrete to rhyme with the stone of Waterloo Bridge, Somerset House and St. Paul's. For the exterior, he used a mix that combined a coarse aggregate of marine-dredged ballast with a fine aggregate of Leighton Buzzard sand, to create a slightly rough surface. The strata, fins, and struts are all imprinted with sedimentary layers of timber planks. This building is built with cabinetmaking quality. In book, *Redefining Brutalism*, Haworth Tompkins said, “the sheer craft of what we blithely call concrete, just working on those three building- that runs the whole gamut for possibility of what concrete can be” (Henley, 2017, p. 32). The use of cement is no longer the most basic and cheapest building material. It can have different formulas and proportions to achieve the roughness desired by any architect, and it can also have textures with different degrees of fineness through different molds. Designers can add different pigments to change the color, to blend in with the surrounding environment. In fact, béton brut is not a shackle that limits the architect, but one that has unlimited possibilities.



Figure 34: National Theatre, London (Lasdun, 1960).

Another surface texture comes from rigorous and delicate formwork, which embodies Brutalism's unabashed attitude towards the construction process and its admiration for craftsmanship. Tadao Ando completed Azuma House in 1975 (see Figure 35). The building uses a reinforced concrete system. The holes in the walls are left by the ties that hold formworks together. Each template is carefully arranged. The concrete projection marks between formworks and holes creates a special texture. Due to the hydrostatic pressure, the formwork under the concrete is slightly deformed, which makes the wall surface also slightly undulate, and the shadow of these undulations gives the cement surface a soft fabric texture.

Although the building is Brutalism architecture, it has a refined and delicate aesthetic. The traces left by the construction process do not give people an unfinished

feeling but reflect the rigor of the design. Although the formwork was deformed, it accidentally gives the building a unique texture that deserves to be reproduced by other designers.



Figure 35: Azuma House (Ando, 1975)

As we all know, concrete surfaces can crack or become damaged due to weathering, and to solve this issue, architects found out that the more textured and profiled the concrete surface the better it will appear and weather. Hence, Paul Rudolph (1962), an

American architect and the chair of Yale University's Department of Architecture, used a special concrete surface technique to solve this problem in his two designs: The Boston Government Service Center (Figure 36 & 37) and the Christian Science Student Center for the University of Illinois in Urbana (Figure 38 & 39). He created a powerfully expressive silhouette and surfaces of concrete 'corduroy'. The texture was created by casting concrete with vertical ribs and hammering by hand to roughen the stripy surface. This technique was a kind of preemptive ruination. It concealed weathering and enhanced the brutalism vibe.

The idea is unquestionably brilliant. Most people think of ways to protect the cement surface, but Rudolph thought that since the cement wall will be destroyed slowly under the action of the climate anyway, it is better to destroy it in advance under his control and turn it into a kind of a texture that looks good and performs better against weathering in the future.



Figure 36: The Boston Government Service Center (Rudolph, 1962)



Figure 37: Stairs of The Boston Government Service Center (Rudolph, 1962).



Figure 38: Christian Science Student Center (Rudolph, 1962).

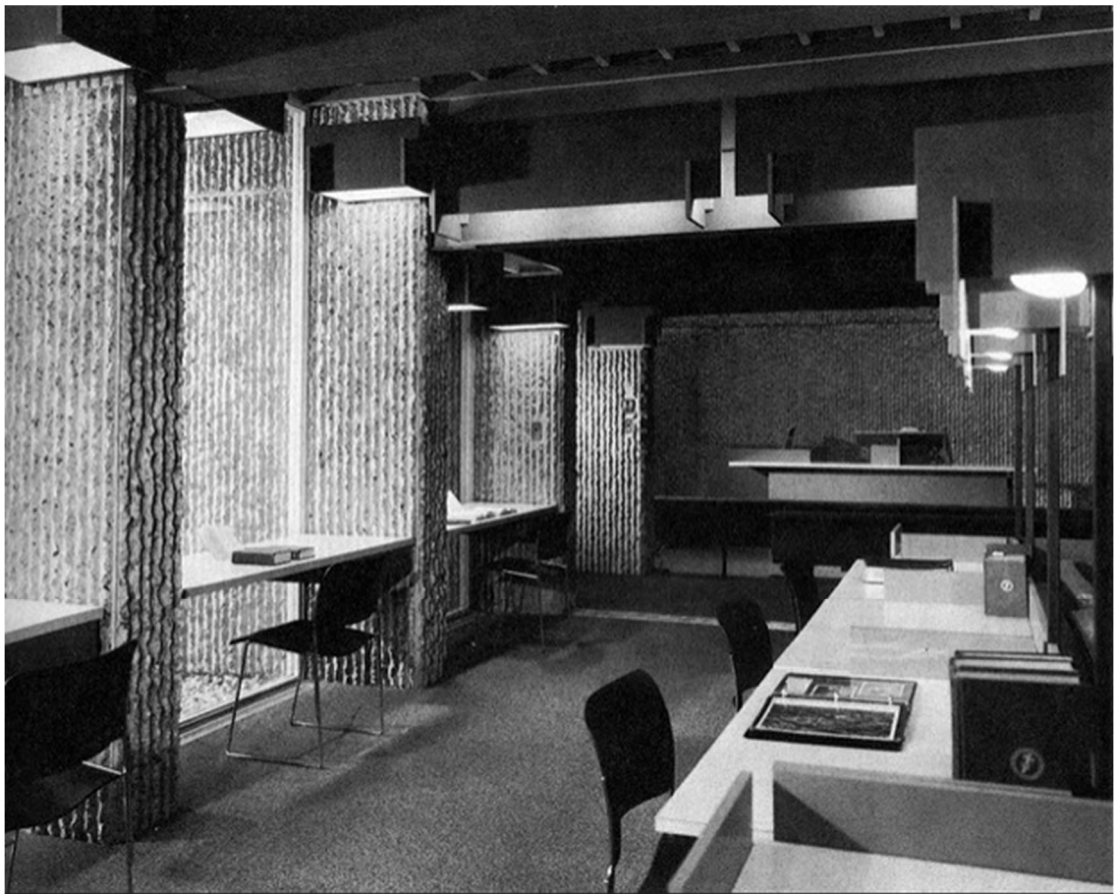


Figure 39: Christian Science Student Center (Rudolph, 1962)

2.1.2.2.2. Repeating Forms

Repetition of simple form is widely used in Brutalism architecture design. Due to the fact that a lot of Brutalist buildings are designed for social housing, the repetitive forms can regulate the size for all the units. Also, when all the functions are compressed into one unit, each unit can be easily arranged without considering too much about shared areas. It is also can maximize the amount of natural light coming into each unit. The repetition reflects the functionalism part of Brutalism, and it balances the sense of chaos that “random” arrangement causes.

One of the examples is Habitat 67 (Figure 40), which is designed by Canadian Architect Moshe Safdie, a famous multi-family complex for the Montreal Expo. Habitat 67 has 158 rectangular, prefabricated boxes stacked on top of each other in a confused fashion, rising to create the impression of a hill town (Gössel, 2007).

The flat roofs serve a dual purpose, as each one provides a balcony for a neighboring flat (Gössel, 2007). Different sizes of window, some of which are sited across the corners of the modules, give the building an even more distinctive appearance (see Figure 41). Balconies are also be used for a roof garden, which is also helping the building blend into the environment, and proposed the idea of an urban “village,” which Safdie considered a more humane and organic alternative to traditional apartment living.



Figure 40: Habitat 67 (Safdie, 1967)



Figure 41: Habitat 67 (Safdie, 1967)

The repetition of this prefabricated unit is not only saving costs but also reducing the building time. If any one of these units was damaged, it is possible to just swap a new unit there.

Another building that shares the same repetitive unit design is the Nakagin Tower (see Figure 42), designed by Kisho Kurokawa. Unlike Habitat 67's more "chaotic" and less orderly arrangement, Nakagin Tower's units are stacked from bottom to top, very in order. Uniform, white, living units with circular window openings are fitted to two black, core buildings in a loose arrangement, like corn kernels on a corn cob. Like Habitat 67, the units were to be produced in modules so that they could be replaced, in order to remain up-to-date and responsive to change (Kurokawa, 1972). There are a lot

of building concepts in sci-fi movies and games borrowed from these types of small capsule unit design, to reflect the massive population in the future world, which unfortunately, gives this type of design the expression of oppression and cruelty.



Figure 42: Nakagin tower (Kurokawa, 1972)

Besides repeating simple cubic forms, this style can also be a more complex unit,

which allows more functions and space. The Bank of Georgia (Figure 43), designed by George Chakhava in 1975, is one of the most remarkable brutalism buildings among all Soviet-era buildings in Georgia (Gössel, 2007). Even though it is not like Nakagin Tower or Habitat 67 that has prefabricated units which can be replaced later, the repetition of the “cross structure” blocks still is able to achieve a more functional and aesthetic expression. Each block has long band-like windows facing different directions, which allows every room to have approximately the same amount of natural light and views. Since every block is significantly larger, more rooms with different functions can be arranged inside of them. Structurally, the “stacking” visual effect really embraces the surroundings. Trees are filling the gaps, which boosts the contrast between concrete and nature.



Figure 43:Bank of Georgia (Chakhava, 1975)

I have never thought that the repetition of the same elements or forms in Brutalist architecture, as well as the way of arrangement and combination, are purely based on functional considerations. In many cases, it pursues the beauty of sculpture while

satisfying the function. It is this idea that makes Brutalist design more than just cold industrial products and rough giant stones.

2.1.2.2.3. Unusual Shapes

In line with the principle of architectural honesty, the Brutalist design style pares down buildings to their most basic forms—relying on simple geometric shapes or unusual forms for visual interest. While Brutalist construction can appear stark and cold, it provides opportunities to treat designs as modern sculptures. The art of Brutalist design comes from the shapes formed by positive and negative space.

The Met Breuer, designed by Marcel Breuer in 1966, is one of the simplest geometry forms design I see in Brutalism architecture (see Figure 44). In the book, *Concrete Concept*, it says, “it’s stepped shape puts one in mind of a puzzle piece from the computer game Tetris, fallen from the sky to land squarely on the corner of Madison Avenue and 75th Street, a block sky of Central Park” (Beanland, 2016, p. 166).

Breuer uses granite as the surface material for the building, with its smooth texture and neat seams adding an exquisite feel to the massive stones. The simple geometric shapes of the reverse steps create a perspective illusion, making the overall structure appear more grandiose. Several windows deviate from the traditional square shape and instead take on a trapezoidal form, all facing in the same direction. This unconventional design adds a playful element to what should be serious Brutalist architecture. To me, this building is like an individual standing out in a crowd, mocking the mundane and ordinary surroundings with its own unrestrained uniqueness.



Figure 44: The Met Breuer (Breuer, 1966)

Another Brutalist architectural example is Ronchamp, a church designed by Le Corbusier in France (see Figure 45). The whole building looks like an irregular sculptural form where the walls, the roof, and the floor slope. This makes it initially challenging to discern how each part is connected and what the overall structure looks like. However, the composition of this building is quite simple, with no complex elements; it's just that its unique design differs greatly from conventional architecture, providing a completely new visual experience (Beanland, 2016). Le Corbusier uses white for the wall color and earth tones for the roof, visually reducing a lot of the

sense of weight. Simultaneously, the upward-curving roofline adds to the overall lightness of the form.



Figure 45: Ronchamp (Corbusier, 1954)

Various-sized windows on the walls are fitted with glass of different colors (Figure 46). When sunlight passes through them, the church interior is bathed in a vibrant play of light and shadows, creating a colorful and sacred atmosphere (Beanland, 2016).



Figure 46: Inside of Ronchamp (Corbusier, 1954)

In designing this church, the purity of space was Le Corbusier's primary focus. He achieved functionality through the elimination of superfluous decorative elements and by remaining faithful to the inherent texture of the materials, employing primitive and natural forms. The entire structure appears organic, seamlessly blending with its surrounding environment. The combination of colors and the rough texture impart a sense of purity, as if there is a cleansing power that purifies the soul (Gössel, 2007).

Another example of Brutalist architecture that falls into this category is the Cultural Center of The Philippines (see Figure 47). It was designed by Architect Leandro V. Locsin in 1966. The theater's form is simple, strong, and precise (Beanland, 2016). A massive, rectangular block of concrete floats in the air. Curved supports carry its weight with an almost effortless grace, creating the illusion of weightlessness. This effect is further heightened by the structure's mirror image in the octagonal pool beneath.

Throughout the building, stark contrasts abound—its dimensions are both imposing and ethereal, playing with light and shadow, smooth surfaces juxtaposed with textured ones. The sweeps and hollows within beckon visitors to explore, fostering an impression of interconnected spaces (Elser et al., 2017).



Figure 47: Cultural Center of The Philippines (Locsin, 1966).

Whether in the form of simple geometric blocks or free-flowing curves, their structural simplification accentuates the texture of the architectural surfaces. The interplay of light and shadow elevates the interest of basic positive and negative shapes. Sometimes, it is precisely this honest design approach to the form itself that best highlights the raw and primal sense of minimalism and purity. In China, there is a saying "大道至简" (Great Truths Are All Simple), and here it aptly describes this type of architecture.

2.1.2.2.4. Expression of Structure

Architects also developed new ways to construct with concrete. The Nordic Pavilion for the Venice Biennale, which was designed by Sverre Fehn in the 1950s (see Figure 48 & 49), is a good example of a new way to construct with concrete. Under the semi-transparent roof, Sverre used a lattice of fine, cast *béton brut* concrete joists spanning the space (Henley, 2017). Traditionally, this structure should be made of timber, but the use of light-colored cement makes the whole space more integrated, creating a sense of lightness and solemnity with the cooperation of the skylight.



Figure 48: The Nordic Pavilion (Sverre Fehn, 1956).



Figure 49: The Nordic Pavilion (Sverre Fehn, 1956).

Another architect, Kenzo Tange, also developed a way to construct with concrete on a higher level. “The wood-like character of Japanese concrete” is very well illustrated in his two works: the Communications Centre in Kofu and the Kagawa Prefecture Office Building in Takamatsu (see Figure 50 & 51).

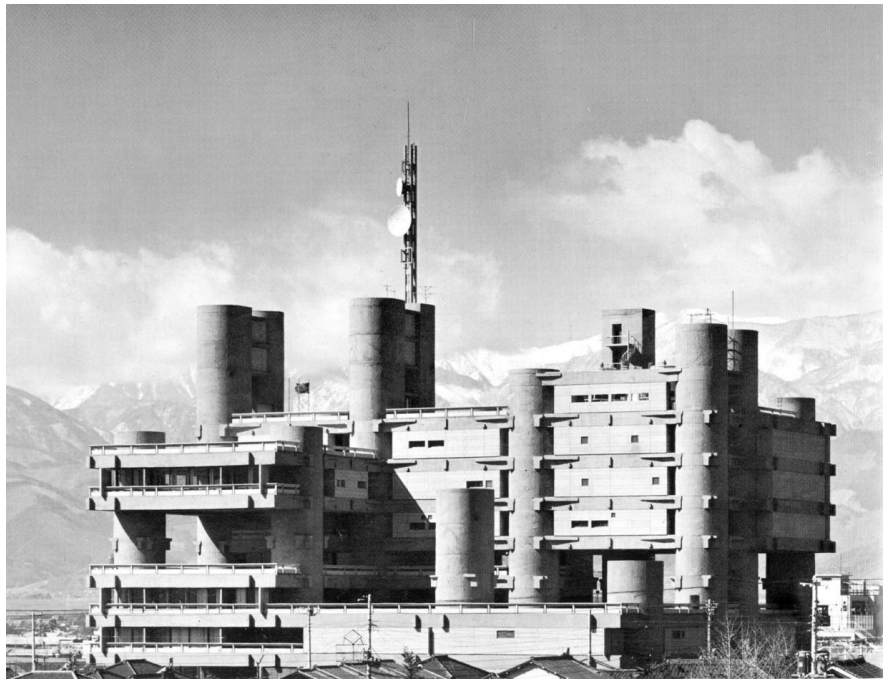


Figure 50: Kagawa Prefecture Office Building (Tange, 1958)



Figure 51: Communications Centre in Kofu (Tange, 1962)

Kenzo quite literally transfers the timber post-and-beam assembly of traditional Japanese carpentry into a concrete order (Henley, 2017). This oriental mortise and tenon structure, which was originally made of wood, gives Brutalism a different and delicate aesthetic feeling. The hollowed-out structure also balances the thickness of the cement, adding a sense of lightness and transparency.

2.1.2.3. Key Figures & Works

2.1.2.3.1. Le Corbusier



Figure 52: Le Corbusier (Britannica,, n.d.).

Le Corbusier (Figure 52) was a Swiss-born French architect and city planner. Le Corbusier was the first architect to make a studied use of rough-cast concrete, a

technique that gave his work a distinctly sculptural, expressive quality. One of his later works, the Unité d'habitation (see Figure 53), is one of the most famous Brutalism architectures in history. His government buildings in Chandigarh, India, with their enormous concrete sunshades, sculptural facades, and swooping rooflines, represent the first large-scale application of his city-planning principles. Le Corbusier's many works, plans, and writings inspired later avant-garde architectural experiments worldwide (Britannica, n.d.).



Figure 53: the Unité d'habitation (Corbusier, 1952).

This building is not the most eye-catching Brutalist architecture, but it is one of the

most famous Brutalism works. The Unite was built between 1947 and 1952. The building is well known for its scale, pilotis, rues intérieures and 'cross-over' apartments (Henley, 2017).

2.1.2.3.2. Alison & Peter Smithson

The partnership of wife and husband Alison (1928-1993) and Peter Smithson (1923-2003) led to British Brutalism in the second half of the 20th century. They were among the first to question and challenge Modernist approaches to design and town planning, and they helped evolve the style into what would become Brutalism. The Smithson's design philosophy helped shape the core principles of Brutalism: low-cost modularity, material focus, and purity. And the most important: buildings that reflected their inhabitants and location, ones that fostered community—Modernism with a Human Face.



Figure 54: Alison & Peter Smithson (Gatley & King, 2017)

Their designs included the headquarters of the Economist, the British Embassy in

Brasilia, a new building at St Hilda's College of Oxford University, and a plastic, mass-produced house for the 1956 Ideal Home Exhibition. Then they started 1972's Robin Hood Gardens design. They wanted to use their "streets in the sky" and the efficiency and density of Le Corbusier's housing blocks, on the Victorian slums (Figure 55). However, due to its structural problems and a crippling crime rate, this became the end of their public career. But from a Brutalism standpoint, it is still an iconic architecture in history (Beanland, 2016).



Figure 55: Robin Hood Gardens (Smithson & Smithson, 1972)

2.1.2.3.3. Ernő Goldfinger



Figure 56: Ernő Goldfinger

Ernő Goldfinger is a Hungarian-born architect. He is an important but controversial figure in the British Modern Movement. He strongly supported Le Corbusier's ideas that high-rise housing was the solution to Britain's post-war housing problems, which earned him a polarized evaluation from society. Goldfinger's most recognized social housing project is Trelick Tower (Figure 57) in North Kensington, London. The building is typically Brutalist, with influences from Le Corbusier's style also visible. Also, influenced by Auguste Perret, the French architect who was among the first to champion reinforced concrete, Goldfinger believed that architects should 'expose' elements of their buildings: structural honesty.



Figure 57: Trellick Tower (Goldfinger, 1972)

2.2. Furniture Design in Mid-20 Century

During the Modern movement, Modern furniture and Modern architecture originated almost during the same period of time, and modern architects often needed furniture that was compatible with their architecture design. However, the existing furniture on the market was far from a modern style, and a lot of architects had to design it themselves. Later on, this furniture started to be offered to the broader consumer market and then became popular (Mácêl, 2012).

Also, the economy began its recovery, and new materials and technologies emerged. Additionally, the growing demand for affordable furniture led to the advent of simple, flush surfaces, and undecorated designs (Sparke, 1986). The prevalence of factories and mass production further encouraged interchangeable standardized components.

In the mid-20th century, extensive exploration of new styles, forms, and materials resulted in a diverse landscape of furniture design. In this section, I am focused on furniture design related to International Style and Brutalism. This exploration includes an investigation into the relationships between architectural and furniture styles, exploring possibilities for transformation. It also considers whether, in the absence of discussing functionality, pairing furniture and architecture of the same style enhances harmony.

2.2.1. International Style Related Furniture Design

2.2.1.1. Steel Furniture

Charlotte Perriand (1929), co–designer of Le Corbusier’s tubular furniture, said: “Metal plays the same role in furniture as cement in architecture. It is a revolution. A new lyric beauty regenerating by mathematical science” (p.1). The strength and appeal of steel make it very popular in furniture design. A lot of Bauhaus designers use steel in their chair designs. The design philosophy behind it is very similar to International Style architecture.

The “father” of Modern functional design, Marcel Breuer, designed his first steel furniture: a fauteuil called the Wassily chair in 1925 (see Figure 58). It is one of the most famous products of Bauhaus school.



Figure 58: Wassily Chair (Breuer, 1925)

It embodies the use of industrial materials and the bendable steel makes a continuous tube line possible, which can lead to a closed yet transparent shape.

In modern interiors, furniture was not allowed to become a visual and physical obstacle in the space. Known are the lyrical words by Breuer (1928) about the spacious effect of the tubular furniture, as “Airly pierced, drawn, as it were in the space” (p. 11). It is very similar to the idea from International Style of creating weightless and geometrically bound volume with isolated supports and glasses. The tubular steel is the skeleton, and the thin leather becomes the continuous surfaces.

From the function standpoint, the leather pieces stop the body from contacting steel structures. and they support the human body in almost every necessary part: lower back,

higher back, and arms. The design is very pragmatic, with no extra parts. Breuer described this fauteuil as “meist maschinenmässig”, which means the most machine-wise (Sparke, 1986). It has a most complex arrangement of parts, and the tubular steel structure not only expresses the stability of the chair, but also the beauty of a piece of complex and sophisticated machines.

The next example of steel furniture is the Easy chair (see Figure 59), designed by Poul Kjærholm, a furniture designer who focused on combining steel and natural materials.

The frame is made from spring steel. Two long cuts and a small number of bends shape each of the two steel profiles. The angle of the undercarriage is mirrored in the angle of the upper section (Dybdahl, 2018). The regularity of steel bending angles and parallel patterns of rope weaving reminds me of the characteristics of International Style architecture. The dark tone color of the steel frame visually reduces the attention and volume, and also harmonizes with the earth tone of the rope weaving surfaces.



Figure 59: PK25. Easy chair (Kjærholm, 1951).

Just like the Wassily chair, the steel structures as well as the gaps between ropes provide open spaces for people to see through, which visually increases the space of the interior. International Style architecture uses isolated support in the middle of the building to achieve the same goal. When placing furniture like this inside of International Style buildings, the effect will definitely be maximized (Dybdahl, 2018).

The next example is the Barcelona chair (Figure 60), which is designed by the famous international style architect, Ludwig Mies van der Rohe.



Figure 60: Barcelona Chair (Rohe, 1929)

Mies combined chromed flat steel and leather together, expressing the simple yet luxurious look. The use of flat steel minimizes the profile of the sideview, which creates a floating visual effect. The leather with square tufting patterns is borrowed from Art Deco, and it balances the cold, serious vibe from the steel frame very well (Dybdahl, 2018).

The wire chair is another exploration of the use of steel. The DKR Chair by Charles and Ray Eames (see Figure 61), Diamond Chair by Harry Bertoia (Figure 63), and the K2 chair by Verner Panton (Figure 62) are the most representative designs in this

category.

These three chairs are all pushing the idea of floating to the maximum. Besides some padding, the whole forms are made of steel wires. It is like pulling out the skeletons from traditional chairs, visually weightless, but structurally solid. As Bertoia (1952) said about wire chairs, with their floating net, these chairs were “mainly made of air”, and space passes right through them. This type of wire net structure is probably the ultimate form of international steel chair (Dybdahl, 2018, p.53).



Figure 61: DKR chair (Eames & Eames, 1951).



Figure 62: Diamond chair (Bertoia, 1952).



Figure 63: K2 Chair (Panton, 1959).

2.2.2. Brutalism Related Furniture Design

Even though Brutalism and International Style were all developed in the mid-20th century, and they are both derived from modernism movement and functionalism, people paid less attention to designing matching furniture for Brutalism architecture.

The main reason is probably because fulfilling functions is the priority of the period when it comes to design. Aesthetic looks or decoration purposes are acceptable if they are the byproduct of achieving functions since the principle of Modernism is promoting ideas from technology, factories, practicality, and usefulness.

When it comes to Brutalism architecture, the raw texture, the gigantic form, the geometric shape, and the expression of the structure are reasonable because these characteristics are formed based on functions. However, when it comes to Brutalism furniture, using real concrete as the material will be so heavy to move around; being gigantic will not be practical for use. Straight transferring of the principles from Brutalism architecture to furniture design is not ideal at all. Hence, it makes sense that there was not a lot of exploring on it during that period.

A lot of furniture pieces are labeled with Brutalism, but they do not show the characteristics of architecture; instead, they only express the philosophy of Brutalism.

Paul Evans, an American furniture designer and sculptor, became a major player in the American craft movement of the 1960s and 70s, which coincided with the proliferation of Brutalist architecture. The term Brutalist was foisted on him by critics and patrons even though his artistic aims never overlapped with the more practical intent of Brutalist architects (Carpenter & Louw, 2020).

His works are mostly focused on cabinets. His skyline cabinet (Figure 64) and wall-mounted faceted cabinet (Figure 65) are very representative.

The skyline cabinet has repeating, sharply angled geometry and raw, unpolished

edges. To me, it is more like a piece of sculpture rather than a functional piece of furniture. Every element is composited by intuition. Rough-hewn structures and layered, patchworks of metal expressed the wildness and rawness of Brutalism.



Figure 64: Skyline cabinet (Evans, 1966).



Figure 65: Wall-Mounted Faceted cabinet (Evans, 1975).

In Evans's Wall-Mounted Faceted cabinet, he used walnut burl to create this rusty metal look, and if you look closer, those geometry shapes are actually polished. The natural pattern of walnut burl magically become more "industrial" than real metal.

However, even though we can see some similarities between Evans' furniture and Brutalism buildings, the key differences still remain: The functionalism part of Brutalism is long gone.

Brutalism in furniture design in the 20th century is like postwar architecture—angled, blocky, geometric, graphic, and raw—riffing from the architecture but without recreating it. Some designers believe that the difficulty in defining Brutalist design is because it has many intersections with modernist and even industrial-style objects. It is like the "unruly offspring" of modernist aesthetics and industrial materials, which went further on the path of being rougher, coarser, and honest to the material itself (Carpenter & Louw, 2020).

Nowadays, there is an interior designer called Annabell Kutucu. Even though she didn't claim herself as a Brutalist designer, her works really express the beauty of Brutalism. The furniture pieces she chose to put in her interior projects really balanced the aesthetic and functions and blended into the space very well.

In her Penthouse Apartment design, Apartment 59, the warm and earthy color that she widely used really offers a feeling of home, somewhere you can truly relax. A lot of Brutalism architecture is hated due to its coldness and cruelty. But in Kutucu's design, the color change completely reverses this feeling (Figure 66). At the same time,

the extensive use of the same color system magnifies the details and textures of the home (Figure 67 & 68).

Natural materials like wood, travertine, bronze, and rough linen fabrics bring out the unpolished structure and haptics. The whole space has a sense of calmness.



Figure 66: Apartment 59 (Kutucu, 2022)



Figure 67: Apartment 59 (Kutucu, 2022)



Figure 68: Apartment 59 (Kutucu, 2022)

Chapter 3. Guidelines

In the process of researching and investigating mid-20th-century architecture and furniture, a tight connection between Internationalist architecture and contemporary furniture design can be easily observed. Many modernist architects also designed corresponding furniture for their architectural creations. This relationship is evident in the design language and logic, exemplified by the aforementioned close connection between steel furniture and internationalist architecture. It can be asserted that among the architectural styles of the mid-20th century, Internationalist Architecture has conducted a lot of research and guidance in the field of furniture design and has mature systems and processes.

As for Brutalism, it was also an architectural style developed during the Modernist movement. However, there is limited research on translating its architectural features into furniture design and unifying the interior and exterior styles of this type of building. Among the few pieces of Brutalist furniture that exist, designers tend to focus only on expressing the philosophy of Brutalism itself and have limited contact with the appearance of Brutalist architectural style.

It has been suggested from previous furniture research that the extensive decorative detailing found on many pieces labeled "Brutalist" may be similar to the warehouse-style pieces of Brutalist pioneers Alison and Peter Smithson, but the architectural style is very different.

Therefore, in this guideline, I will focus on applying the characteristics of Brutalist architecture to furniture design, aiming to achieve a harmonious unity of architectural and furniture styles both inside and outside. This guideline primarily provides guidance on the aesthetic aspects, without delving into the ergonomic aspects of furniture design.

3.1. Materials & Surfaces

When it comes to the Brutalist architectural style, the most impressive thing about it is its use of materials and its treatment of surfaces. When designing Brutalist furniture, functional and aesthetic considerations greatly influence the choice of materials and surface treatments. In many cases, the use of different materials in combination with each other is more responsive to different functional needs.

3.1.1. Choice of Material

This section will provide designers options of materials that can emphasize Brutalist style the most.

3.1.1.1. Traditional Concrete

Pouring concrete into formworks is the traditional method in building construction. Due to the physical properties of cement itself and reinforcements inside, it is not easy to post-process it after casting, so it is best to pour and mold at once.

Conventional cement casting also requires internal reinforcement and aggregate reinforcement, so the finished product will weigh a lot. There is also a risk of breaking

and cracking later.



Figure 69: Pouring Cement (Gage, 2018).

3.1.1.2. Resin-cement hybrid material

Epoxy resin is lighter in weight for the same volume, and because of its material properties, it has strong physical and mechanical properties after solidification. After being fully mixed with cement and solidified, it will show the color and texture of cement. At the same time, this composite material does not need to be reinforced and connected internally with steel bars and aggregates as in traditional poured cement, thus reducing the weight significantly.

When making this composite material, if it is large in size, foam or wood can be used as a filler inside, thus reducing the overall weight and resin consumption. When working with this material, molds need to be made. If there is a need for special shapes or textures, designers can choose the silicone turnover molding method, which is a one-time molding process. There is also the option of finishing with woodworking methods

at a later stage.



Figure 70: Pouring Resin-cement Mixture.

3.1.1.3. Cement board

Cement board is usually made from cement and reinforced with a fiberglass mesh. It is a waterproof material and is also available in different thicknesses. When using it, designers need to use a wooden board as the internal support, and then use screws to fix the cement board to the wooden board, which can reduce the weight and enhance the strength of the board. Finally, cement board tape is used to cover all the edges and then a thin layer of cement skim coat product is applied to the surface of the cement board to obtain a flat cement surface.

Due to the physical properties of cement board, this method is suitable for

geometric structures rather than curved shapes.



Figure 71: Cement Board Attached to Wood Frame.

3.1.1.4. Wood

The only requirement when it comes to choosing wood type is about wood grain. Wood species with fine grains are preferred since they will not detract too much attention from the form and surface textures. The grain directions of the chosen wood will affect the furniture visually and structurally. The form will be visually extended in the grain direction. Wood is also much stronger following the grain directions.

3.1.1.5. Metal

Sheet metal, metal rods, and tubular steel can be added to furniture designs to add textural richness. Surfaces need to be matted or textured to integrate them into the overall design. Delicate and polished surfaces must be avoided.



Figure 72: Hammered Steel (*Hammered Texture*, n.d.).

3.1.2. Surface Patterns

In this section, surface patterns and textures for different materials will be provided for designers to use when designing Brutalist Furniture.

3.1.2.1. Wood Grain Texture

Wood grain texture was widely used in Brutalist architecture. The w texture is a

by-product of pouring cement into the wood formwork. The granular effect can be enhanced by sandblasting the formwork or soaking the wood in water or a weak ammonia solution. It is best suited for the traditional cement materials mentioned above. If wanting to use it as a resin-cement mixture, it can only be achieved by molding and pouring.



Figure 73: Cast Concrete Texture (*Wood Grain Left in a Concrete Wall | GL Barnhart Construction ...The Blog, n.d.*)

3.1.2.2. Concrete "Corduoy"

This surface texture was proposed by Paul Rudolph, a famous architect who graduated from the Auburn University School of Architecture. The texture was created by pouring concrete with vertical ribs and roughening the striped surface by hand hammering. This technique is a form of preemptive destruction. It masks weathering and enhances the Brutalist aesthetic. The texture is not very aggressive when it is applied on walls, but it is not suitable for tabletops or seating surfaces when using it on furniture.



Figure 74: Corduroy Texture (Rudolph, 1962)

3.1.2.3. Undulating Surface

Originally, the deformed, undulating surface was an imperfection which was caused by hydrostatic pressure. However, it gives the cement surface a soft, fabric-like texture. This type of texture can be found in many Brutalist buildings. It can be achieved during the regular concrete casting process. However, if wanting to create this texture on resin-cement mix, cement board, and wood, grinding and sanding are the way to go. Similar effects can also be achieved on sheet metal through hammering.



Figure 75: Azuma House (Ando, 1975)

3.1.2.4. Tie Hole Texture

Tie holes are where concrete ties are left to hold the formwork together in preparation for pouring concrete. This particular texture, which only appears on poured cement walls, is usually kept as marks of craftsmanship in Brutalist architecture. Hence, creating the same texture in furniture will strengthen the connection to Brutalist architecture. This texture can be applied to traditional cast concrete, resin cement

composites, and cement board.

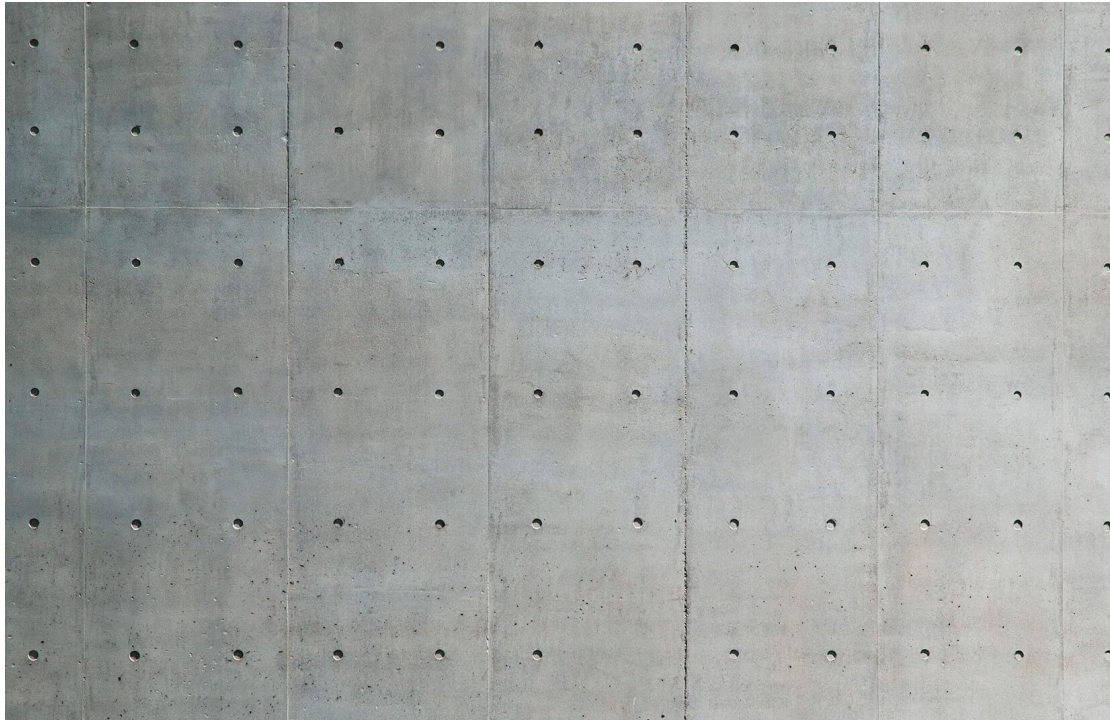


Figure 76: Tie Hole Texture (*Concrete Wall with Tie Hole Texture*, n.d.)

3.1.2.5. Ratio of Coarse to Fine Aggregate

By adjusting the proportion of coarse and fine aggregate, different levels of surface roughness can be obtained. This method is suitable for traditional cast cement and resin cement composite materials. This method can highlight the texture of cement, but it will add more weight and make post-processing more difficult.

3.1.2.6. Wood Surface Texture

When applying texture to wood surfaces in Brutalist furniture design, it is best to cover the whole face of wood instead of small patches. There are many techniques of creating texture on wood; here I will introduce some of them that suit the Brutalist style. Also, all of these textures below can be applied to resin-cement mixture material by

molding and casting.

3.1.2.6.1. Carving Gouge

Though passes generally work best cross grain, working parallel to the grain is possible with care. If an extra-deep groove is needed, multiple passes may be required. With firm footing, use both hands to control the gouge. Shallow grooves can feel quite delicate, while deep grooves are a very dramatic addition to a project.



Figure 77: Groove Texture (Brown, 2013).

3.1.2.6.2. Router

Works with all woods, and in many different situations. Can add very dramatic texture over a small or large surface. If a circle-cutting jig is used, circular grooves can be added in a geometric pattern. A template guide and bandsaw template can be used to cause the router to follow certain paths, creating various effects. Adjusting the type of

bit, depth of cut or number/density of passes can create heavy or light texture. There are lots of texturing possibilities with a router.

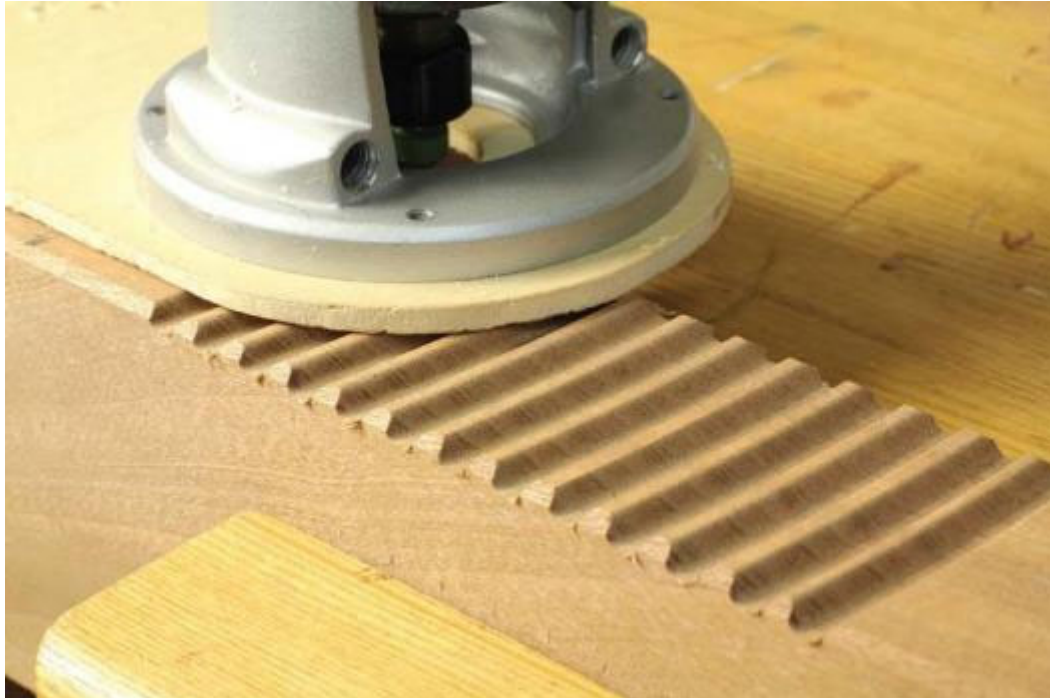


Figure 78: Router Carving (Brown, 2013).

3.1.2.6.3. Angle Grinder

Much less subtle than many other forms of texture. Best for medium to large areas but can be used on small areas as well. A heavily textured, wavy surface is left. Slightly different surfaces can be produced using different cutting attachments or manipulating the grinder certain ways.



Figure 79: Grinding (Brown, 2013).

3.1.2.6.4. Dremel

Textures can be added on softer woods. Great for texturing smaller areas. Very time consuming for large area covering due to the small size bits.

3.1.2.6.5. Yakisugi

Yakisugi can be literally translated as “burned cedar”. It has been used as a traditional method to protect timber siding surfaces and create a darker color. Designers should use a torch to evenly burn the surface of the wood, and then use steel wool to sand out the ash, and finally, wood finish to seal the surface. This method can create a darker color which can be adjusted as it is sanded.

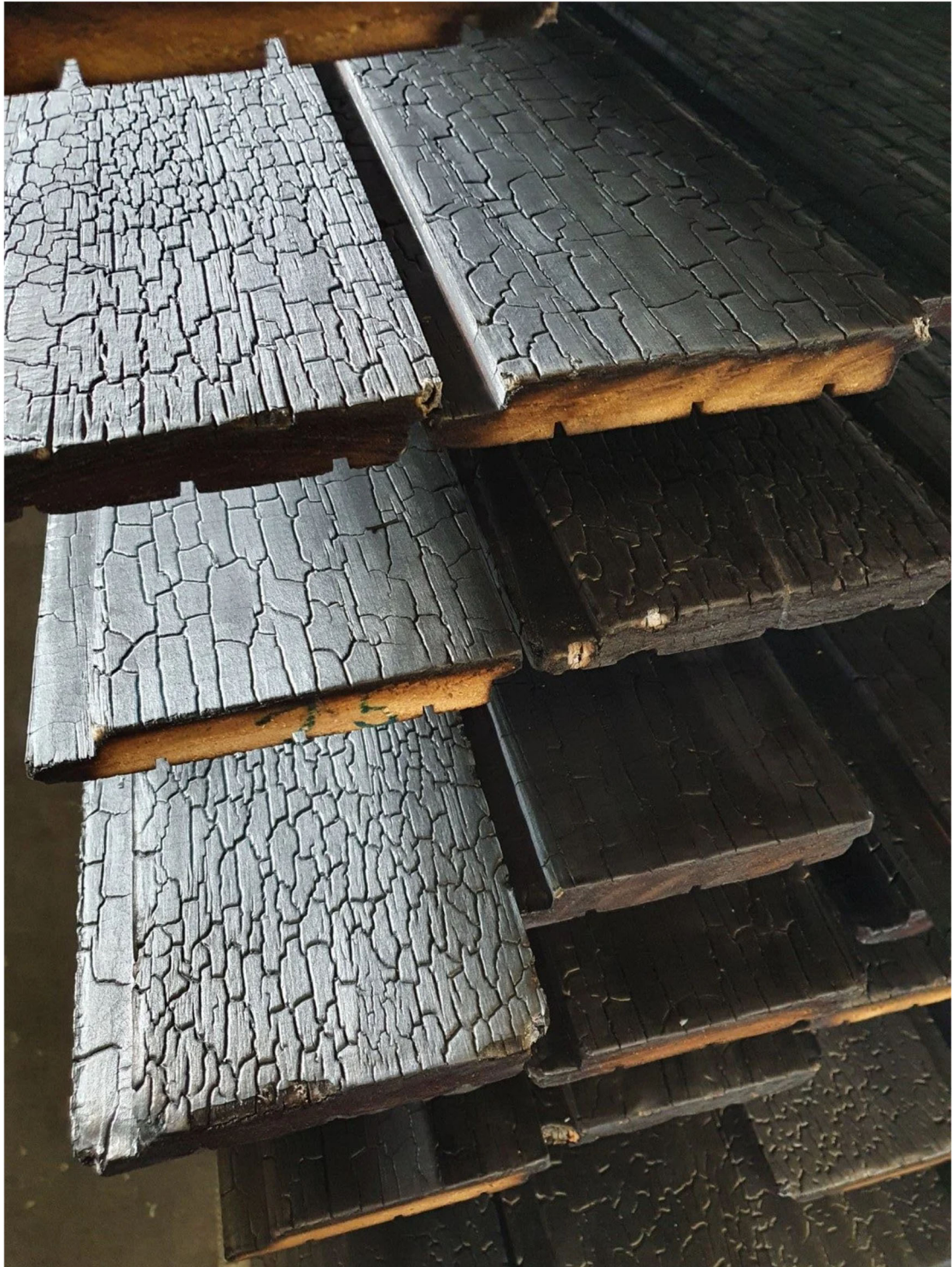


Figure 80: Yakisugi (“Yakisugi (Shou Sugi Ban),” 2020)

3.1.2.7. Steel Cold Bluing

Cold bluing is usually applied on firearms to prevent rusting from small scratches.

Bluing solutions contain selenium dioxide, and it works by depositing a coating of

copper selenide on the metal surface. This method will give a steel surface a grayish-blue color, which is perfect for Brutalist design. This treatment is especially good for hammer-textured metal surfaces since different depths will have different degrees of bluing, which can add more interest to the overall design.



Figure 81: Steel bluing (Blacktail Studio, 2023)

3.2. Color Palette

Because most Brutalist architecture is purely made of concrete or granite, the colors are different shades or tones of gray color. When it comes to furniture design, only using gray colors will make interiors look like a factory instead of a home where people should feel cozy and relaxed. Hence, strictly mimicking the color theme from Brutalist architecture is not ideal. Here are some basic rules that designers can follow and come

up with their own color theme.

- At least 80 percent of colors on one furniture piece should be gray, but tones and shades can be varied.
- Earthy and warmer colors can be applied in the remaining 20 percent to balance the cold tone of grey.
- Colors that are too bright will attract too much attention and break the harmony.

Here are some color palette examples:



Figure 82: Color Palette

3.3. Form

Based on the research and analysis of Brutalist architecture, this section will provide designers with form and structure choices when applying the Brutalist style to furniture. I divided the form styles into two main types based on the way they are constructed.

3.3.1. Single Form

- The overall look is a geometric block or an organic block, with a small amount of sunken or protruding structure to add interest. The form is relatively simple, and the main emphasis is the surface texture. When using this type of form in furniture design, it can emphasize the sense of volume and highlight the texture details. Reference pictures are generated by using prompts and blending in Midjourney.



Figure 83: Single Form (Zhu, 2023)

- The surface has repetitive hollow patterns, protruding patterns, and other patterns formed by the repeated use of simple blocks and structures. This type of form is better for small projects due to their complexity of. Molding and casting are probably the easiest method to achieve this result. Reference pictures are generated

by using prompts and blending in Midjourney.

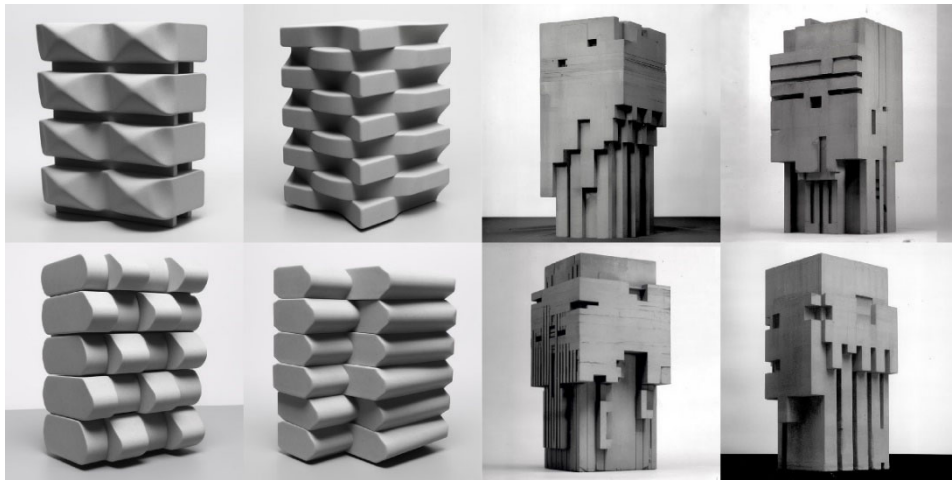


Figure 84: Single Form 2 (Zhu, 2023)

3.3.2. Multi-body Form

- A structure formed by the fusion of multiple geometric bodies of different sizes.

This type of structure is like playing with Lego, so it can be easily arranged for achieving different functions. Reference pictures are generated by using prompts and blending in Midjourney.



Figure 85: Multi-body Form (Zhu, 2023)

- Stacking and connecting geometric forms like beams and columns, emphasizing the traditional wooden house structure. Reference pictures are generated by using prompts and blending in Midjourney.

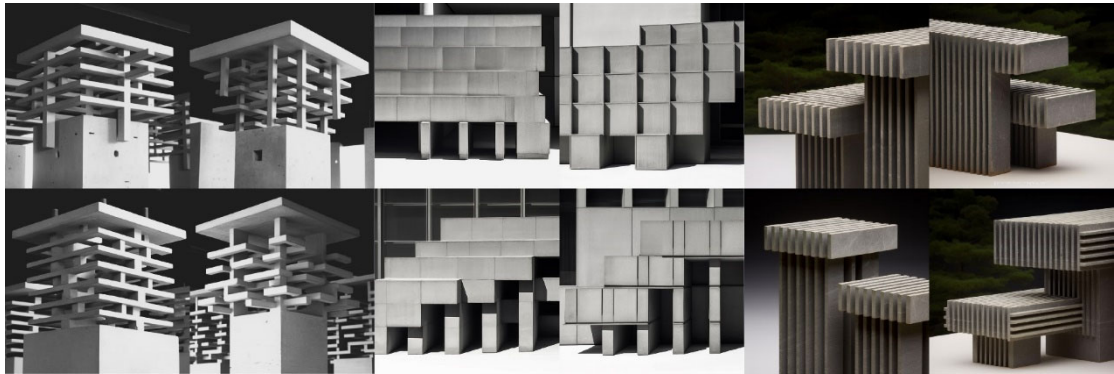


Figure 86: Multi-body Form 2 (Zhu, 2023)

- A complex structure formed by repeated units with similar shapes and characteristics. Habitat 67 and Nakagin Tower are great examples of this type of structure. In furniture, it is similar to modular design. By only making one mold, designers are able to cast as many units as they want to form different furniture. Reference pictures are generated by using prompts and blending in Midjourney.

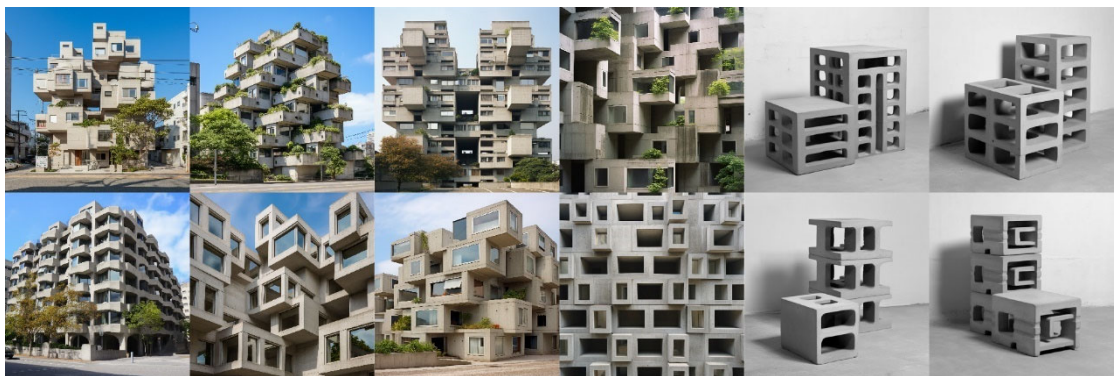












Figure 87: Multi-body Form 3 (Zhu, 2023)

3.4. Guidelines Form







The images following are the visual representation of the guidelines.

MATERIALS		
Pouring Concrete	Resin-Cement Mixture	Metal
		
Cement Board	Wood	
		

SURFACES		
Concrete		
Wood Grain	Corduroy	Undulating Surface
		
Tie Hole Marks	Ratio of Aggregate	
		

Wood		
Gouge	Router	Grinder
		
Dremel	Yakisugi	
		

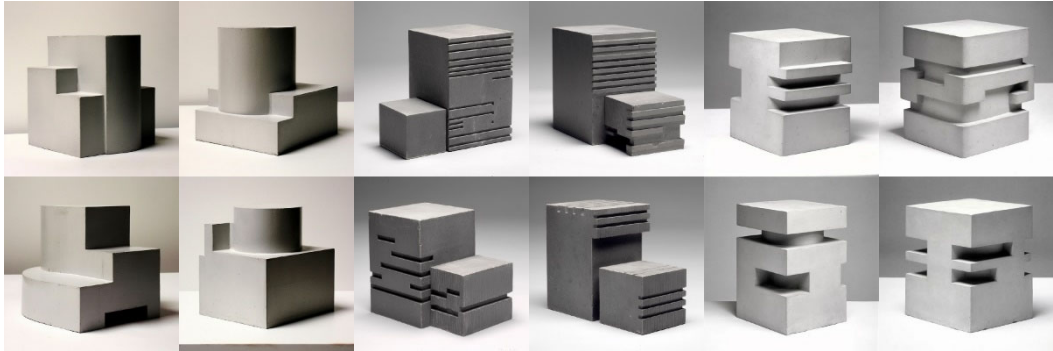
Steel
Cold Bluing


COLOR PALETTE	
	
	
	

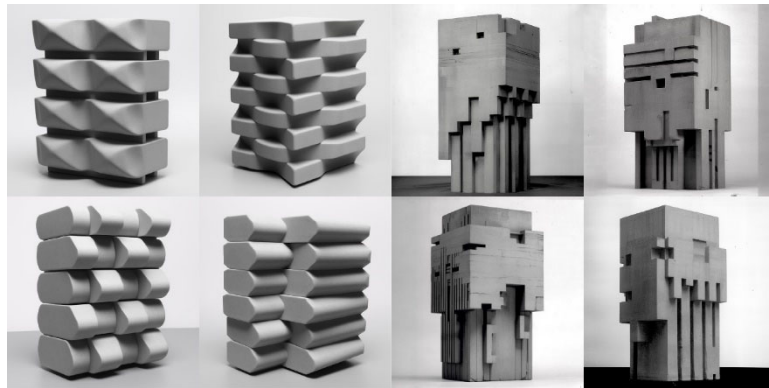
FORMS

Single Form

Random Details



Repetitive Patterns

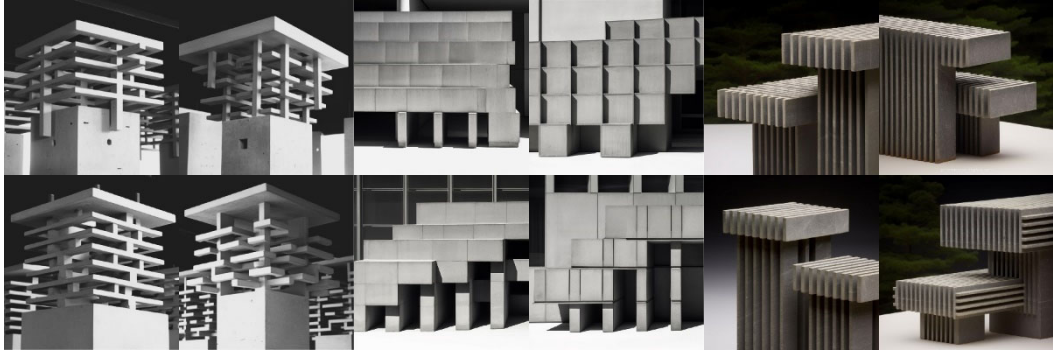


Multi-body Form

Geometry Blocks



Stacking Structures



Repetitive Units



Figure 88: Guidelines Form

Chapter 4. Application

4.1. Planning

In this chapter, design decisions will be made based on the guidelines. The goal is to design and build a Brutalist style bench.

4.1.1. Materials Choices

Since the main function of a bench is for people to sit, the surface of the seating plane needs to be durable and comfortable to sit on. Mahogany is the chosen material for this task, and its warm, reddish-brown color can balance the cool gray tone of concrete. For the supporting sections, cement boards with wood cores would be a great choice to reflect the characteristics of the Brutalist style. The lighter weight compared with traditional concrete makes it easier for users to move around.

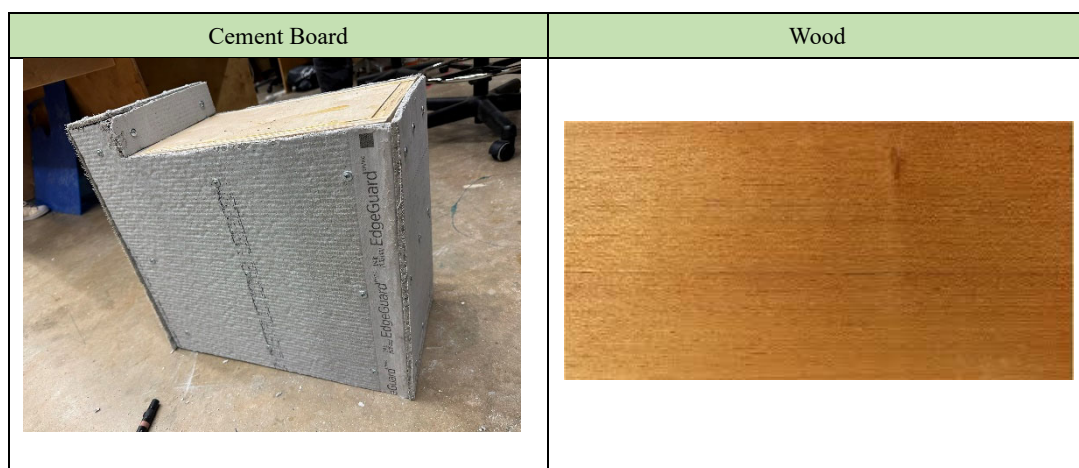


Figure 89: Materials

4.1.2. Form Choices

The structure of a bench can be simplified as a seating surface and support structure.

Using multiple geometric bodies of different sizes to fuse a multi-body form is a good choice to achieve the functions of the bench and emphasize the aesthetic of Brutalism. A larger primary seating area and a smaller secondary seating area can add more interest to the picture.

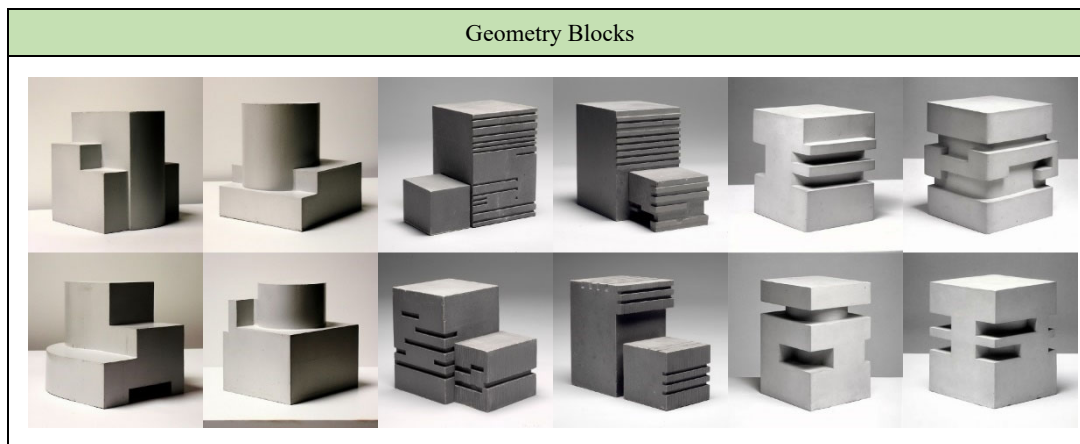


Figure 90: Forms

4.1.3. Texture & Color Choices

The main focus should be the primary seating surface. Hence, using a gouge to create shallow groove textures to the surface can bring more interest without reducing the comfort of sitting. Finally, applying the Yakisugi method to burn and seal the wood will give the wood a dark color, which can highlight the groove texture on top.

For the secondary seating area, finishing with a wax coating to keep the original warm tone color, which is about 30 percent area of the whole bench, will balance the gray and black color from the rest.

Concrete supporting parts will maintain the cool gray color and the natural texture from the skim coating, emphasizing the raw, unpolished, and aging look of Brutalism.



Figure 91: Color Palette

4.1.4. Ideation & Final Decision

After trying different combinations, the final decision is made. This design has three sections, which offer two seating areas. Instead of using one single block of wood like the primary seating area, the secondary seating area is formed with multiple similar blocks to add interest. This area can also be used for placing items. The design also allows the bench to be taken apart for moving. Reference pictures down below are generated using prompts and blending tools in Midjourney.

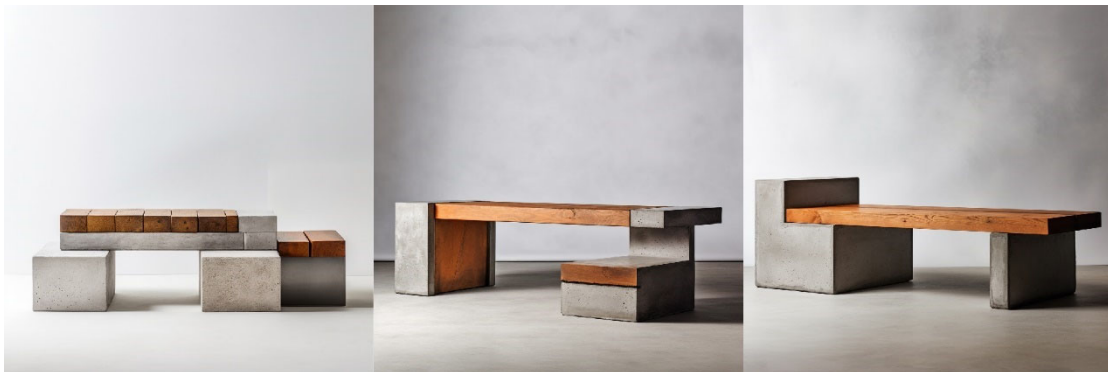


Figure 92: Ideations (Zhu, 2023)

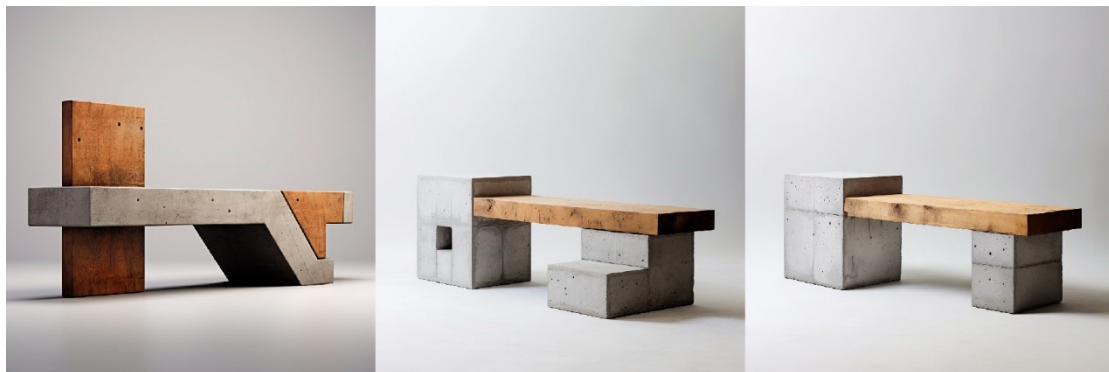


Figure 93: Ideations 2 (Zhu, 2023)



Figure 94: Final Rendering.

4.2. Manufacture Process

This section will go through the building process of this bench design.

4.2.1. Building Inner Core for Concrete Support

To build the inner core, plywood was used to build a hollow form of the support sections. This will be the core for the cement board to attach.



Figure 95: Gluing Plywood.

4.2.2. Attaching Cement Board

This image shows cutting cement boards to exact shapes and screwing them to the plywood surfaces. The skim coat of cement can be applied to cement board later.



Figure 96: Attaching Cement Board.

4.2.3. Apply Cement Board Tape

Applying cement board tape on top of the surface can prevent the skin coating from cracking.

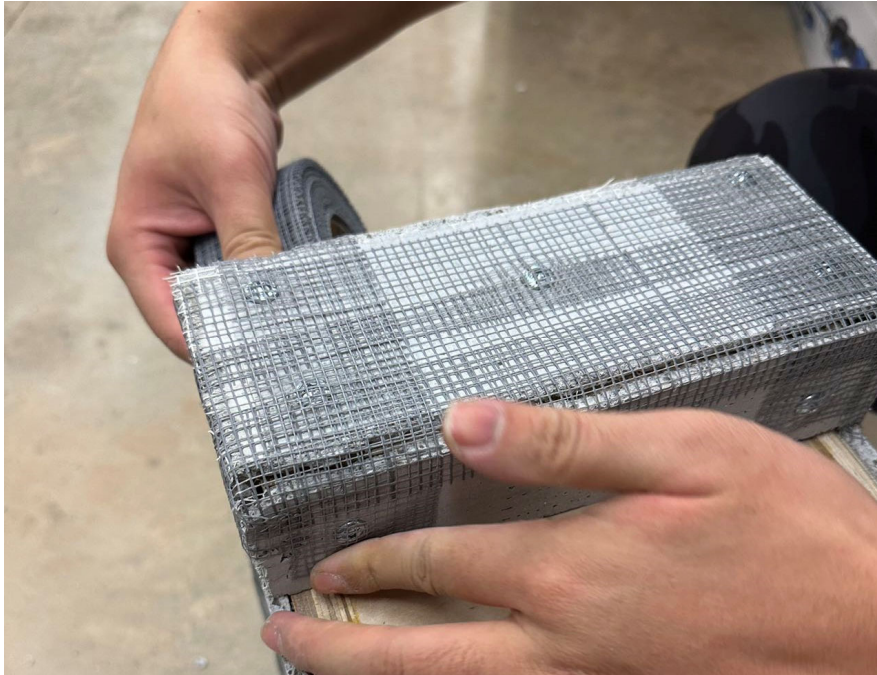


Figure 97: Putting on Cement Board Tape.

4.2.4. Apply Cement Coating & Sanding

Based on the plan, texture will not be applied to the cement surface. Hence, there is no special requirement for how to apply the cement coat. After the coating is dry, it should be sanded smooth.

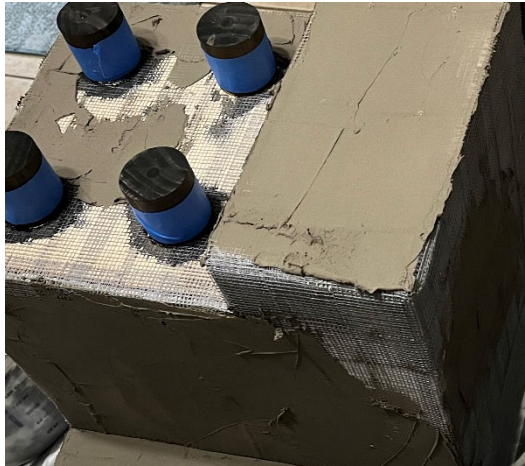


Figure 98: Skim coat the surface.

4.2.5. Process The Wood

This image shows cutting the wood to the size and drilling holes for supporting rods.



Figure 99: Process the wood.

4.2.6. Texture Carving

Figure 99 shows the results of using a gouge to carve groove texture on top of the wood surface. Lightly burning can mark out the areas that have been carved.



Figure 100: Carving wood.

4.2.7. Yakisugi The Surface

The Yakisugi finish is done by charring the wood, cooling it, cleaning by sanding with steel wool and finishing the wood with oil finish.

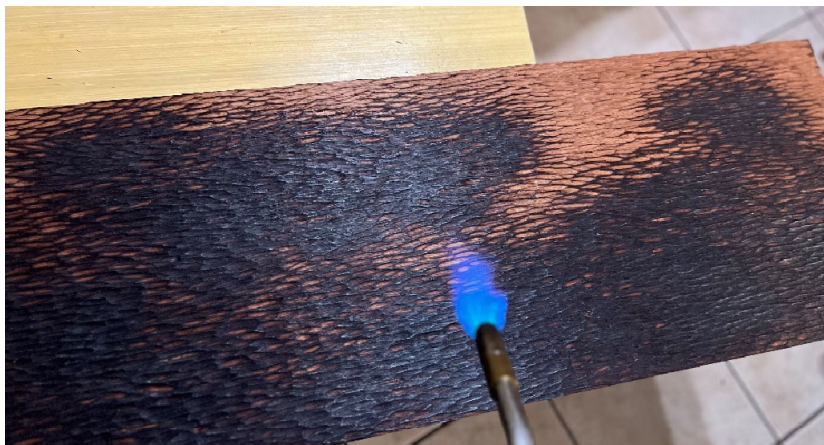


Figure 101: Yakisugi the wood.

4.2.8. Attach Secondary Seating

This image shows installation of wood blocks to the concrete base to form the seating surface.



Figure 102: Attaching the wood seating.

4.2.9. Assembly

Next, the wood seating board is dropped on the supporting rods, which will lock three parts together, forming a stable structure.



Figure 103: Assembly.

Chapter 5. Conclusion

5.1. Conclusion

Through the study of the architectural style of the mid-20th century, especially the Brutalist style architecture, its architectural characteristics are summarized into four parts: rough surface, unusual shapes, expression of structures, and repeating forms. After adjusting and improving these characteristics based on furniture design considerations, guidelines of materials, surfaces, colors, and forms are developed.

By following these guidelines from Chapter 3, a Brutalist style bench was designed and built in Chapter 4. Judging from the results, if it is placed in a Brutalist style building, its style should harmonize with the architectural style very well.

Through this application process, it can be confirmed that these guidelines can guide designers to apply Brutalist architectural style to furniture design.

5.2. Further Research

This thesis is only focused on transferring styles, giving guidelines on materials, forms, colors, and surfaces. However, there are still many considerations that need to be investigated further.

To achieve the harmony between architecture and furniture inside of it, interior design also plays a big role. Transferring Brutalist architecture style into interior design can be something to explore in the future.

REFERENCES

- Aalto, A. (1930). *Turun Sanomat Building, Abo, Finland*.
- Altun, D. (2016). Brutalism Now: Rethinking Brutalism in Contemporary World Architecture. *Arts*, 5, 3. <https://doi.org/10.3390/arts5020003>
- Art & Architecture Thesaurus Full Record Display (Getty Research)*. (n.d.). Retrieved May 16, 2023, from https://www.getty.edu/vow/AATFullDisplay?find=California&logic=AND¬e=&english=N&prev_page=1&subjectid=300265653
- Ando, T. (1975). *Azuma House*. <https://www.metalocus.es/en/news/row-house-sumiyoshi-azuma-house-tadao-ando>
- Atmosphere (architecture and spatial design). (2023). In *Wikipedia*. [https://en.wikipedia.org/w/index.php?title=Atmosphere_\(architecture_and_spatial_design\)&oldid=1180847185](https://en.wikipedia.org/w/index.php?title=Atmosphere_(architecture_and_spatial_design)&oldid=1180847185)
- Beanland, C. (2016). *Concrete concept: Brutalist buildings around the world* (1st Frances Lincoln edition.). Frances Lincoln,.
- Bertoia, H. (1952). *Diamond Chair*.
- Blacktail Studio (Director). (2023, August 10). *My Best Project Ever*. <https://www.youtube.com/watch?v=kLPE5QLz9VY>
- Breuer, M. (1925). *Wassily Chair*.
- Breuer, M. (1966). *The Met Breuer*.
- Breuer, M. (1928). Metallmöbel und moderne Räumlichkeit—DesignWissen, Das

- Neue Frankfurt. *DesignWissen*. <https://designwissen.net/metallmobel-und-moderne-raumlichkeit/>
- Britannica, T. (n.d.). *Le Corbusier summary* | *Britannica*. Le Corbusier. Encyclopedia Britannica. Retrieved June 19, 2023, from <https://www.britannica.com/facts/Le-Corbusier>
- Brown, R. (2013). *12 ways to add texture with tools you already have*. Canadian Woodworking. https://canadianwoodworking.com/techniques_and_tips/12-ways-to-add-texture-with-tools-you-already-have/
- Carpenter, W., & Louw, G. L. (2020). *Brutalist Design—Pamono Stories*. Pamono.Com. <https://www.pamono.com/stories/qu-est-ce-que-c-est-brutalism>
- Chadwick, P. (2016). *This brutal world*. Phaidon Press,.
- Chakhava, C. (1975). *Bank of Georgia*.
- Corbusier, L. (1954). *Ronchamp*.
- Corbusier, L., & Jeanneret, P. (1927). *Single House & Double House at the Weissenhofsiedlung, Stuttgart*.
- Corbusier, L. (2007). *Toward an architecture*. Getty Research Institute,.
- Corbusier, L. (1952). *Unité d’Habitation*.
- Corbusier, L. (1931). *Villa de Mandrot*.
- Corbusier, L. (1931). *Villa Savoye*
- Curtis, W. J. R. (1983). *Modern architecture since 1900*. Prentice-Hall,.
- De Koninck, H. L. (1926). *Lenglet House, Uccle, Near Brussels*.

- Dybdahl, L. (2018). *Furniture boom: Mid-century modern Danish furniture 1945-75* (First edition.). Strandberg Publishing,.
- Eames, C., & Eames, R. (1951). *DKR Chair*.
- Eisler, O. (1926). *Double House, Brno, Czechoslovakia*.
- Eisler, O. (1931). *House of Two Brothers, Brno, Czechoslovakia*.
- Elser, O., Kurz, P., & Schmal, P. C. (Eds.). (2017). *SOS brutalism*. Park Books.
- Evans, P. (1966). *Skyline cabinet*.
- Evans, P. (1975). *Wall-mounted Faceted cabinet*.
- Figini, L., & Pollini, G. (1930). *Electrical House at the Monza Exposition, Italy*.
- Frampton, K. (2020). *Modern architecture: A critical history* (Fifth edition.). Thames and Hudson,.
- Gage, M. (2018, March 14). Laying a Concrete Slab | DIY Projects, Guides and Tips. *DIY Extra*. <https://www.diy-extra.co.uk/laying-a-concrete-pad.html>
- Gatley, J., & King, S. (2017). *Brutalism resurgent*. Routledge.
- Goldfinger, E. (1972). *Trellick Tower*.
- Gössel, P. (2007). *The A-Z of modern architecture*. Taschen,.
- Gropius, W. (1926). *Bauhaus School, Dessau, Germany*.
- Gropius, W. (1928). *City Employment Office, Dessau, Germany*.
- Haefeli, M. (1928). *Rotach Houses*.
- Haefeli, M. E. (1929). *Apartment House in Zurich*.
- Hammered Texture*. (n.d.). Adobe Stock. Retrieved December 6, 2023, from

<https://stock.adobe.com/search?k=hammered+texture>

Helene Sroat. (2005). Brutalism: An Architecture of Exhilaration. *Paul Rudolph Symposium*.

<https://prudolph.lib.umassd.edu/files/pr/Sroat%20Transcription,%20041305.pdf>

Henley, S. (2017). *Redefining brutalism*. RIBA Publishing,.

Hitchcock, H. R. (1966). *The international style*. Norton,.

Kenzo Tange. (1962). *The Communications Centre in Kofu*.

[https://www.google.com/search?q=the%20Communications%20Centre%20in%20Kofu&tbs=isch&tbs=isz:l&hl=en&sa=X&ved=0CAIQpwVqFwoTCPD13fiJx](https://www.google.com/search?q=the%20Communications%20Centre%20in%20Kofu&tbs=isch&tbs=isz:l&hl=en&sa=X&ved=0CAIQpwVqFwoTCPD13fiJxP8CFQAAAAAdAAAAABAI&biw=2031&bih=1048#imgrc=uz4gTzV-wTBuPM)

[P8CFQAAAAAdAAAAABAI&biw=2031&bih=1048#imgrc=uz4gTzV-](https://www.google.com/search?q=the%20Communications%20Centre%20in%20Kofu&tbs=isch&tbs=isz:l&hl=en&sa=X&ved=0CAIQpwVqFwoTCPD13fiJxP8CFQAAAAAdAAAAABAI&biw=2031&bih=1048#imgrc=uz4gTzV-wTBuPM)

[wTBuPM](https://www.google.com/search?q=the%20Communications%20Centre%20in%20Kofu&tbs=isch&tbs=isz:l&hl=en&sa=X&ved=0CAIQpwVqFwoTCPD13fiJxP8CFQAAAAAdAAAAABAI&biw=2031&bih=1048#imgrc=uz4gTzV-wTBuPM)

Kjærholm, P. (1951). *Easy chair*.

Kranz, J. (1929). *Café Era in Brno, Czechoslovakia*.

Kurokawa, K. (1972). *Nakagin Capsule Tower, Tokyo, Japan*.

Kutucu, A. (2022). *Annabell Kutucu—Apartment 59*.

<https://annabellkutucu.com/apartment-59>

Kysela, L. (1929). *Bata Shoe, Prague, Czechoslovakia*.

Lasdun, D. (1960). *National Theatre in London*.

Lehr, J. W. (1929). *Volksstimme Building, Frankfurt, Germany*.

Locsin, L. (1966). *Cultural Center of The Philippines*.

Mácêl, O. (2012). Modern Architecture and Modern Furniture. *Docomomo Journal*, 46,

14–19. <https://doi.org/10.52200/46.A.9RK52TG1>

Oud, J. J. P. (1924). *Workers' Houses, Hook of Holland*.

Panton, V. (1959). *K2 chair*.

Perriand C. (1929). *Wood or Metal. design manifestos .org.*
<https://designmanifestos.org/charlotte-perriand-wood-or-metal/>

Rohe, M. van der. (1929). *Barcelona Chair*.

Rohe, M. van der. (1929). *Rohe's Barcelona*.

Rohe, M. van der. (1945). *Farnsworth House, Plano, Illinois, U.S.*

Rudolph, P. (1962). *Boston Government services center.*
https://www.google.com/search?sxsrf=APwXEdeCgxpoxe2nQdy1ZdqDQOkdt9TC6A:1687384031573&q=Boston+Government+services+center&tbm=isch&sa=X&ved=2ahUKEwi5sbSuq9X_AhUsL0QIHc8KDgcQ0pQJegQICRAB&biw=2048&bih=1048&dpr=1.25#imgrc=mUKCLZubVbLURM

Rudolph, P. (1962). *Christian Science Organization Building.*
<https://www.paulrudolph.institute/196206-christian-science-organization-building>

Safdie, M. (1967). *Habitat 67*. <https://www.artsy.net/article/artsy-editorial-10-icons-of-brutalist-architecture>

Schmidt, H. (1929). *Huber Haus, Riehen, Switzerland*.

Schneider, K. (1930). *Kunstverein, Hamburg, Germany*.

Smithson, A., & Smithson, P. (1972). *Robin Hood Gardens*.

Sparke, P. (1986). *Furniture*. Bell & Hyman,.

Sverre Fehn. (1956). *Nordic Pavilion in Venice*.

<https://www.archdaily.com/784536/ad-classics-nordic-pavilion-in-venice-sverre-fehn/56fa67c7e58ece7e1e000057-ad-classics-nordic-pavilion-in-venice-sverre-fehn-photo>

Tange, K. (1958). *Kagawa Prefecture Office Building*.

<http://dome.mit.edu/handle/1721.3/131441>

Van der Vlugt, L. (1925). *Van Nelle Factory, Rotterdam*.

Vidler, A. (2011). Another Brick in the Wall. *October*, 136, 105–132.

Wood grain left in a concrete wall | GL Barnhart Construction ...The Blog. (n.d.).

Retrieved December 3, 2023, from

<https://glbarnhart.wordpress.com/2018/01/04/wood-grain-left-in-a-concrete-wall/>

Wright, F. (1935). *Fallingwater, Pennsylvania, U.S.*






Yakisugi (Shou Sugi Ban). (2020, February 24). *Japan Woodcraft Association*.

<https://japanwoodcraftassociation.com/traditions/techniques/yakisugi-shou-sugi-ban/>






Zhu, J. (2023). *Reference Pictures*.


APPENDICES







Appendix A: Guidelines Form

MATERIALS		
Pouring Concrete	Resin-Cement Mixture	Metal
		
Cement Board	Wood	
		

SURFACES		
Concrete		
Wood Grain	Corduroy	Undulating Surface
		
Tie Hole Marks	Ratio of Aggregate	
		

Wood		
Gouge	Router	Grinder
		
Dremel	Yakisugi	
		

Steel
Cold Bluing


COLOR PALETTE	
	
	
	

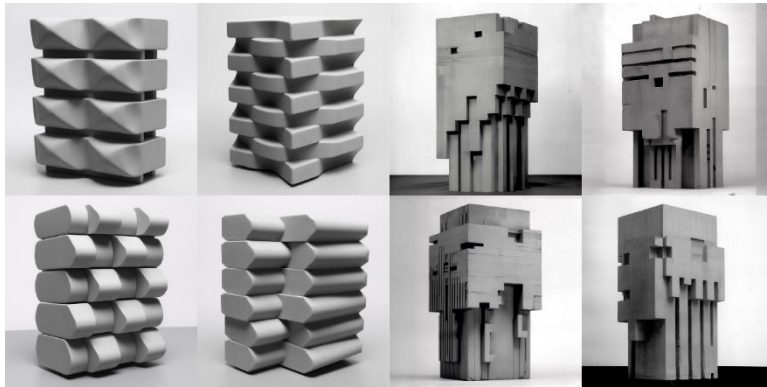
FORMS

Single Form

Random Details



Repetitive Patterns

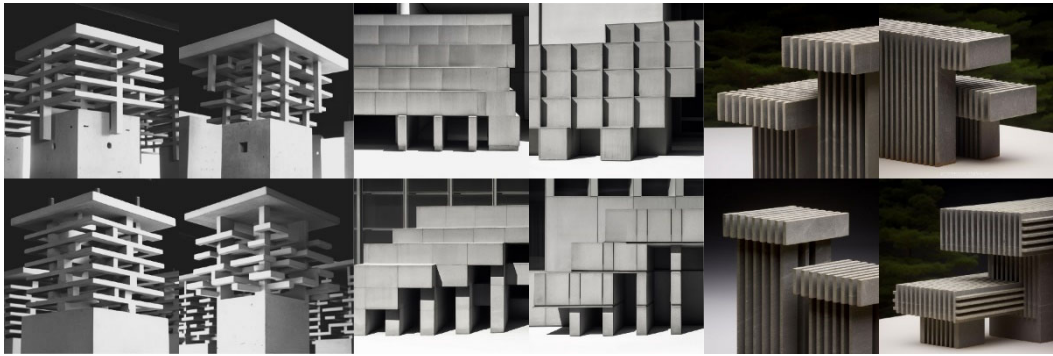


Multi-body Form

Geometry Blocks



Stacking Structures



Repetitive Units

