PRECEDENTS IN ARCHITECTURE

ANALYTIC DIAGRAMS, FORMATIVE IDEAS, AND PARTIS

THIRD EDITION

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MICHAEL PAUSE
PRECEDES IN
ARCHITECTURE

Analytic Diagrams,
Formative Ideas, and Partis

Third Edition

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Michael Pause

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CONTENTS

Prefaces / v
Introduction / xi
Analysis / 1

Alvar Aalto / 8
Tadao Ando / 16
Erik Gunnar Asplund / 20
Peter Q. Bohlin / 28
Mario Botta / 36
Filippo Brunelleschi / 44
Sverre Fehn / 52
Romaldo Giurgola / 56
Nicholas Hawksmoor / 64
Herzog & de Meuron / 72
Steven Holl / 76
Louis I. Kahn / 90
Le Corbusier / 88
Claude Nicholas Ledoux / 96
Sigurd Lewerentz / 104
Edwin Lutyens / 108
Richard Meier / 116
Rafael Moneo / 124
Charles Moore / 128
Glenn Murcutt / 136
Jean Nouvel / 140
Andrea Palladio / 144

Henry Hobson Richardson / 152
James Stirling / 160
Louis Sullivan / 168
Yoshio Taniguchi / 176
Giuseppe Terragni / 180
Ludwig Mies van der Rohe / 188
Robert Venturi / 196
Frank Lloyd Wright / 204
Peter Zumthor / 212

Formative Ideas / 217

Plan to Section or Elevation / 232
Unit to Whole / 239
Repetitive to Unique / 246
Additive and Subtractive / 252
Symmetry and Balance / 254
Geometry / 260
Configuration Patterns / 274
Progressions / 284
Reduction / 288

Index / 293

Index by Architect / 293
Index by Building / 301
PREFACES

PREFACE TO THE FIRST EDITION

This book is about architecture.

In particular, it focuses on a way of thinking about architecture that emphasizes what is in essence the same, rather than different. Our concern is for a continuous tradition that makes the past part of the present. We do not wish to aid the repetition or revival of style whether in whole or part. Rather, by a conscious sense of precedent that identifies patterns and themes, we hope to pursue archetypal ideas that might aid in the generation of architectural form.

While architecture embodies many realms, we concentrate on built form. Without apology, we make no attempt to discuss the social, political, economic, or technical aspects of architecture. The domain of design ideas lies within the formal and spatial realm of architecture, and thus it is this arena that is explored in this book.

Obviously, a sound architectural idea will not, as a tool for design, inevitably lead to a good design. One can imagine many undesirable buildings which might originate with formative ideas. To be sensitive to the potential of archetypal pattern in design does not lessen the importance of concern for other issues or for the building itself. However, one commonality shared by the great buildings of this era with those of the past, is a demonstrated understanding of basic architectural ideas which are recognizable as formative patterns.

Our analysis and interpretations are of built form and, therefore, may not necessarily coincide with the architect's intentions or the interpretations of others. The analysis is not all-inclusive in that it is limited to characteristics which can be diagrammed.

The intentions of this study are to assist the understanding of architectural history, to examine basic similarities of architects' designs over time, to identify generic solutions to design problems which transcend time, and to develop analysis as a tool for design. Of importance is the development of a vehicle for the discussion of ideas through the use of example. The understanding of history derived from this kind of investigation can only be obtained by far greater labor than that involved in acquiring a knowledge of history that focuses on names and dates. The reward for this effort is a design vocabulary that has evolved and been tested over time. We believe designers benefit from a comprehensive understanding of formative ideas, organizational concepts, and parts.

As a resource, this book offers factual graphic information on 64 buildings, a detailed analysis of each of these buildings, a range of designs by individual architects, a compilation of formative ideas for design generation, a collection of architectural images, and a reference for a technique of analysis. Some of this information is not readily available in other sources.

We are indebted to the Graham Foundation for Advanced Studies in the Fine Arts for support to make this study possible.

Any effort of this nature is the fruit of many encounters with individuals and ideas, but one debt in particular stands out as significant. Through a series of conversations with George E. Hartman, Jr., several years ago, some of our thoughts and ideas about architecture and history were focused. Since that time, he has continuously and enthusiastically offered support and encouragement. James L. Nagel, Ludwig Glaser, William N. Morgan, and the late William
Caudill each generously sponsored our efforts to secure assistance from the Graham Foundation. Roger Cannon, Robert Humenn, and Debbie Buffalin provided valuable help in locating material and information. For their assistance and support we thank several persons in the School of Design: Dean Claude E. McKinney, Winifred Hodge, the secretaries, and the librarians. The students in our classes have enriched, stimulated, and challenged our ideas, and encouraged us to record them in this volume. We fully acknowledge our debt to them.

A special acknowledgment is reserved for Rebecca H. Mentz and Michael A. Nieminen, whose considerable talents were used to draw the sheets reproduced in this volume. Without their skill, patience, diligence, and dedication this volume would not have been possible.

Our gratitude is extended to our families who have aided our efforts through sacrifice, devotion, and understanding.

To all other persons who have encouraged or in some way contributed to this study we collectively give thanks.

By making available the information that is presented in this volume, we hope to expand the understanding of precedents in architecture; to illustrate an educational technique that is useful to students, educators, and practitioners; and to demonstrate an analytic technique that can have impact on architectural form and space decisions.

PREFACE TO THE SECOND EDITION

The success of the first edition indicated that there was a need for conceptual and analytic information about architecture. Our experience with the first edition over the past decade demonstrated that the material has been useful as a tool for teaching architecture. It has provided a vocabulary for analysis that helps students and architects understand the works of others and aids them in creating their own designs. This approach continues to be useful and there was no apparent need to revise the information. Instead, the second edition gave us the opportunity to enrich the content of the analysis section by adding the works of seven architects. They were chosen initially to augment the content of the original sixteen architects. Some were selected for historical significance, some for lack of widespread documentation of their work. Others were picked because of emerging reputations and the production of a meaningful body of work since the publication of the first edition. All were selected because of the strength, quality, and interest of their designs. It is our intent to continue to show that design ideas transcend culture and time. Keeping the same format, we have added factual and analytic information on two or four buildings by each of the seven new architects.

While some may find this book useful for information about a particular architect or building, it is not our primary purpose to present any one building or architect exhaustively (e.g., photographs, written descriptions, or contract documents). Rather, our intention is to continue to explore the commonality of design ideas through comparison. To achieve this we have used the diagrammatic technique that was developed in the original study. While some of the architects and architectural authors have used diagrams to explain or inform others about the buildings included in this volume, the diagrams in this book are our own creation.

In addition to the acknowledgments cited in the preface of the first edition the following have helped make this edition a reality. The Graham Foundation for Advanced Studies in the Fine Arts supported our work for a second time; for this we are grateful. Van Nostrand Reinhold also contributed grant money to make this edition possible. Both of these sources aided our research and allowed for the production of the drawings.

While difficult to acknowledge all individuals who have contributed to or influenced our ideas, certain people's
efforts deserve recognition. We are indebted to Wendy Lochner for persuading us to attempt a second edition. Her support and encouragement were critical. The editorial staff at Van Nostrand Reinhold provided us with willing and valuable assistance. James L. Nagle, Victor Reigier, and Mark Simon supported our efforts through encouragement, suggestions, and recommendations. Peter Bohlin and Carole Rusche generously contributed valuable information on the works of some of the architects. Collectively, we thank the staff of the School of Design for their willing assistance.

Special recognition goes to Mara Murdoch who single-handedly, with great skill, dedication, and patience, drew all of the new pages.

Finally, we wish to acknowledge all of our students, who have shown us that the study of precedents is a valuable tool for learning to design, and who continue to challenge us.

PREFACE TO THE THIRD EDITION

We commend to the reader the Prefaces to the first and second editions of this volume. Much of what is included in those Prefaces remains pertinent to us and our feelings about this work. The approach to understanding architecture presented herein continues to be useful and this edition again gave us the opportunity to enrich the Analysis section by adding factual and analytic information on two buildings by each of eight architects.

As with the previous editions, we have chosen to continue to present the buildings as a series of analytical diagrams that examine archetypal ideas. Our intention is to continue to explore the commonality of design ideas for comparison. We, of course, are aware that the architects examined herein may not have embraced the subjects of the diagrams nor, if they did consider the issues, approached them in the same way we have interpreted them. Thus, the diagrams are our own interpretations and some are more interpretive than others. Obviously these diagrams are then abstractions that focus on an issue that we have identified. For a particular architect or building a single diagram may be clearer or more revealing, which might suggest the identification of an issue of interest to the architect involved. By examining the buildings through the same issues it is possible to see relationships and nuances of development between architects and their buildings. We also understand that architecture has many manifestations—social, technical, economical, cultural, legal, and political. Any or all of these areas can impact the final form of the building, as can an individual architect's or client's personal predilection or whim.

Of those architects, for instance, that have been added for this edition, we know of Sigurd Leworentz's interest in not doing things the conventional way. He is perhaps not as well known as some of the other architects in this volume, probably because he did not write about his work and did not teach. Fortunately, some publications have appeared in recent years that have chronicled his life and his work. We found it interesting that while he began with a refined, yet original, Classical language (at the Chapel of the Resurrection, for instance), his later work, represented here by the St. John's Church in Klippan, rejected that language. Yet there are similarities between the earlier and later work, as revealed by the analytical diagrams. His work demonstrates a subdued and restrained imagination that resulted in uncompromising and mysterious buildings.

Steven Holl seems to borrow from concepts of biology and geology in making sculpturally fluid spaces. While his buildings gesture toward their context, he has an obvious interest in the introduction and manipulation of natural light for the interior spaces of his buildings. Much has been written about the importance of his sketches and watercolors in capturing the feelings he desires for a building, yet his early interest in geometries is still demonstrated in his recent buildings.
 Rafael Moneo's work included in this edition shows his intense use of the site, resulting in a building that is compact and basically fills the site. Through this compactness, Moneo reacts to the urban context while providing an autonomous and animated inner world. Herzog and de Meuron, on the other hand, give obvious priority in their work to the skin, the surface, of their buildings. Perhaps their desire is to create a visual and tactile surface that will create the perception that the built form has disappeared.

The common thread is that each of these architects has, regardless of their interest or considerations, produced built forms that include the physical and spatial realms of architecture. Architecture is not formless. In the end the built form may outlast the current fascinations and considerations. The issues we examine here may not be part of those considerations. Our analytical diagrams afford a way to understand buildings. In some cases they may help build a formal vocabulary. The issues examined could be the means for ordering or organizing an idea, or they may possibly be a way to generate a design. In any case, we can diagram what has been done, but not necessarily why it has been done.

The work that has been used for this third edition is in the same format as the previous editions. The new pages have been seamlessly inserted into the Analysis section in alphabetical order. This section now includes the work of thirty-one architects. Collectively they represent architects of historic importance and those who have produced meaningful work recently. All were selected not only because of the quality and strength of their work, but also because they afford the opportunity to explore buildings, their organizations and ordering ideas, through comparison.

We began exploring the analysis of architectural precedents in the 1970s and first published such work in a student publication of the School (now College) of Design at North Carolina State University. That volume, titled Analysis of Precedent, appeared in 1978. Van Nostrand Reinhold published the original edition of Precedents in Architecture in 1985 and the second edition followed in 1996. Both editions have been through several printings, and each has been translated into Spanish and Japanese. We are also aware that these editions have been translated on an ad-hoc basis into Korean and Chinese. The second edition received an International Architecture Book Award from the American Institute of Architects. The jury for this awards program, which included books from publishers worldwide, commented that "Precedents in Architecture provides a vocabulary for architectural analysis that helps architects understand the works of others and aids in creating original ideas. Whether a novice or professional, this work enriches the reader's design vocabulary."

The success and longevity of this work suggests there is a need for this information about architecture. As we started to produce the material for this third edition, we were keenly aware of the initial premise for the study—the commonality and significance of design ideas that transcend time and place. As the work progressed, these assumptions have been reinforced. Architectural ideas are the underpinnings of architecture upon which other concerns—social, technical, economical, cultural, legal, and political—are layered.

In addition to the acknowledgements cited in the prefaces to the first and second editions, we wish to recognize some people directly related to this edition. It is always difficult to thank adequately all of the individuals who have had an influence on this work or have contributed to its development. We are indebted to each of them whether they knew they had an influence or not. Certain people, however, deserve to be mentioned specifically. This edition would not have existed at all without the efforts of Margaret Cummins of John Wiley and Sons. She approached us about considering a third edition, and she made it all possible by securing for us a grant from John Wiley to support our work. Her powers of persuasion, suggestions, and encouragement were
critical. The other members of the editorial, art, and production staff at Wiley were also helpful. Peter Q. Bohlin, James L. Nagle, and Victor Reignier encouraged us through suggestions and recommendations. We also thank the College of Design, its administration and staff, for their willing assistance.

As with previous editions all of the pages in this edition are from original drawings. While we are responsible for the content of the drawings, Jason Miller has with diligence, patience, and great skill interpreted our sketches to create these thirty-two new pages. We owe him a special thank you.

Finally, as we have done previously, we wish to thank our students, who reinforce, challenge, and question constantly while demonstrating that analytical processes are valuable as a tool for design. They make each day an interesting pleasure.

Roger H. Clark and Michael Pause
The renewed and growing interest in architectural history and historic architectural example has focused the need to clarify the link between history and design. History studied in the academic sense of seeing our place within a continuum, or in the strictly scholarly sense of knowing the past, can limit our knowledge as architects to little more than names, dates, and style recognition. Seeing between and beyond the layers of historical styles, within which architecture is generally categorized and presented, can make history a source of enrichment for architectural design.

The search, in this study, is for theory which transcends the moment and reveals an architectural idea. The technique for this search is the careful examination and analysis of buildings. The desired result is the development of theory to generate ideas with which to design architecture.

This volume is organized into two parts. The first concentrates on the analysis of 104 buildings which are presented in both conventional drawings—site plan, plan, and elevation—and diagrams. The second identifies and delineates formal archetypal patterns or formative ideas from which architecture might evolve. It can be observed that certain patterns persist through time, with no apparent relationship to place.

Buildings that represent a range of time, function, and style, and architects who exemplify seemingly different approaches to architecture, were selected. This selection was tempered by availability of information; some architects and some buildings were not included because the material available did not permit thorough analysis.

Preference was given to built buildings in lieu of projects, which are included in the second part only when they represent pertinent examples of an idea. While the analytic technique utilized in this volume is applicable to groups of buildings, this study is limited to single works of architecture.

The information available for the selected buildings contained inconsistencies in some areas. When discrepancies did occur, every effort was made to verify the accuracy of the information. If it could not be totally verified, then reasonable assumptions were made. For example, a site plan was never drawn by Robert Venturi for the Tucker House; therefore, the site plan indicated in this volume is inferred from other information.

In some instances, particular buildings are cited in the literature by more than one name. For example, La Rotonda by Andrea Palladio is often referred to as Villa Capra. Less frequently it is called Villa Almerico, after the name of the family for whom it was originally built. In cases where such multiplicity occurs, buildings are identified in the body of this study by the most frequently used name and in the index by the several names used.

Opinion also differs about dates attributed to several buildings. Because of the length of time it takes to complete a building or because of the imprecision of recorded history, it is often difficult to establish an exact date or series of dates for a building. The significance of the date is simply to place the work in a chronological context. When conflict did occur between sources, the date that is ascribed most often is the one used.

Undoubtedly, the complexity of architecture often makes it difficult to attribute a building to a single person. It is clear that buildings, regardless of when executed, are the products of partnerships or collaborations and the result of inputs from several persons. However, for the sake of clarity, the buildings in this study are assigned to the person who is normally recognized as the designer. For instance, Charles
Moore is listed rather than the several associations which might be included for each building. Similarly, Romeo Gurgola is acknowledged instead of the firm in which he is a partner.

In the analytical part of the study, the plan, elevation, and section for any individual building are drawn at the same scale. However, the scale between any two buildings varies depending upon building size and presentation format. Site plans are oriented to correspond generally to the orientation of the floor plan, and north is indicated where known.

To communicate the analysis of the buildings and the formative ideas in this study, a diagram or a set of diagrams is utilized. The diagrams are drawings that, as abstractions, are intended to convey essential characteristics and relationships in a building. As such, the diagrams focus on specific physical attributes which allow for the comparison of that attribute between buildings independent of style, type, function, or time. The diagrams are developed from the three-dimensional form and space configurations of the building. They take into account more information than is normally apparent in a plan, an elevation, or a section. To reduce the building to its essentials, the diagrams have been intentionally simplified. This elimination of all but the most important considerations makes those that remain both dominant and memorable.

For the analysis, it was necessary to establish a graphic standard so that comparison could be made between the diagrams. In general, heavy lines are used in each diagram to accent a particular issue. In the formative idea part of the study, the plan, elevation, or section of the building is drawn lightly for orientation purposes, while the issue being analyzed and compared is indicated by heavy lines or shading. The legend on page xiii indicates the specific graphic standard used for the diagrams in the analysis section.

This study is not exhaustive; rather, examples are included to illustrate the nuances of the idea. It is rare to find a building configuration which embodies a single formal theme in absolute purity. More normal is a variety of patterns layered upon one another—the consequence of which is the potential for the richness that can evolve from multiple interpretations. In this study dominant patterns have been identified, but this is not to suggest that others do not exist.
ANALYSIS

Alvar Aalto / 8
Town Hall, Saynatsalo
Vouksenniska Church, Imatra
Enso-Gutzeit Company Headquarters, Helsinki
Cultural Center, Wolfsburg

Tadao Ando / 16
Chapel on Mt. Rokko, Kobe
Church on the Water, Tomamu

Erik Gunnar Asplund / 20
Snellman House, Djurholm
Woodland Chapel, Stockholm
Lister County Courthouse, Solvesborg
Stockholm Public Library, Stockholm

Peter Q. Bohlin / 28
Weekend Residence for Mr. and Mrs. Eric Q. Bohlin, West Cornwall
Gaffney Residence, Romansville
House in the Adirondacks, New York State
Guest House, Gates Residence, Medina

Mario Botta / 36
Single Family Residence, Riva San Vitale
Church of San Giovani Battista, Mogno
Blanda Residence, Losone
The Church of Beato Odorico, Pordenone

Filippo Brunelleschi / 44
Old Sacristy, Florence
Ospedale degli Innocenti, Florence
Church of Santa Maria degli Angeli, Florence
Church of San Spirito, Florence

Sverre Fehn / 52
Villa Busk, Bamble
The Glacier Museum, Fjaerland

Romaldo Giurgola / 56
Adult Learning Research Laboratory, Bryn Mawr
Lang Music Building, Swarthmore
Student Union, Plattsburgh
Tredyffrin Public Library, Stafford

Nicholas Hawksmoor / 64
Easton Neston, Northamptonshire
St. George-in-the-East, Wapping
Christ Church, Spitalfields
St. Mary Woolnoth, London

Herzog & de Meuron (Jacques Herzog and Pierre de Meuron) / 72
Goetz Collection Museum, Munich
Dominus Winery, Yountville

Steven Holl / 76
Kiasma, Museum of Contemporary Art, Helsinki
Chapel of St. Ignatius, Seattle

Louis I. Kahn / 80
Alfred N. Richards Medical Research Building, Philadelphia
Salk Institute of Biological Studies, La Jolla
Kimball Art Museum, Fort Worth
Library, Exeter

Le Corbusier / 88
Villa Savoye, Poissy
Unite d'Habitation, Marseilles
Notre Dame du Haut Chapel, Ronchamp
The Palace of Assembly, Chandigarh

Claude Nicholas Ledoux / 96
Hotel de Montmorency, Paris
Hotel Guimard, Paris
Theater, Besançon
Director's House, Saltworks of Arc and Senans
Sigurd Lewerentz / 104
Chapel of the Resurrection, Stockholm
Church of St. Peter, Klippan

Edwin Lutyens / 108
Homewood, Knebworth
Nashdom, Taplow
Heathcote, Ilkey
The Salutation, Sandwich

Richard Meier / 116
Smith House, Darien
The Athenaeum, New Harmony
Ulm Exhibition and Assembly Building, Ulm
Weishaupt Forum, Schwendi

Rafael Moneo / 124
Don Benito Cultural Center, Badajoz
Murcia Town Hall, Murcia

Charles Moore / 128
Moore House, Orinda
Condominium I, Sea Ranch
Hines House, Sea Ranch
Burns House, Santa Monica Canyon

Glenn Murcutt / 136
Magney House, Bingle Point
Simpson-Lee House, Mt. Wilson

Jean Nouvel / 140
Institute of the Arab World, Paris
Cartier Foundation, Paris

Andrea Palladio / 144
Villa Foscari, Malcontenta
Church of San Giorgio Maggiore, Venice
La Rotonda, Vicenza
Redentore Church, Venice

Henry Hobson Richardson / 152
Trinity Church, Boston
Sever Hall, Cambridge
Allegheny County Courthouse, Pittsburgh
J. J. Glessner House, Chicago

James Stirling / 160
Engineering Building, Leicester
History Faculty Building, Cambridge
Florey Building, Oxford
Olivetti Training School, Haslemere

Louis Sullivan / 168
Auditorium Building, Chicago
Wainwright Building, St. Louis
Carson Pirie and Scott Store, Chicago
National Farmer's Bank, Owatonna

Yoshio Taniguchi / 176
Shiseido Art Museum, Kakegawa
Kasai Rinkai Park View Point Visitors Center, Tokyo

Giuseppe Terragni / 180
Novoconum Apartment House, Como
Casa del Pascio, Como
Sant' Eia Nursery School, Como
Villa Bianca, Seveso

Ludwig Mies van der Rohe / 188
German Pavilion at International Exhibition, Barcelona
Tugendhat House, Brno
Farnsworth House, near Plano
Crown Hall, Chicago

Robert Venturi / 196
Vanna Venturi House, Philadelphia
Fire Station Number 4, Columbus
Peter Brant House, Greenwich
Caril Tucker III House, Mount Kisco

Frank Lloyd Wright / 204
Unity Temple, Oak Park
Frederick G. Robie House, Chicago
Fallingwater (Edgar J. Kaufmann House), Ohio
Solomon R. Guggenheim Museum, New York

Peter Zumthor / 212
Chapel of St. Benedict, Sumvitg
Art Museum (Kunsthalle) Bregenz, Bregenz
ANALYSIS

In this section, 104 works of architecture are documented. The buildings are the designs of 31 architects. For most architects, four buildings are presented which are representative of that person's work. The material is ordered with the architects arranged alphabetically and the buildings for each architect presented chronologically and successively.

Each building is recorded on two adjacent pages; the left-hand page documents the building with name, date, and location as well as drawings of the site plan, floor plans, elevations, and sections; illustrated on the right-hand page is a series of eleven analysis diagrams and the parti diagram which culminates and summarizes the analysis for the building. The parti is seen as the dominant idea of a building which embodies the salient characteristics of that building. It encapsulates the essential minimum of the design, without which the scheme would not exist, but from which the architecture can be generated.

A major concern of the analysis is to investigate the formal and spatial characteristics of each work in such a way that the building parti can be understood. To accomplish this, 11 issues were selected from the widest range of characteristics: fundamental elements which are common to all buildings, relationships among attributes, and formative ideas. Each issue is first explored in isolation and then in relationship to the other issues. This information is studied to discern reinforcement and to identify the dominant underlying idea. From the analysis and the resulting parti for each building, similarities and differences among the designs can be identified.

The issues selected for the analysis are: structure; natural light; massing; and the relationships of plan to section, circulation to use-space, unit to whole, and repetitive to unique. Also included are symmetry and balance, geometry, additive and subtractive, and hierarchy.

STRUCTURE

At a basic level, structure is synonymous with support, and therefore exists in all buildings. At a more germane level, structure is columnar, planar, or a combination of these, all of which a designer can intentionally use to reinforce or realize ideas. In this context, columns, walls, and beams can be thought of in terms of the concepts of frequency, pattern, simplicity, regularity, randomness, and complexity. As such, structure can be used to define space, create units, articulate circulation, suggest movement, or develop composition and modulations. In this way, it becomes inextricably linked to the very elements which create architecture, its quality and excitement. This analysis issue has the potential to reinforce the issues of natural light, unit to whole relationships, and geometry. It can also strengthen the relationship of circulation to use-space and the definition of symmetry, balance, and hierarchy.

NATURAL LIGHT

Natural light focuses on the manner in which, and the locations where, daylight enters a building. Light is a vehicle for the rendering of form and space, and the quantity, quality, and color of the light affect the perceptions of mass and volume. The introduction of natural light may be the consequence of design decisions made about the elevation and section of a building. Daylight can be considered in terms of
qualitative differences which result from filtering, screening, and reflecting. Light which enters a space from the side, after modification by a screen, is different from light which enters directly overhead. Both examples are quite different from light which is reflected within the envelope of the building before entering the space. The concepts of size, location, shape, and frequency of opening; surface material, texture, and color; and modification before, during, or after entering the building envelope are all relevant to light as a design idea. Natural light can reinforce structure, geometry, hierarchy, and the relationships of unit to whole, repetitive to unique, and circulation to use-space.

MASSING

As a design issue, massing constitutes the perceptually dominant or most commonly encountered three-dimensional configuration of a building. Massing is more than the silhouette or elevation of a building. It is the perceptual image of the building as a totality. While massing may embody, approximate, or at times parallel either the outline or the elevation, it is too limiting to view it as only this. For example, on the elevation of a building the fenestration may in no way affect the perception of the volume of the building. Similarly, the silhouette may be too general and not reflect productive distinctions in form.

Massing, seen as a consequence of designing, can result from decisions made about issues other than the three-dimensional configuration. Viewed as a design idea, massing may be considered relative to concepts of context, collections and patterns of units, single and multiple masses, and primary and secondary elements. Massing has the potential to define and articulate exterior spaces, accommodate site, identify entrance, express circulation, and emphasize importance in architecture. As an issue in the analysis, massing can strengthen the ideas of unit to whole, repetitive to unique, plan to section, geometry, additive and subtractive, and hierarchy.

PLAN TO SECTION OR ELEVATION

Plan, section, and elevation are conventions common to the simulation of the horizontal and vertical configurations of all buildings. As with any of the design ideas in this analysis, the relationship of plan configuration to vertical information may result from decisions made about other issues. The plan can be the device to organize activities and can, therefore, be viewed as the generator of form. It may serve to inform about many issues such as the distinction between passage and rest. The elevation and section are often considered to be more closely related to perception since these notations are similar to encountering a building frontally. However, the use of plan or section notations presumes volumetric understanding; that is, a line in either has a third dimension. The reciprocity and the dependence of one on the other can be a vehicle for making design decisions, and can be used as a strategy for design. Considerations in plan, section, or elevation can influence the configuration of the others through the concepts of equality, similarity, proportion, and difference or opposition.

It is possible for the plan to relate to the section or elevation at a number of scales: a room, a part, or the whole building. As an issue for analysis, the plan to section relationship reinforces the ideas of massing, balance, geometry, hierarchy, additive, subtractive, and the relationships of unit to whole and repetitive to unique.

CIRCULATION TO USE-SPACE

Fundamentally, circulation and use-space represent the sig-
significant dynamic and static components in all buildings. Use-space is the primary focus of architectural decision making relative to function, and circulation is the means by which that design effort is engaged. Together, the articulation of the conditions of movement and stability form the essence of a building. Since circulation determines how a person experiences a building, it can be the vehicle for understanding issues like structure, natural light, unit definition, repetitive and unique elements, geometry, balance, and hierarchy. Circulation may be defined within a space that is for movement only, or implied within a use-space. Thus, it can be separate from, through, or terminate in the use-spaces; and it may establish locations of entry, center, terminus, and importance.

Use-space can be implied as part or all of a free or open plan. It can also be discrete, as in a room. Implicit in the analysis of this issue is the pattern created by the relationship between the major use-spaces. These patterns might suggest centralized, linear, or clustered organizations. The relationship of circulation and use-space can also indicate the conditions of privacy and connection. Basic to employing this issue as a design tool is the understanding that the configuration given to either circulation or use directly affects the manner in which the relationship to the other takes place.

UNIT TO WHOLE

The relationship of unit to whole examines architecture as units which can be related to create buildings. A unit is an identified entity which is part of a building. Buildings may comprise only one unit, where the unit is equal to the whole, or aggregations of units. Units may be spatial or formal entities which correspond to use-spaces, structural components, massing, volume, or collections of these elements. Units may also be created independently of these issues.

The nature, identity, expression, and relationship of units to other units and to the whole are relevant considerations in the use of this idea as a design strategy. In this context, units are considered as adjoining, separate, overlapping, or less than the whole. The relationship of unit to whole can be reinforced by structure, massing, and geometry. It can support the issues of symmetry, balance, geometry, additive, subtractive, hierarchy, and the relationship of repetitive to unique.

REPETITIVE TO UNIQUE

The relationship of repetitive to unique elements entails the exploration of spatial and formal components for attributes which render these components as multiple or singular entities. If unique is understood to be a difference within a class or a kind, then the comparison of elements within a class can result in the identification of the attributes which make the unique element different. This distinction links the realms of the repetitive and the unique through the common reference frame of the class or kind. Essentially, the definition of one is determined by the realm of the other. In this context, components are determined to be repetitive or unique through the absence or presence of attributes. Concepts of size, orientation, location, shape, configuration, color, material, and texture are useful in making distinctions between repetitive and unique. While repetitive and unique elements occur in numerous ways and at several scales within buildings, the analysis focuses on the dominant relationship. In the analysis, this issue generates information which strengthens or is reinforced by the concepts of structure, massing, units related to whole, plan related to section, geometry, and symmetry or balance.
SYMMETRY AND BALANCE

The concepts of symmetry and balance have been in use since the beginning of architecture. As a fundamental issue of composition, balance in architecture occurs through the use of spatial or formal components. Balance is the state of perceptual or conceptual equilibrium. Symmetry is a specialized form of balance. Compositional balance in terms of equilibrium implies a parallel to the balance of weights, where so many units of “A” are equal to a dissimilar number of units of “B.” Balance of components establishes that a relationship between the two exists, and that an implied line of balance can be identified. For balance to exist, the basic nature of the relationship between two elements must be determined; that is, some element of a building must be equivalent in a knowable way to another part of the building. The equivalence is determined by the perception of identifiable attributes within the parts. Conceptual balance can occur when a component is given additional value or meaning by an individual or group. For example, a smaller sacred space can be balanced by a much larger support or secondary space.

Whereas balance is developed through differences in attributes, symmetry exists when the same unit occurs on both sides of the balance line. In architecture this can happen in three precise ways: reflected, rotated about a point, and translated or moved along a line.

Both symmetry and balance can exist at the building, component, or room level. As scales change, a distinction is made between overall and local symmetry or balance. Consideration of size, orientation, location, articulation, configuration, and value is involved in its use as a formative idea. Balance and symmetry may have an impact on all of the other analysis issues.

GEOMETRY

Geometry is a formative idea in architecture that embodies the tenets of both plane and solid geometry to determine built form. Within this issue, grids are identified as being developed from the repetition of the basic geometries through multiplication, combination, subdivision, and manipulation.

Geometry has been used as a design tool since the very beginnings of architectural history. Geometry is the single most common determinant or characteristic in buildings. It can be utilized on a broad range of spatial or formal levels that includes the use of simple geometric shapes, varied form languages, systems of proportions, and complex form generated by intricate manipulations of geometries. The realm of geometry as an architectural form generator is a relative one of measurement and quantification. As a focus for this analysis, it centers on the concepts of size, location, shape, form, and proportion. It also concentrates on the consistent changes in geometries and form languages that result from the combination, derivation, and manipulation of basic geometric configurations. In the analysis, grids are observed for frequency, configuration, complexity, consistency, and variation. As the pervasive attribute of buildings, geometry can reinforce all of the issues used in the analysis.

ADDITIVE AND SUBtractive

The formative ideas of additive and subtractive are developed from the processes of adding, or aggregating, and subtracting built form to create architecture. Both require the perceptual understanding of the building. Additive, when used to generate built form, renders the parts of the building
as dominant. The perception of a person engaging an additive design is that the building is an aggregation of identifiable units or parts. Subtractive, when utilized in designing, results in a building in which the whole is dominant. A person viewing a subtractive scheme understands the building as a recognizable whole from which pieces have been subtracted. Generally, additive and subtractive are formal considerations which can have spatial consequences.

Richness can occur when both ideas are employed simultaneously to develop built form. For example, it is possible to add units together to form a whole from which pieces are subtracted. It is also possible to subtract pieces from an identifiable whole and then to add the subtracted parts back to create the building.

The manner in which the building whole was articulated, and the ways in which the forms were rendered, was important to the analysis. This was achieved by observing massing, volumes, color, and material changes. Additive and subtractive, as ideas, can strengthen or be reinforced by massing, geometry, balance, hierarchy, and the relationships of unit to whole, repetitive to unique, and plan to section.

HierARCHY

As a formative idea, hierarchy in the design of buildings is the physical manifestation of the rank ordering of an attribute or attributes. Embodied in this concept is the assignment of relative value to a range of characteristics. This entails the understanding that qualitative differences within a progression can be identified for a selected attribute. Hierarchy implies a rank ordered change from one condition to another; where ranges such as major-minor, open-closed, simple-complex, public-private, sacred-profane, served-servant, and individual-group are utilized. With these ranges, the rank ordering can occur in the realm of the formal, spatial, or both.

In the analysis, hierarchy was explored relative to dominance and importance within the built form through examination of patterns, scale, configuration, geometry, and articulation. Quality, richness, detail, ornament, and special materials were used as indicators of importance. Hierarchy, as a design idea, can be related to and support any of the other issues explored in the analysis.
ALVAR AALTO

TOWN HALL
SAINTSALO, FINLAND
1950–1952

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
ALVAR AALTO

VOKSENNIKSA CHURCH
IMATRA, FINLAND
1966–1986

SECTION A

SECTION B

ELEVATION 1

ELEVATION 5

FLOOR PLAN

SITE PLAN
<table>
<thead>
<tr>
<th>Structure</th>
<th>Circulation to Use</th>
<th>Additive and Subtractive</th>
</tr>
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<td>Symmetry and Balance</td>
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<td>Repetitive to Unique</td>
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</tr>
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</table>
TADAO ANDO

CHAPEL ON MT. ROKKO
KOBÉ, HYOGO, JAPAN
1985–1986

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

FLOOR PLAN
TADAO ANDO

CHURCH ON THE WATER
TOMAMU, HOKKAIDO, JAPAN
1986-1988

SECTION A

ELEVATION 1

SITE PLAN

ELEVATION 2

MAIN FLOOR PLAN

UPPER FLOOR PLAN
<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>CIRCULATION TO USE</th>
<th>UNIT TO WHOLE</th>
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BOHLIN AND POWELL (PETER BOHLIN)

WEEKEND RESIDENCE FOR MR. AND MRS. ERIC Q. BOHLIN
WEST CORNWALL, CONNECTICUT
1975–1976

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<thead>
<tr>
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<th>Section A</th>
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<tbody>
<tr>
<td>Upper Floor Plan</td>
<td>Elevation 2</td>
<td>Main Floor Plan</td>
</tr>
</tbody>
</table>

28
BOHLIN CYWINSKI JACKSON (PETER BOHLIN)

HOUSE IN THE ADIRONDACKS
NEW YORK STATE
1987-1992

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN

LOWER FLOOR PLAN
MARIO BOTTA

SINGLE FAMILY RESIDENCE (BIANCHI RESIDENCE)
RIVA SAN VITALE, TICINO, SWITZERLAND
1971-1973

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

TOP FLOOR PLAN

MAIN FLOOR PLAN
BIANDA RESIDENCE
LOSONE, TICINO, SWITZERLAND
1987-1989

SECTION A

SITE PLAN

ELEVATION 1
ELEVATION 2
ELEVATION 3

FIRST FLOOR
SECOND FLOOR
GROUND FLOOR
<table>
<thead>
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<th>Structure</th>
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FILIPPO BRUNELLESCHI

OLD SACRESTY
CHURCH OF SAN LORENZO
FLORENCE, ITALY
1421-1440

SECTION A

ELEVATION 1

FLOOR PLAN
FILIPPO BRUNELLESCHI

OSPEDALE DEGLI INNOCENTI
FLORENCE, ITALY
1421-1445

SECTION A

ELEVATION 1

FLOOR PLAN

SITE PLAN

46
FILIPPO BRUNELLESCHI

CHURCH OF SANTA MARIA DEGLI ANGELI
FLORENCE, ITALY
1434-1436

SECTION A

SITE PLAN

ELEVATION 1

FLOOR PLAN
SVERRE FEHN

VILLA BUSK
RAMBLE, TELEMARK, NORWAY
1966

SECTION A

SECTION B

SECTION C

ELEVATION 1

ELEVATION 2

SITE PLAN

FLOOR PLAN

52
SVERRE FERN

THE GLACIER MUSEUM
FLÅEBLAND, BALESTRAND, NORWAY
1991

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

ELEVATION 3

ELEVATION 4

SITE PLAN

MAIN FLOOR PLAN
ROMALDO GIURGOLA

TREDYFFRIN PUBLIC LIBRARY
STRAFFORD, PENNSYLVANIA
1976

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

LOWER FLOOR PLAN

MAIN FLOOR PLAN
**Nicholas Hawksmoor**

**Easton Neston**
Northamptonshire, England
C. 1695-1710

<table>
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NICHOLAS HAWSMOOR

ST. GEORGE-IN-THE-EAST
WAPPING, STEPNEY, ENGLAND
1714–1729

SECTION A

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
NICHOLAS HAWKSMOOR

CHRIST CHURCH
SPITALFIELDS, LONDON, ENGLAND
1716–1729

ELEVATION 1
SECTION A
SECTION B

MAIN FLOOR PLAN
UPPER FLOOR PLAN
ELEVATION 2

SITE PLAN
LOUIS I. KAHN

ALFRED N. RICHARDS MEDICAL RESEARCH BUILDING,
UNIVERSITY OF PENNSYLVANIA
PHILADELPHIA, PENNSYLVANIA
1967-1961

SECTION A.

ELEVATION 1

ELEVATION 2

LOWER FLOOR PLAN

UPPER FLOOR PLAN
<table>
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LE CORBUSIER

UNITÉ D'HABITATION
Marseille, France
1946-1952

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

TYPICAL FLOOR PLAN

ROOF FLOOR PLAN
LE CORBUSIER

NOTRE DAME DU HAUT CHAPEL
RONCHAMP, FRANCE
1950–1955

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

FLOOR PLAN
LE CORBUSIER

THE PALACE OF ASSEMBLY
CHANDIGARH, INDIA
1953-1963

SECTION A
SECTION B

ELEVATION 1
ELEVATION 2

SITE PLAN
LOWER FLOOR PLAN
UPPER FLOOR PLAN
CLAUDE NICHOLAS LEDOUX

HOTEL DE MONTMORENCY
PARIS, FRANCE
1769

SECTION A

ELEVATION 1

SITE PLAN

LOWER FLOOR PLAN

MAIN FLOOR PLAN
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ADDITIVE AND SUBTRACTIVE
CLAUSE NICHOLAS LEDOUX

HOTEL GUIMARD
PARIS, FRANCE
1770

SECTION A

ELEVATION 1

SITE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
CLAUDE NICHOLAS LEDOUX

THEATER
BERANCON, FRANCE
1775

SECTION A

SECTION B

ELEVATION 1

LOWER FLOOR PLAN

MIDDLE FLOOR PLAN

UPPER FLOOR PLAN
CLAUDE NICHOLAS LEDOUX

DIRECTOR’S HOUSE
SALTWORKS OF ARG AND SENANS
NEAR BESANÇON, FRANCE
1775-1779

SECTION A

ELEVATION 1

SITE PLAN

LOWER FLOOR PLAN

MIDDLE FLOOR PLAN

UPPER FLOOR PLAN
<table>
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</table>
EDWIN LUTYENS

HOMEWOOD (EARL OF LYTTON HOUSE)
KNELLWORTH, HERTFORDSHIRE, ENGLAND
1901

SECTION A

ELEVATION 1

ELEVATION 2

ELEVATION 3

SITE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
EDWIN LUTYENS

NASHDOM (PRINCESS ALEXIS DOLGORUKI HOUSE)
TAPLOW, BUCKINGHAMSHIRE, ENGLAND
1906–1909

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

STIR PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN
EDWIN LUTYENS

HEATHCOTE (HEMINGWAY HOUSE)
ILKLEY, YORKSHIRE, ENGLAND
1906

SECTION A

SITe PLAN

ELEVATION 1

ELEVATION 2

LOWER FLOOR PLAN

UPPER FLOOR PLAN
EDWIN LUTYENS

THE SALUTATION (HENRY FARRER HOUSE)
SANDWICH, KENT, ENGLAND
1911

SECTION A

ELEVATION 1

ELEVATION 2

SITE PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN
SMITH HOUSE
DARIEN, CONNECTICUT
1966-1967

SECTION A
SECTION B

ELEVATION 1
ELEVATION 2

SITE PLAN

LOWER FLOOR PLAN
MIDDLE FLOOR PLAN
UPPER FLOOR PLAN
RICHARD MEIER

ULM EXHIBITION AND ASSEMBLY BUILDING
ULM, GERMANY
1986–1992

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

FIRST FLOORS PLAN

SECOND FLOORS PLAN
<table>
<thead>
<tr>
<th>STRUCTURE</th>
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<th>UNIT TO WHOLE</th>
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RAFAEL MONEO

DON BENITO CULTURAL CENTER
BADAJOS, SPAIN
1991–1997

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN

THIRD FLOOR PLAN

FOURTH FLOOR PLAN
CHARLES MOORE

CONDOMINIUM I
SEA RANCH, CALIFORNIA
1964-1965

SECTION A

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
<table>
<thead>
<tr>
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<td>PARTYI</td>
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</table>
CHARLES MOORE

BURNS HOUSE
SANTA MONICA CANYON, CALIFORNIA
1974

SECTION A

ELEVATION 1

ELEVATION 2

ELEVATION 3

SITE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
GLENN MURCUTT

MAGNEY HOUSE
BINGIE POINT, MORUYA, AUSTRALIA
1982–1984

ELEVATION 1

SECTION A

ELEVATION 2

ELEVATION 3

SITE PLAN

FLOOR PLAN
GLENN MURCUTT

SIMPSON-LEE HOUSE
MT. WILSON, NEW SOUTH WALES
1960-1964

ELEVATION 1
SECTION A

ELEVATION 2
ELEVATION 3

SITE PLAN

FLOOR PLAN
JEAN NOUVEL

INSTITUTE OF THE ARAB WORLD
PARIS, FRANCE
1981–1987

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN

FIFTH FLOOR PLAN
ANDREA PALLADIO

VILLA POSCAR
MALCONTENTA, ITALY
c. 1549-1563

SECTION A

SITE PLAN

ELEVATION 1

FLOOR PLAN

ELEVATION 2
ANDREA PALLADIO

LA ROTONDA (VILLA CAPRA or ALMERICO)
VICENZA, ITALY
1566–1571

SECTION A

SECTION B

ELEVATION 1

SITE PLAN

FLOOR PLAN
ANDREA PALLADIO

REDENTORE CHURCH
VENICE, ITALY
1576-1591

SECTION A
SECTION B

ELEVATION 1
ELEVATION 2

SITE PLAN
FLOOR PLAN
HENRY HOBSO N RICHARDSON

TRINITY CHURCH
BOSTON, MASSACHUSETTS
1872-1877

SECTION A
ELEVATION 1

ELEVATION 2
ELEVATION 3

SITE PLAN
MAIN FLOOR PLAN
UPPER FLOOR PLAN
HENRY HOBSON RICHARDSON

SEVER HALL
HARVARD UNIVERSITY
CAMBRIDGE, MASSACHUSETTS
1879-1880

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN
JAMES STIRLING

HISTORY FACULTY BUILDING
CAMBRIDGE UNIVERSITY
CAMBRIDGE, ENGLAND
1964

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN
JAMES STIRLING

OLIVETTI TRAINING SCHOOL
HASLEMERE, SURREY, ENGLAND
1969

SECTION A

SECTION B

SITE PLAN

ELEVATION 1

LOWER FLOOR PLAN

UPPER FLOOR PLAN
LOUIS SULLIVAN

AUDITORIUM BUILDING
CHICAGO, ILLINOIS
1887–1890

SECTION A

ELEVATION 2

ELEVATION 1

SITE PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN
LOUIS SULLIVAN

WAINWRIGHT BUILDING
ST. LOUIS, MISSOURI
1880-1891

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN
LOUIS SULLIVAN

CARSON PIRIE AND SCOTT STORE
(SCHLESINGER AND MAYN DEPARTMENT STORE)
CHICAGO, ILLINOIS
1899-1903

SECTION A

ELEVATION 1

SITE PLAN

MAIN FLOOR PLAN

TYPICAL FLOOR PLAN
LOUIS SULLIVAN

NATIONAL FARMERS' BANK
OWATONNA, MINNESOTA
1907-1908

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
<table>
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GIUSEPPE TERRAGNI

SANT' ELIA NURSERY SCHOOL
COMO, ITALY
1936-1937

SECTION A

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN
GIUSEPPE TERRAGNI

VILLA BIANCA (ANGELO TERRAGNI HOUSE)
SEVESO (MILAN), ITALY
1937

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
LUDWIG MIES VAN DER ROHE

GERMAN PAVILION AT INTERNATIONAL EXHIBITION
BARCELONA, SPAIN
1928-1929

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

FLOOR PLAN
<table>
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LUDWIG MIES VAN DER ROHE

TUGENDHAT HOUSE
BRNO, CZECHOSLOVAKIA
1928–1930

SECTION A

ELEVATION 1
ELEVATION 2

SITE PLAN

UPPER FLOOR PLAN
LOWER FLOOR PLAN
ROBERT VENTURI

PETER BRANT HOUSE
GREENWICH, CONNECTICUT
1973

SECTION A

SECTION B

ELEVATION 1

SITE PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN

200
ROBERT VENTURI

CARLL TUCKER III HOUSE
MOUNT KISCO, WESTCHESTER COUNTY, NEW YORK
1975

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

LOWER FLOOR PLAN

MAIN FLOOR PLAN
FRANK LLOYD WRIGHT

FREDERICK G. ROHIE HOUSE
CHICAGO, ILLINOIS
1909

SECTION A

SECTION B

ELEVATION 1

ELEVATION 2

SITE PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN
FRANK LLOYD WRIGHT

FALLINGWATER (EDGAR J. KAUFMANN HOUSE)
OHIOFYLE, PENNSYLVANIA
1935

SECTION A

SECTION B

SITE PLAN

ELEVATION 1

ELEVATION 2

LOWER FLOOR PLAN

UPPER FLOOR PLAN
<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>CIRCULATION TO USE</th>
<th>UNIT TO WHOLE</th>
<th>ADDITIVE AND SUBTRACTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NATURAL LIGHT</td>
<td>PLAN TO SECTION</td>
<td>REPETITIVE TO UNIQUE</td>
<td>SYMMETRY AND BALANCE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAKING</td>
<td>GEOMETRY</td>
<td></td>
<td>JAFTI</td>
</tr>
</tbody>
</table>
FRANK LLOYD WRIGHT

SOLOMON R. GUGGENHEIM MUSEUM
NEW YORK, NEW YORK
1956

SECTION A

SECTION B

ELEVATION 1

SITE PLAN

LOWER FLOOR PLAN

UPPER FLOOR PLAN
PETER ZUMTHOR

CHAPEL OF ST. BENEDICT
SUMVITG, SWITZERLAND
1987–1988

SECTION A

SECTION B

ELEVATION 1

SITE PLAN

FLOOR PLAN
PETER ZUMTHOR

ART MUSEUM (KUNSTHAUS) BREGENZ
BREGENZ, AUSTRIA
1990-1997

SECTION A

SECTION B

ELEVATION 1

SIZE PLAN

MAIN FLOOR PLAN

UPPER FLOOR PLAN
FORMATIVE IDEAS

Plan to Section or Elevation / 232
   Equal
   One to One-Half
   Analogous
   Proportional
   Inverse

Unit to Whole / 239
   Unit Equals Whole
   Units Contained in Whole
   Whole Greater than Sum of the Units
   Units Aggregate to Form Whole
      Units Adjoin
      Units Overlap
      Units Separate

Repetitive to Unique / 246
   Unique Surrounded by Repetitive
   Unique by Transformation of Repetitive
   Unique in Repetitive Field
   Unique Added to Repetitive
   Unique Defined by Repetitive

Additive and Subtractive / 252
   Subtractive
   Additive

Symmetry and Balance / 254
   Symmetry
   Balance by Configuration
   Balance by Geometry
   Balance by Positive and Negative

Geometry / 260
   Basic Geometry
   Circle and Square
   Rectangle Overlapped by Circle
   Two Squares
   Nine-Square
   Four-Square
   1.4 and 1.6 Rectangles
   Geometric Derivatives
   Rotated, Shifted, and Overlapped
   Pinwheel, Radial, and Spiral
   Grid

Configuration Patterns / 274
   Linear: Use
   Linear: Circulation
   Central: Use
   Central: Circulation
   Double Center
   Cluster
   Nested
   Concentric
   Binuclear

Progressions / 284
   Hierarchy
   Transition
   Transformation
   Mediation

Reduction / 288
   Large Plus Small Reduction
   Part of Whole Reduction
FORMATIVE IDEAS

From the analysis of the 104 buildings in the first section, patterns in the design consideration of various architects were identified. Similarities in design approaches appeared among many of the architects' works, independent of time, style, location, function, or type of building. The similarities can be grouped into dominant themes or formative ideas which were conceivably used in the generation of the building designs.

A formative idea is understood to be a concept which a designer can use to influence or give form to a design. The ideas offer ways to organize decisions, to provide order, and to consciously generate form. By engaging one formative idea instead of another, a designer begins to determine the formal result and the manner in which it will differ from other configurations. The use of different ordering ideas may generate different results.

Presented in this section of the book is a series of connections among architects' designs organized by formative idea. Each concept is defined and explored through the presentation of generic manifestations of the idea. The written description is followed by a set of diagrams which exemplify some, but not all, of the generic alternatives. The inventory is not exhaustive: every idea is not explored, nor is every example included. Generally, diagrams developed in the analysis section are supplemented with other examples to illuminate a formative idea. Diagrams were selected which best illustrate the idea, show a variety of manifestations, and represent the widest range of building types from the broadest time frame.

PLAN TO SECTION OR ELEVATION

As a formative idea, the relationship of a plan to a section or an elevation entails design by using an identifiable correlation between the horizontal and vertical configurations of the building. Embodied in this is the linking of the two realms so that decisions in one arena determine or influence the form of the other.

The most direct connection between the plan and section occurs when they are the same—when the delineation of the two is equal. This can be described as a one to one relationship. A sphere, for example, is a figure in which the plan and section are represented by one circle. It is also possible to relate part of one configuration to the whole of the other. For example, a one to one-half relationship exists in a building that has a section or elevation equal in figure and dimension to one-half of the plan. In this case, a circle in plan becomes a half-circle in section, creating a hemisphere. The reciprocal condition is also possible, where the whole plan form of a building is the same as one-half of the section or elevation. In either case, the figures that appear in both plan and section are equal in dimension. In those circumstances in which the section is one-half the plan, a laterally symmetrical plan configuration can be achieved by utilizing the section form twice to create the whole plan. A special condition occurs when the same part of each figure overlaps, such as in the definition of the main space at La Rotonda.

A relationship of proportion by ratio can be used to link the plan with section or elevation. Distinct from the part to whole connection just described, the relationship of proportion establishes the plan and the section as the totality of the other, though different in scale. This relationship is predicated on more information in plan and section being paired than just the outline of each. Examples of ratios which are often used because of their compatibility with primary geometry are 1:2, 2:3, and 1:5. In each case, the plan and section have configurations that differ by dimension in one direction only.
In the case of a 1 : 2 relationship, the plan and the section have the same shape, but one is twice the other in one dimension. For example, a circle in plan would be an oval in section, with the height one-half the width. It is not necessary, though, for each of the parts in the plan to be reduced or increased at the same rate when they are utilized in the section or elevation. In Christ Church, by Nicholas Hawksmoor, for instance, while one element is reduced when it appears in the other realm, the other element is increased.

Plan and section or elevation can have a relationship identified specifically as analogous when the information from one is seen to resemble generally the shape of the other. This type of relationship between the plan and section is the most common, and often involves part of the plan and section rather than the entire plan or section form. Differences between the two may be due to a form language change, size or location shift, or irregular increments of change. In a form language change an orthogonal element in plan or section may be paired with a comparable curve form in the other realm. When size and location shifts occur, an element in the horizontal arena is larger or smaller, or in a slightly different location than in the vertical dimension. In increment change the plan or section information changes at one rate while the correlative information in the other changes in a similar way, but at a different rate.

An inverse relationship exists between the plan and section when the configuration of one is paralleled with some opposite condition in the other. For example, when the plan form has components which are large, or simple, or positive, or random, and that correspond to section elements that are small, or complex, or negative, or ordered, respectively, then an inverse relationship exists between the two.

Whereas the relationships of equal, part to whole, proportional, analogous, and inverse establish a link between plan and section in which decisions about one determine the configuration of the other, it is also possible to have a connection that is less deterministic and more influential in nature. In this type of relationship, decisions about the plan or section establish a range of possible configurations for the other.

A part to whole relationship can be created between the plan and the section. In this context, one configuration serves as the whole shape, which, by reduction, becomes a part in the other configuration. The whole is evident in this relationship in its entirety as a part in the other domain, but in reduced dimensions. An example of this form of relationship exists in the Yano House by Arata Isozaki. In this house, which is diagrammed on page 291, the whole configuration of the plan is repeated as part of the section.

Plan and section can also have a coincident relationship when significant points and limits in the plan form coincide with important points in the section. Essential is the alignment of the locations where major changes occur in both plan and section even though the actual configurations are quite varied. The Allegheny Courthouse by H. H. Richardson, which is analyzed in the first part of this book, exemplifies this relationship.

A final alternative to the plan and section relationship is that of common derivation or common origin. In this case, the plan and the section configurations are determined by separate derivation from a common origin. For example, in San Maria degli Angeli by Filippo Brunelleschi, which is also in the analysis section, the plan and section forms are both developed from two overlapped squares that are rotated 45 degrees to each other. In the plan, the two squares have a common center, while in the section, the corner of one square intersects the middle of a side of the other. Both plan and section derive from the same size squares, but the resulting configurations are quite different.

UNIT TO WHOLE

The unit to whole relationship is a formative idea which involves the concept of unit and the understanding that units
can be related to other units in specific ways to create built form. A unit is a major recognizable component of a building that generally has a scale that approaches, or is one level removed from, the scale of a whole building. Units can exist within a building at several scales. However, while a brick can be seen as a unit at the scale of a wall, it is less productive to view the brick as a unit at the scale of a building; otherwise, all brick buildings will have the same unit to whole relationship. Units, then, are normally spatial volumes, use-spaces, structural elements, massing blocks, or composites of these elements.

The most direct relationship between a unit and the whole occurs when the two are the same entity—when the unit is equal to the whole. This usually occurs in buildings which are designed as minimal monolithic forms. For example, Cheop's pyramid comprised enormous quantities of stone blocks and cladding pieces. Yet, the dominant perception of this building is that of an identifiable entity. At a greatly reduced level of importance this perception may be qualified to include the surface texture or pattern developed by the fine scale cladding units. Similarly, the glass, tight-skinned cladding on some modern buildings is secondary to the overall monolithic form.

The most prevalent form of unit to whole relationship is the aggregation of units to create the whole. To aggregate units is to put the units in proximity with each other such that some relationship is perceived to exist. The units may or may not be in physical contact with each other for a relationship to be identified. The alternative forms of creating a whole through the aggregation of units are characterized as adjoining, separate, and overlapped.

Adjoining is the most common form of aggregation. In this relationship the units are visible, perceived as entities, and relate to other units through face to face, face to edge, or edge to edge contact. Interlocking is one variation of face to face adjoining.

Units may be separate and at the same time related to other units to form a whole. Separation can occur through physical isolation or through the articulation of the connection between the units such that the units are perceived to be separate. Essential to this type of relationship is the perceived segregation of units and the proximity of the units so as to establish a compositional relationship.

Units may also aggregate to form a whole through overlap. Since architecture is a three-dimensional phenomenon, the overlap of units in the volumetric realm is by interpenetration. For this to happen the units are identified as entities that partially share form or space with other units. The portion of the overlap is seen as part of each unit and at the same time common to both.

Units can also be contained within a built whole. To distinguish this relationship from units adjoined to form a whole, the building as a whole is the dominant expression with the units contained and not expressed. Embodied in this relationship is the concept of a building as a wrapper or container for units which are usually spatial or structural volumes.

It is possible for a building whole to have more built form than that generated by the assemblage of the identified units. This relationship can be described as one in which the whole is greater than the sum of the parts. In this case, some of the built form serves as a matrix which holds, connects, or at times, just has contact with the units. The units may be formal or spatial, and visible or not. Important to this relationship is the concept of poche, which is the defined difference between interior volume and exterior configuration.

**REPEITITIVE TO UNIQUE**

The formative idea of relating repetitive and unique elements entails the design of built form through the establishment of relationships between components which have multiple and singular manifestations. Fundamental to this idea is the understanding of unique to be a difference within a class or a kind. This distinction allows for the common reference frame of class or kind to couple the domain of the repetitive with the
unique. The definition of the unique, in terms of the repetitive, permits the identification of the differences in attributes of common elements. For example, massing units are compared with massing units to determine the differentiating features which make one unit unique. If massing units were compared to windows or structure, the nature of the difference might never be discerned because of the disparity of characteristics to be compared. Repetitive and unique elements can occur at a number of varied scales and levels within a building. As with the unit to whole relationship, the concern is with the dominant manifestation of the idea.

In the realm of architecture, the repetitive and unique elements are usually three-dimensional, and, as such, can be communicated through the conventions of plan and section. In most cases, the repetitive and unique will appear in the same vertical or horizontal arena. However, it is possible for the repetitive elements to occur in plan and the unique element to occur in section, or conversely for the unique to appear in plan and the repetitive in section. San Maria degli Angeli by Brunelleschi is an example of this separation.

A unique element can be developed through the transformation of repetitive units through changes in size, color, location, and orientation. Shape, geometry, and articulation changes can also render an element unique. The distinction between a change in shape and one in geometry is determined by the degree of difference between the two figures. If the unique element is in part the same configuration as the repetitive, then a transformation by shape exists. For example, a square can be transformed into a figure that has three straight, equal length lines at right angles to each other and is closed by an arc of a circle. If the unique component is different in form language from the repetitive, then a transformation by geometry occurs. In this situation, a circle is unique to repeated squares. A change in articulation happens when the same form or configuration is made manifest in two ways. For example, a transparent cube is unique by articulation to a series of opaque cubes.

The unique component can be surrounded by the repetitive. In this case, the unique is central and has its own configuration. The repetitive elements are located around it. It is possible, but not necessary, for the repetitive elements to be coincident with the boundary of the unique. However, a change in the arrangement of the repetitive elements will not change the unique that is surrounded. The counterpart relationship where the unique surrounds the repetitive is also possible.

An alternative to the unique surrounded configuration occurs when the unique is defined by the arrangement of the repetitive. The distinction between this alternative and the unique surrounded model is determined by the manner in which the unique is established. In this case, the unique is dependent upon the configuration of the repetitive elements for its shape or form. The unique does not exist without the repetitive, or, at least, its form will change if the repetitive elements or their arrangement changes.

Unique and repetitive elements can be added together to create built form. The determination of whether repetitive is added to unique or unique is added to repetitive is made perceptually by consideration of relative scales, configuration, location, or some combination. Generally, that which is added to will appear to be dominant.

Unique elements can be formed as a result of overlapping repetitive units where the shared configuration is unique. In some cases, the unique component in a building is the remainder of the built form after the repetitive units have been defined. In this instance, the unique is the difference between the overall building configuration and the sum of the repetitive parts.

If units are in proximity to each other so that a relationship exists, then the unique element can be separate from the repetitive. The nature of the separation can be physical or perceptual, as it is in the unit to whole relationship. Unique elements may also be located within a field in which the repetitive elements have a scale, configuration, and uniformity of relationship that renders them a larger unit that can be identi-
fied as a field or network. In this relationship, the difference between the repetitive and the unique is heightened by the disruption of the field by the unique.

Location can establish an element as unique. Singular occurrence in a linear arrangement can be the basis of uniqueness. Therefore, a unit at the center, one which is a terminus to a path, or one that is shifted out of alignment, can be rendered unique. It is also possible in a linear configuration to view the ends as unique units connected by repetitive elements.

ADDITIVE AND SUBTRACTION

Additive and subtractive are formative ideas which entail the design of buildings through the aggregation or removal of built form. Basic to these related ideas is the understanding that an additive design has perceptually dominant parts and a subtractive scheme has a perceptually dominant whole. The image a person has of an additive design is that the building is an assemblage of identifiable units. A person engaging a subtractive design understands the building to be a recognizable totality from which parts are removed. Buildings may embody both images, but it is the dominant perception of parts added or parts subtracted from a whole which renders them additive or subtractive, respectively. Generally, these ideas have the greatest bearing on formal considerations of a building, with massing a particular concern. However, as with any formal issue, spatial consequences can result from decisions made in this realm. Although additive and subtractive, as formative ideas, operate at the scale of the building, it is possible to use these concepts to make design decisions at other scales, like parts of buildings and rooms.

Additive and subtractive differ from the other concepts presented in that they are the generic examples of the idea. Alternatives are possible when the ideas are used in conjunction with each other to determine a building design. As noted previously, the potential for design richness is enhanced by the use of the two concepts in consort. This normally occurs when the use of the alternative is sequenced in some manner. For example, the creation of a form by subtracting pieces from a recognized whole, and then after adding parts to form a new whole, subtracting again. The amount of imagery developed by any one step, the dominance of the perception, and the sequence of the processes allow a broad range of alternatives within this formative idea.

SYMMETRY AND BALANCE

Symmetry and balance are formative ideas which entail the design of buildings through the establishment of perceived and conceived equilibrium between components. Intrinsic to an understanding of balance and symmetry in architecture are the notions that elements can be identified as equivalent, and that the nature of the equivalency can be discerned. The generic alternatives for balance and symmetry exist in the nature of these equivalencies. Balance and symmetry both create a stable state relationship between components on either side of an implied line or point. Generally, balance is perceptually based and focuses on the composition of elements. It becomes a conceptual phenomenon when components are given added value and meaning.

Symmetry, as a specialized form of balance, is perceptual in nature. Symmetry differs from balance in that the same unit occurs on both sides of the line of symmetry. The most familiar form of symmetry is referred to as axial, reflected, or mirrored, because the components are oriented such that one unit appears to be reflected in a mirror to create a second unit. In this type of symmetry, the elements are equal in configuration and opposite in handedness. That which occurs on the left side of one element will be on the right side of the other. Biaxial or bilateral symmetry is reflected symmetry that occurs in two directions.
A second form of symmetry is developed through the rotation of components about a common center. Implied in this situation is the central point, which by definition establishes patterns that are different from those developed by symmetry about a line. The central point can be located within, at the edge of, or outside the figure. If the point of rotation is within the figure, a series of overlapping forms will be created. This type of symmetry might also result in pinwheel configurations if the center of rotation is asymmetrically located in both directions. Besides the location of the center of rotation, other important variables are the number of times the figure is rotated and the increments between the rotations.

Symmetry by translation occurs when elements with identical shape and orientation are shifted. This symmetry allows for the development of linear organizations through the aggregation of multiple, equal units, where the symmetrical relationship exists between any two components. Configurations are not limited to straight lines, and can be serial in nature. It is also possible to incorporate more than one sequence of translation into a design. For example, the atrium housing by Jorn Utzon utilizes two sets of symmetrically related units, each with a different orientation.

While symmetry is predicated on equal units occurring on each side of a line or point, balance exists when the units on each side are different in some identifiable way. Differences in attributes which can create a balanced situation between elements include geometry, orientation, location, size, configuration, and a positive-negative reversal. Balance by geometry results from the relationship of equivalent units that vary in form language. For example, one element could be circular and the other rectilinear.

Equal units that have an orientation difference other than those stipulated in reflected and rotational symmetry can be balanced about an implied line. Unit size and relative distance from the line of equilibrium determine balance by location, which closely parallels the concept of balance by weights on a scale.

Units that vary in size can be equidistant from the line of balance when balanced by ratio. In this relationship, the difference in size is balanced by an intensification or concentration of other attributes within the smaller unit, such that the line of balance is created midway between the two. This occurs when a special condition, given importance, like a jewel, balances a much larger, less significant component. For example, two dissimilar size units can be related to a balance line midway between them through the utilization of special materials on the smaller unit.

Balance can also be developed through configuration differences in two and three dimensions. Visual equilibrium on a surface or in a form is achieved by the manipulation of area or mass, respectively. This distinction applies to a building elevation which can be understood in two dimensions, and to architecture which is a three-dimensional phenomenon. In this relationship, the issues of number, shape, and pattern are engaged through consideration of ranges of attributes like open-closed, few-many, and simple-complex.

Finally, balance can occur when two equivalent components exist in positive and negative form. It is this type of balance that can utilize the very essence of architecture, for it embodies equilibrium between mass and space. In this context, the positive tower form balances the void of the courtyard.

GEOMETRY AND GRID

As a formative idea geometry entails the use of the tenets of both plane and solid geometry to determine built form. Geometry in one form or another exists in all buildings, but as a formative idea it must be knowingly central to decisions regarding form at several levels.

The most fundamental use of this idea incorporates the basic figures of geometry as form or space to determine the overall configuration of a building. Thus, a building might be
a circle, a square, a triangle, a hexagon, an octagon, or any other singular describable and recognizable geometric form. While the geometric figure may not totally incorporate every piece of the building, it is necessary that the basic figure be dominant and perceptible.

Although architecture might be developed from one geometric figure, these forms can also be combined to generate a building; that is, a circle and square can be added together to create a building. Similarly, any two or more other basic forms might be combined, providing each is perceptible as a whole figure. The forms do not have to physically exist, but each must at least be implied. Within the realm of combinations, it is possible to locate one geometry that is within, contiguous to, or overlaps the other. When one geometry is located inside the other, the inner geometry might be an object, a room, a courtyard, a defined precinct, or an implied space.

A specialized form of geometric overlap prevalent in architecture is the combination of a rectangle and a smaller circle. A circle or a series of circular forms can overlap the rectangle at a side or corner. The overlap can result in a number of specific configurations, including the circle engaged on the centerline of the major side of the rectangle. A circle at the corner of the rectangle can overlap both sides, can have its center at the corner, or can be tangent to one of the sides.

As differing geometries are assembled, so too can similar geometries be combined. For example, buildings may consist of two circles, three triangles, or two hexagons of the same or different size. When square figures of the same size are combined in specific ways, some interesting and very particular phenomena occur.

Two identical squares combined with one congruent face create a rectangle with a 2:1 proportion. However, these same squares can be overlapped to make other rectangles smaller than 2:1, or separated to imply rectangles larger than this proportion. Normally, the space formed by the overlap or the space implied by the separation is used for special purposes, like entrances, or the main hall of building. Two squares can also be overlapped and rotated about a central point such that an eight-cornered figure is developed. It is also possible to unite two squares by attaching the corner of one to the face of the other.

Particular combinations of squares have the characteristic of being either multiples or equal subdivisions of a square. The distinguishing characteristic of these combinations is that they actually form another larger square. When four squares are assembled into a two-square by two-square configuration, the result is a figure that can be viewed as a four-part subdivision of the larger square or as a multiple of the smaller square. Similarly, nine squares can be assembled into a three-square by three-square configuration. By extension, squares can be assembled into 16-square and 25-square constructs.

In a nine-square configuration there are three types of squares, each with its own characteristics. Four of the squares are located on the corners and are bounded by two other squares. Four others are located on the sides and are bounded on three sides by other squares. The final square is located in the center and is completely surrounded. This bounded center square makes the nine-square format an identifiable and unique configuration. Whereas this arrangement emphasizes a central square or space, the four-square format articulates a central point.

Identifiable variations within the nine-square configuration are possible by removing certain squares, while maintaining others in their normal location. Thus, by using only the eight squares on the perimeter, a square ring is created. An “X” form is possible by using only the corner and center squares. By utilizing the middle square on each side and the square in the center, a “plus” configuration is made. Leaving out two side squares opposite each other results in an “H” shape. Finally, a stepped configuration is possible by removing one corner and the two contiguous side squares.

Forms can also be derived by using parts of the basic geometric shapes. In the simplest terms, this might be one-half or
some other fraction of a circle, square, or triangle. However, more complex configurations are possible through combinations of forms derived from several geometric shapes. Though clearly derived from geometry, these configurations are not describable in simple geometric terms. Another geometric derivation is the implying of a larger geometric shape by points located within the architectural configuration. For example, at the Guild House by Robert Venturi, the corners of the building align to project a large triangle.

Certain derivations from a square result in three different rectangles with sides of particular proportions. The proportions are all less than the 2:1 proportion that results from combining two squares. The first, the square-root-of-two rectangle, is derived from the 45 degree rotation of the diagonal of a square, to form the long side. A 1.5:1 rectangle can be formed by adding one-half of a square to a square. The third, the golden-section rectangle, is derived from the rotation of the diagonal of one-half the square to form the major side of the figure. The center of rotation in this case is the midpoint of one of the sides of the square. Each of these rectangles, used either alone or in combinations, is frequently utilized to form buildings or parts of buildings.

Another series of configurations can be developed through the manipulation of geometries by rotation, shift, and overlap. These manipulations, all described by a process of implied movement, can be used in combinations to create more complex forms: for instance, rotation used in conjunction with overlapping.

Rotation is the conceptual process of moving a part or parts about a center. This center of rotation may be, but is not necessarily, the same for all the parts. Rotational movement naturally changes the orientation of the part involved. A particular configuration that results from rotation is the hinge in which two linear and connected elements are normally oriented in different directions. In some examples, the pin of the hinge or connector actually appears as a figure in the building; in other cases, it is implied.

When the manipulation by shifting occurs, the parts move, but unlike rotation, the orientation of the parts remains the same. While the shifting is often orthogonal in nature, a diagonal shift can create added richness by resulting in change in two directions through movement in one. Shifting might also be understood as sliding of two parts against one another. When this occurs, a third space or form is usually introduced between the shifting parts to neutralize the fissuring.

Overlap has the unique characteristic of creating a third figure from the combining of two other figures. The overlap of relatively simple shapes can result in a common space, as well as a total configuration, that is quite complex. Depending upon the nature of the overlap, the figure of the common area might be quite different from either of the overlapping figures.

The geometric configurations of radial, pinwheel, and spiral share the common attribute of originating from a center. Buildings that can be considered radial have dominant multiple elements that extend from a center. These raylike elements may be intersected with other elements that are in a concentric arrangement. Both spiral and pinwheel configurations are more dynamic than radial. Spirals move away from a center at a constant rate of change and in a rotational direction. Pinwheels consist of offset linear elements that are connected to a common core or abut to form an implied core. The parts of this configuration are positioned so that the centerlines of the elements do not intersect at a common center. These elements do, however, occur radially at regular intervals, and have similar relationships to the core and to each other. Spinning is the implied dynamic of a pinwheel configuration.

Grids are developed from the repetition of the basic geometries. Multiplication, combination, subdivision, and manipulation are the processes used to create the repetitions. Conceptually, grids are infinite fields in which all units relate equally to all other units. A grid can be described as a series of parallel lines that intersects at least one other series of parallel lines.
The intervals between lines can repeat or vary. In the series' simplest form, all intervals would be equal. The complexity of the series can be altered by increasing the number of intervals that occur within it. The frequency with which a particular interval occurs, and its relationship to another interval and its frequency, will determine whether a discernible pattern exists, and the nature of that pattern. Thus, if "a," "b," and "c" represent intervals on a grid, and if "a" is to occur at the frequency of every fourth interval, then the pattern might be "a, b, c, a, b, c, a, b, ..."; but it might also be "a, b, c, a, b, c, a, b, ..." or "a, b, c, a, b, c, a, b, ...".

Another aspect of grid is the relationship between one series and another. Two series might or might not be orthogonal to each other. If the relationship is orthogonal, with all intervals in both series equal, a square grid results. A regular rectangular grid occurs when two series, each with a different interval, are orthogonal, and the intervals within each series are equal. Two orthogonal series, each with more than one equal interval, create a rectangular, plaid grid. Two nonorthogonal series of lines constitute a parallelogram grid. A triangular grid is formed by three intersecting series of lines which have common points of intersection. The number of series of lines which might exist coincidentally is conceptually infinite, but practically, the number is significantly lower.

Within the grid, a critical construct is the intersection created by any two lines in the series. However, intersections alone do not provide enough information to describe a grid accurately. For instance, a series of intersections arranged in what is apparently a square grid configuration, also can describe a parallelogram or triangular grid if the intersections are connected differently.

Important to the total understanding of a grid is the method of articulating both the line and the intersection. As discussed, both must exist conceptually and be defined, but either may be implied by the existence of the other; that is, at least two points or intersections must exist in order to imply a line. If enough of the field exists so that an expected pattern can be perceived, then it is also possible for an intersection or part of a line in the grid to be removed. Expectations, then, complete or fill in the implied piece. Articulation of the lines and intersections can establish importance or give major and minor emphasis to the grid. Like the basic geometric figures, grids can be combined or manipulated through the processes of rotation, shift, and overlap.

CONFIGURATION PATTERNS

As a formative idea, patterns of configuration describe the relative disposition of parts. The patterns are essentially themes that have the potential for making space and organizing groups of spaces and forms. The terms that describe these basic patterns are: central, linear, cluster, concentric, nested, double-centered, and binuclear.

Central configuration patterns can be classified as those that are central-dominant and those in which the central space is used to organize other spaces. How the center is engaged is the primary difference in each of these cases. In the first, one goes to or around the center while in the second, one goes through the center. A third model of central configuration, but one that is not included in this study, is that of a central solid, such as a fireplace.

In the central-dominant model, the center is the focus with the most important use-space located in that position. If this space is covered, it is very often done so by forms that are higher in the center than at the edges—a hemisphere or dome, a cone, or a pyramid. Thus, the idea of center is reinforced by the roof or ceiling configuration. A primary characteristic of central-dominant space is that the center appears to generate the entirety of volume and form. This space can be functionally or symbolically dominant. In some cases it is considered sacred; in others it is less sacred, but no less important. The configuration of this pattern may suggest a singular volume or a spatial composition that extends
from the center. These volumetric extensions, which might create complex patterns, emanate from the center. Each successive volume reinforces the center, but lessens its own importance. Excessive extensions will at some point diminish the importance of the center itself. A fundamental difficulty in this configuration is maintaining the center focus or dominance while introducing entrance. Ideally, though it is not usually feasible, the entrance should be introduced at the center or through a continuous series of openings equally spaced around the perimeter.

Circulation within the central-dominant configuration is either to or around the center space. Therefore, the central space can be an outdoor space that one walks around, but generally not through. A cloister, in which the outdoor space is a sanctuary, or a multistoried atrium that one walks around, might be examples of voids that are central-dominant. Within this idea, the central space does not necessarily have to have external visual impact.

The other model of central configuration employs the center as an organizer of spaces. In this case, the center space can be considered a servant space that is used for circulation and as a clearinghouse that resolves circulation problems. The classic rotunda is an example of such a space. It may have great significance externally, and formally may unify the building, but functionally it is not important as a use-space. This configuration, like the central-dominant organization, does not necessarily have to be expressed externally. It can be a void, such as a courtyard or atrium, that is used for circulation.

Whereas the previous configurations developed from the concept of center, linear configuration patterns focus on line and movement. They entail the critical issues of path and direction. As with central configuration, linear patterns are classified into two types. The primary distinction is identified by the relationship of use-space and how one engages it through circulation. In the first model, the circulation is separate from the use-space, and can be referred to as a spine. In the second type, circulation is through the use-space and the spaces are linked, much as the chain of a necklace links beads by passing through them.

The spine is a servant space that provides access to a series of independent parts or rooms. Often, the common circulation route allows parts that have no direct relationship to each other to be grouped. The spine may be dominant in the form of the building, or it may be hidden within. In the latter case, the spine is reduced to a single- or double-loaded corridor. Symmetrical or asymmetrical arrangements of parts is possible along the spine. By nature, a spine is not hierarchical, nor is it of a given length, but what it serves may begin to determine its limits. Other architectural issues, like entrance, also influence the actual spine configuration and the way it is experienced. Normally, spines are assumed to be straight, but they can be bent to create enclosed space, to focus view, to reduce its apparent length, or to respond to some exterior situation. Within a building there also may be more than one spine. In these instances, spines that cross and the nature in which they cross might suggest hierarchy or special areas.

A use-space that is traversed longitudinally, or a series of spaces that are linked to suggest movement from one to another, describes that second type of linear configuration. Thus, a path is either through the space or from space to space. In the space to space circumstance, the pattern of the location of openings between spaces will determine the configuration and the legibility of that path. Volumetric extensions may enrich the path if the extensions are rendered secondary to the primary space and are located in a manner that reinforces the linear quality of the space.

In this type of linear configuration exists the opportunity to exploit the potentials of serial progressions. While progressions themselves are discussed later, it is important to realize that space to space linear configurations are normally engaged sequentially. Therefore, it is possible to place importance on any space in the sequence. Accent can be at the beginning of, along, at the center of, or at the end of the path.

Cluster organizations refer to groupings of spaces or
forms in which there is no discernible pattern. The units, whether forms or spaces, need to be in proximity to one another, yet the relationship between these units is irregular. While not a prerequisite for clustering, the random character of the relationships may permit the units to be irregular. Spaces can cluster within an overall form and in a way that influences or determines three-dimensional forms. Forms that cluster may have spatial subdivisions that are not important or dominant within them.

The concentric configuration pattern is analogous to the pattern created by dropping a pebble into water. The pattern is concentric when a series of units of differing sizes have the same center. This configuration can also be viewed as layering in which one element is viewed in the context of another. A characteristic of concentric organizations is that several rings are necessary to begin to see the pattern. However, it is important to note that the rings, though they share a common center, may not be of the same form language.

Nested configuration patterns share certain characteristics with concentric patterns. While both patterns have units inside one another, in nested patterns the center of each unit is different. Nested units can have other parts, such as one or more sides or a centerline, in common. Both nested and concentric patterns can be created at the formal or spatial level, and both imply layering.

A configuration pattern with two equally important foci is called double-centered. Prominent in the understanding of double-center is the idea of a precinct or field that has definite boundaries. The precinct can be either solid or void. If a void, the field can be a room, a large interior volume, or an outside space, like a court or a discernible area.

If the building is considered a mass, then the precinct is a solid. In either case of precinct as void or as solid, the double-centers are rendered opposites within the field. Thus, if the precinct is solid, the double-centers refer to objects within a defined space. If the precinct is considered solid, the double-centers are spaces that are hollowed from the mass, and the remainder is considered poche.

Binuclear configuration patterns have the primary attribute of two equally dominant parts, which, as forms, comprise the general building configuration. The two forms establish a line of symmetry or balance. While the nuclear parts may be the same, they also may be different through changes of geometry, orientation, configuration, or state. A third form may create a link between the nuclear forms, but it is not essential. Usually, this connector is a secondary or neutral space which is exclusive of both dominant parts. On occasion, though, it can be a major use-space or a solid in the form of a wall. The dominant parts are often engaged by entering between them, or by entering into one and then proceeding to the other in a linear fashion.

PROGRESSIONS

The archetypal themes that comprise the formative idea of progressions focus on patterns of incremental change that occur between one condition and another. Progressions embrace ideas of multiplicity, rather than duality. Therefore, to discern a pattern, more than two increments of change are normally necessary. Hierarchy, transition, transformation, and mediation are the generic progression types discussed in this study. An important distinction between these generes and the overall progression category is that the generes are bounded subsets of progressions. Whereas progressions can be infinite, the four generic examples are finite, with definite beginnings and ends. In these bounded sets, the characteristics of the increment are describable in relation to the next increment, rather than as an isolate. Similarly, the increment can be understood in relation to the boundaries. Something large in one instance, for example, is actually small in another.

Hierarchy refers to the rank ordering of parts relative to a common attribute. This ranking differentiates among the
parts by assigning importance. Sacred to profane, large to small, figure to poche, center to edge, servant to served, tall to short, few to many, and inclusive to exclusive are some of the hierarchies often found, either alone or in any number of combinations, in architecture. In some instances, it is necessary to determine more about the attribute before knowing the importance. Large, for instance, is not necessarily more important than small. Rank orderings from large to small and from small to large are both evident in buildings.

The dominance of hierarchy within a building is often reinforced through the layering of more than one progression type. The Temple of Horus at Edfu, for example, employs several architectural hierarchies to reinforce the importance of the room for the main god. These architectural hierarchies support the religious and social hierarchical beliefs of the society. The Temple's hierarchies are based upon the importance of the sacred to the profane, and are architecturally rendered as small to large, one to many, dark to light, rooms to areas, and closed to open. The openings between the various precincts of the building change with gates in the profane areas and with the openings of increasingly smaller size that are closed by doors at the more sacred rooms. Changes in floor height through steps and sloping floors, even though slight in nature, also signal the movement to the sacred. The most holy space, which is protected and separated from the outside world by a series of walls, then, is the smallest, darkest, most enclosed, and roomlike precinct in the Temple. This sanctuary is for a few worshippers and the main god, as opposed to the many lesser gods found in other areas of the Temple. Immediately behind the large entrance gate is the great court or "hall for the masses." This precinct is large, open to the sky, and the least roomlike area in the Temple.

In other buildings, evidence indicates that the most important increment in a hierarchy is often rendered by architects with the most ornament, the most intense polychromy, the most precious materials, or the highest level of detail and texture. Location, as in the center, or at the end of an axis, might also reinforce the specialness of a space or form. In general, those qualities which make something special or precious in relation to others suggest the devices which are available to create importance in a piece of architecture.

Transitions are bounded progressions in which change takes place in an attribute without a change in form. A change from open to closed, inside to outside, simple to complex, movement to rest, individual to collective, and one size to another are typical transitions. As with hierarchy, transitions have definite limits, but as opposed to hierarchy, there is no value placed on the end condition of the limits; that is, simple is not seen as being more important than complex, or vice-versa. While the end states are seen as equal, the individual conditions between those ends must also be equal. Aldo van Eyck's discussions of the "inbetween" and "twin phenomena" are of value in understanding transition and its potentials. Within a transition there is necessarily a series of intermediate steps. Each of the increments between the extreme conditions of the transition will suggest what is on either side, and thus will form a link for the conditions on either side.

Transformation is a progression in which changes in form take place within the boundary of the object itself. It is similar to transition, but more specific in that the attribute being changed is the configuration. This configuration change may have impact on either the two or three dimensional form. A reference frame of multiple images is necessary so the change from one form to another is perceptible. Transformation is not, then, a comparison between two forms, but a series of form changes, with each form in the series hierarchically undifferentiated.

Mediation is distinct from the other generic progressions in that the end states are conditions which exist outside the building itself. The building is viewed as a bridge, or a piece of connective tissue, between conditions that exist in the context. Thus, the building cannot be considered autonomous, but must be seen in relation to its context. In order to utilize
mediation as a formative idea, a position is taken or a statement is made about the context in which a building is to exist. Generally, this is achieved by a certain amount of abstraction. For example, Richard Meier in the Atheneum at New Harmony abstracts the river on one side as a wavy wall and the grid of the town on the other side as orthogonal geometry. Preferably, such a position entails at least two conditions which might be in either the natural or the built context. Thus, the new building might mediate between two built situations, between two circumstances in the natural environment, or between a built condition and a natural one.

Within this idea, the building is seen as a fragment of a larger piece. Through mediation the building reconciles differences that exist in the context. In the building, a series of gestures might be made which modulate the form to reflect the external conditions. Alternately, one condition can be repeated in some form in part of the building and then altered to be more like the other external condition. Another possibility is that the building is a midpoint or series of intermediates between the two external circumstances.

REDUCTION

Reduction is a formative idea in which a configuration is repeated at a lesser size within the building. This miniaturization can occur in two ways: part of the whole, and large to small. In the first type, the whole, or a large portion of the whole, is reduced in size, and utilized as a part. Normally, in this case, the reduced piece is located within the whole. Alternately, a large unit and at least one reduction of that unit are combined to form a building or part of a building. The reduced unit may be repeated or reduced further. In this type, the reduced piece is usually located next to, rather than within, the larger unit. In either case, but particularly in the part of the whole type, the reduction may involve a positive to negative state change. At one size, for instance, the configuration might be a solid or mass while at the other size the configuration might be a void or space.

A unique quality of the part of the whole type of reduction is that an observer can learn about the whole by encountering a part. With this capacity to inform the observer, this type transcends the perceptual to the conceptual. Thus, by observing the configuration of a room, a court, or a wing of a building, it is possible to infer the configuration of the entire building. The conceptual transference of information may also take place between the plan and the section. In this case, the whole of the plan or section may be repeated in miniature form in the other position. For example, the section of a space or room may correspond to the configuration of the plan of the entire building, as in the Yano House by Isozaki.

On the other hand, in large to small type reduction, comprehending one part may inform about only another part, and not the whole. Therefore, this type remains purely perceptual. In many cases, large to small reductions are incorporated into buildings with major and minor parts so that less important aspects of the building occur in the reduced piece. Typical examples of this are the several buildings in which servant spaces, literal and otherwise, are the small parts. An interesting reversal to this more typical interpretation, though, is that small might mean intense, and thus more important. Alvar Aalto's Town Hall at Saynatsalo is an example where the small piece, which is the town meeting space, is the more important in the large to small reduction.
Plan, section, and elevation are conventions common to the horizontal and vertical configuration of all buildings. Decisions made in one of these arenas can determine or influence the form of the other. Illustrated are examples of equal, one to one-half, proportional, inverse, and analogous relationships.

Equal

The most direct relationship between the plan and section or elevation occurs when they are the same. In its simplest form, this equal relationship entails only the overall building configuration. At Asplund's Snellman House (1) the rectangle of the main house becomes the figure of the elevation, excluding the roof. Similarly, the rectangle of the overall plan form at the Old Sacristy (5) is repeated in the major mass of the elevation. Richard Meier, in the Smith House (2), employs a 1:4 rectangle for both the plan and section. The small outbuilding is a cube that is related to the major house form in the same way in both arenas. In the Pantheon (3), the circle that forms the major space in plan determines the interior configuration of that space. The dome of this space is a hemisphere with its crown located at a height equal to the diameter of the circle in plan. This space may be as close to a sphere in form as practically can be achieved. The Tucker House (4) by Robert Venturi is, without the roof form, a cube. Le Corbusier's Villa Stein (6) has plan and elevation configurations which are the same, not only in overall form, but also in their grid subdivisions.
One to One-Half

The configuration of the whole plan or section can be equal to a part of the other, as in the Stockholm Pavilion (1) by Corbusier in which the elevation wall is the same as one-half the plan. The large, dominant squares and smaller square skylights which constitute the major portion of the elevation in Isozaki's Nakayama House (2) are repeated as part of the plan. Generally, one-half the plan at Ronchamp (3) becomes the elevation where the thick wall corresponds to the roof. Saarinen, at the Yale Hockey Rink (4), utilizes the exact curve form that is the center rib of the roof as the outside configuration of each side. On the other hand, one-half the plan at Melnikov's Rusakov Club (5) and Breuer's St. John's Abbey (6) approximates the general configuration of the sections. In Palladio's San Giorgio Maggiore Church (7) the configuration of the main ceiling forms is equal to one-half of the plan form of this space. At Villa Rotonda (8), one-half of the plan is similar to the dominant exterior form.
An analogous relationship exists between plan and section when the configuration of one generally resembles the shape of the other. Differences in form language, size, location, or irregular increments of change may account for the resemblance rather than equivalence. The Florey Building (1) and Adult Learning Labs (2) have 'U'-shaped configurations in plan and section. Differences in size occur between plan and section in the Scottish Rite (5), Poplar Forest (6), Salutation (9), and Sullivan's bank (16). In the Hines House (13) size differences occur in two directions. Increment changes account for the variations in plan and section in the Ford Foundation Building (7), Fallingwater (14), Wolfsburg Cultural Center (15), Esso-Gutezeit (17), and the Besançon theater (18). Plan and section differ by form language in Exeter Library (8), Sever Hall (10), and Redentore Church (11). Location shift renders the plan of St. Clement Danes (12) somewhat different from the section. A combination of form language and size changes creates the variation in the Palace of Assembly (4). Form language and increment changes make the plan and section of the History Faculty Building (3) analogous, rather than equal.
Proportional

In the proportional plan to section relationship, the plan and section or elevation are totalities of each other, but have a dimension change in one direction. Connections between the two realms should involve more than just outlines of the plan and section. Most of the examples have section configurations that are uniformly smaller than the plane, but Unite d'Habitation (5) and the residence in Cadenazzo (10) are exceptions. At Carson Pirie and Scott (11), the increments between parts in plan reduce in section, but the number of increments in section increases. In Christ Church (7) a reversal occurs in the proportional change between plan and section. The interior form in section increases in plan while the exterior form decreases. Different parts of the Khunr Villa (13) have different rates of change between plan and section. The Brant House (14) and Lister Courthouse (15) both have modified form languages in plan or section. The Farnsworth House (1), Hotel de Montmorency (2), Villa Savoye (3), Schinkel's Residence (4), and the Charof Residence (5) exemplify proportional plan to section relationships with the sections smaller than the plan, and some but not all of the interior configuration related. Additional examples of this are St. Mary Woolnoth (8), the Lang Music Center (9), and the Salk Institute (12).
An inverse relationship exists between plan and section when the configuration of one is connected to some opposite condition in the other. In the fire station (1) and St. Mary Le Bow (2), a lesser plan form is the dominant element in section or elevation. This reversal of dominance occurs twice in the Leicester Engineering Building (3), where the major plan form is less significant in elevation and the dominant elevation component is small in plan. The inverse configurations in the Stockholm Library (4) have positive and negative manifestations, the central drum in elevation and the recess in plan. The church in Imatra (5) has a sequence of three curved and increasingly larger plan forms related to three decreasing forms in section. In the weekend house (6), the long side of the plan is low in section and the short side is tall. Simple plan forms relate inversely to a complex section and elevation in the Kimball Art Museum (7). At the medical building (8), two forms in elevation, one curvilinear and simple, the other rectilinear and articulated, reverse their characteristics in plan.
UNIT TO WHOLE

The unit to whole relationship is a formative idea that relates units to other units and to the whole in specific ways to create built form. Illustrated are examples of units equal to, contained within, less than, and aggregated to form the whole.

1. PYRAMID OF CHEOPS
ARCHITECT UNKNOWN
c. 2700 B.C.

3. FROG HOLLOW
STANLEY TIGERMAN
1973-1974

5. UNITED NATIONS PLAZA
ROCHE-DUNIKLOO
1963-1976

7. RESIDENCE IN RIVA SAN VITALE
MAURO BOTTI
1972-1975

2. RUFER HOUSE
ADOLF LOOS
1922

4. HOUSE AT WEISSENFHOF
LE CORBUSIER
1927

6. KRESGE AUDITORIUM
EROO SAARINEN
1955

8. ELPHINSTONE TOWER
ARCHITECT UNKNOWN
16TH CENTURY

9. SMALL OLYMPIC ARENA
KENZO TANGE
1961-1964

Unit Equals Whole

The most direct relationship between a unit and the whole occurs when the unit equals the whole. In Cheops's Pyramid (1) and the Rüfer House (2) surface material, color, and form render the unit as the whole. At Frog Hollow (3), the application of the color black unifies the roof, walls, and windows into a single entity. The unified grid becomes a wrapper that makes the United Nations Plaza (5) a unit and whole concurrently. As a segment of a sphere, Kresge Auditorium (6) is at once a unit and the whole. Le Corbusier's house at Weissenhof (4) and Mario Botta's house in Switzerland (7) are examples of whole forms that are subtractive. Thick walls that are unified in material and color along with the simple block form of Elphinstone Tower (8) render it a unit equal to the whole. A singular sculptural form makes the unit and whole equal in the Olympic Arena (9).
Units Contained in Whole

In the relationship of units contained in the whole, the units are structural components, use-spaces, or blocks of use-spaces. The whole is the dominant image, with the units not expressed on the exterior. Christ Church (6) and the churches of San Giorgio (1), San Spirito (3), and Redentore (4) are composed of implied spatial units in configurations that emphasize major subdivisions in the forms. The Student Union (2) and Carson Pirie and Scott store (5) are designed with units that are structural modules. In the Auditorium Building (7), the units are blocks of use-spaces which generally are divided into different types of uses. Lesser spatial units are organized around the main central space in St. Mary Woolnoth (8). Spatial volumes form the major units in the Old Sacristy (9), while domed ceiling forms create secondary units. In the Director's House (10) the units generally coincide with use and circulation spaces. Major rooms and groupings of smaller rooms create the units in the Lang Music Building (11) and the Hotel Guimard (12).
Whole Greater than Sum of the Units

In this relationship, the whole incorporates more built form than that ascribed to the identified units. The central space in the Exeter Library (1) is not a use-space and, therefore, not a unit. Tredyffrin Library (2) is more than the major use-space formed by the structural bays. In Hotel de Montmorency (3), Tendering Hall (4), Morgan Library (5), the Irish house (6), and Finlandia Hall (12), the major figured use-spaces form the units, and the lesser, servant spaces are poche. The units in Edfu Temple (7) are major building blocks set within a whole defined by a wall; the difference between the wall and the units is exterior space. In the Palace of Assembly (8), the units are the two unique central forms and the blocks of use-spaces at the perimeter; the remainder of the interior court is the excess. At Fallingwater (9), the units are expressed in elevation by balcony forms and chimney masses, viewed against the remainder of the building. A wall defines the whole in the Musgum Village (10), which is more than the units combined. At Sea Ranch (11), the units are the living spaces, while the whole also includes the central space and the secondary units added to each dwelling.
Units Aggregate to Form Whole

Units are aggregated to form a whole when they are arranged in proximity to other units to establish a perceived relationship. This is done by adjoining, separating, and overlapping.

James Stirling's work at this time, is exemplified in the Engineering Labs (1), History Faculty (2), and the Florey Building (3). At Easton Neston (4) and Nashdom (7), assembled units emphasize the classic central entrance. Built form and spatial units are combined in St. George (5). The Besançon Theater (6) and Trinity Church (8) exemplify units added around a dominant central form. In Richardson's Courthouse (9) and Aalto's Town Hall (10), units as groups of use-spaces adjoin around a central court, and at Aalto's Church (12), Cultural Center (14), and Sanatorium (15) they adjoin to create the building itself. At Unity Temple (10), two sets of added units are combined. Major and minor units connected by a third unit define the Guggenheim Museum (11). In La Rotonda (16), the units are added symmetrically about a central space, while at Karlskirche (19) the use-space units adjoin symmetrically. Major volumes and components comprise the fire station (17) and the Brant House (18), and units occur around a central form or space in Stockholm Library (20) and Santa Maria (21). Structural units adjoin in Villa Savoye (22) and the Kimball Art Center (23), Kahn's Convent (24) is a series of forms partially contained by units which are groups of spaces.

242
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| 1. **SEVER HALL**  
HENRY HOBSON RICHARDSON  
1879-1880 | 4. **LISTER COUNTY COURTHOUSE**  
ERIK GUNNAR ASPLUND  
1917-1921 |
| 2. **FREDERICK G. ROBIE HOUSE**  
FRANK LOYD WRIGHT  
1900 | 5. **CARL TUCKER III HOUSE**  
ROBERT VENTURI  
1975 |
| 3. **YALE ART AND ARCHITECTURE**  
PAUL RUDOLPH  
1958 | 6. **ERDMAN HALL DORMITORIES**  
LOUIS I. KAHN  
1960-1965 |
| 7. **OCCUPATIONAL HEALTH CENTER**  
HAROLD HOLZMAN-PFEFFER  
1973 | 8. **PRATT RESIDENCE**  
HAROLD HOLZMAN-PFEFFER  
1974 |
| 9. **SALISBURY SCHOOL**  
HAROLD HOLZMAN-PFEFFER  
1972-1977 | 10. **RESIDENCE IN BRIDGEHAMPTON**  
GWATNEY-SIEGEL  
1966-1971 |
| 11. **COOPER RESIDENCE**  
GWATNEY-SIEGEL  
1968-1969 | 12. **BARCELONA PAVILION**  
LUDWIG MIES VAN DER ROHE  
1929 |

**Units Overlap**

Units overlap to form a whole through volumetric interpenetration. Two elongated forms defined by four towers overlap the main block of Sever Hall (1), and an upper level wing with perpendicular orientation connects the two masses of the Robie House (2). In the Yale Architecture Building (3), a series of overlapping trays define interior space. The circular main space of Lister Courthouse (4) is partially engaged into the central mass, while the circle unites the triangle of the roof to the square of the building in the Tucker House (5). Overlapping corners allow for continuous circulation in the Byn Mawr Dormitories (6). Rotated sets of forms overlap in the Occupational Health Building (7), the Pratt Residence (8), and the Salisbury School (9). At the Bridgehampton Residence (10), implied circles overlap a rectangle and each other, and in the Cooper Residence (11), the overlapping forms create spatial subdivisions and imply a partial pinwheel. The Barcelona Pavilion (12) is a complex series of interpenetrating, orthogonal, and implied spatial volumes.
Units Separate

Units which are related to other units can be separated through isolation or articulation of the connection to create perceived separation. In the Deere Office Building (1), the units are separated by glass, a defined circulation element, and an atrium space. Glass is used to create perceptual separation in the Olympic Arena (2) and the house in Switzerland (3). The College Life Insurance Buildings (4) are isolated forms tenuously connected by a bridge at one level. A deck serves to unify isolated elements in the Mt. Desert house (5), and separated forms share a common roof in the Mellon Arts Center (6). Glass perceptually separates the units of the Everson Museum (7), and is also used to create apparent separation of units in the National Assembly (8) and the Chapel at Ronchamp (9).
REPETITIVE TO UNIQUE

The formative idea of relating repetitive and unique elements is the design of buildings by establishing relationships between components which have singular and multiple manifestations. Illustrated are examples of unique surrounded by repetitive; formed by transformation in a repetitive field; added to repetitive; and defined by repetitive.

**Unique Surrounded by Repetitive**

Repetitive elements surround a unique unit when the unique is in a bounded form and is ringed by multiple equal units. Unique elements are located in larger spaces formed by the repetitive units in Schinkel's museum (1), the Florey Building (10), and the Palace of Assembly (18). In the Hunting Lodge (2) the unique center is surrounded. It is partially surrounded in the Adult Learning Lab (16). Unique elements are surrounded in the Rhode Island Capitol (3), Unity Temple (4), and San Spirito (23), and are partially ringed in the Guggenheim Museum (5), the Convent (13), the Auditorium Building (15), and the Lang Music Center (17). The repetitive elements form a pinwheel in the Archives Building (6), and a "U" shape in both the Knueer Villa (9) and the Stockholm Library (22). St. George (7), Cambridge History (11), Trinity Church (12), and San Spirito (23) exemplify two kinds of repetitive elements. In Christ Church (8) and Villa Foscari (20), the multiple units relate to the unique element in more than one way. A central unique element is totally surrounded at Exeter Library (14), the theater (19), and La Rotonda (21). Santa Maria (24) has a unique center surrounded by two sets of repetitive elements, one spatial and one structural.
10. FLOREY BUILDING
JAMES STIRLING
1966
11. CAMBRIDGE HISTORY FACULTY
JAMES STIRLING
1964
12. TRINITY CHURCH
HENRY HOBSON RICHARDSON
1972-1877

13. CONVENT FOR DOMINICAN SISTERS
LOUIS I. KAHN
1965-1969
14. EXETER LIBRARY
LOUIS I. KAHN
1967-1972
15. AUDITORIUM BUILDING
LOUIS SULLIVAN
1887-1890

16. ADULT LEARNING LABORATORY
ROMALDO GIURGOLA
1972
17. LANG MUSIC BUILDING
ROMALDO GIURGOLA
1973
18. THE PALACE OF ASSEMBLY
LE CORBUSIER
1963-1963

19. THEATER IN BROUSSON, FRANCE
CLAUDE NICHOLAS LÉGOUX
1775
20. VILLA FOSCARI
ANDREA PALLADIO
c. 1549-1553
21. LA ROTONDA
ANDREA PALLADIO
1566-1571

22. STOCKHOLM PUBLIC LIBRARY
ERIK GUNNAR ASPLUND
1920-1925
23. SAN SPIRITO
FILIPPO BRUNELLESCHI
1434
24. SANTA MARIA DEGLI ANGELI
FILIPPO BRUNELLESCHI
1434-1436
A specific geometric combination is a rectangle overlapped by a smaller circle. The Lister Courthouse (1), the Ranger Lodge (2), the Casino (3), the Thermae (4), and the Swan House (5) exemplify the circle as a major use-space half engaged on the centerline of the long side of a rectangle. The residence by Botta (6) has the same configuration with the circle, a stair, reduced in scale. In Castlegar (7), the rectangle is overlapped by an ellipse at the centerline, and in Tendering Hall (8), a circle and an ellipse overlap the rectangle. In Austin Hall (9), two rectangles are intersected by two circles with a third circle that overlaps at the entry. Richardson’s Higginson House (10) has circles on opposite corners implying the diagonal, while in the Planetarium (11) two circles occur on the same side. Double major and minor circles overlap the rectangle in the Wheels of Heaven Church (12). In the castles, Rait (13) and Pitichie (14), the circle overlaps the corner in two directions, and in Chateau de Chambord (15) multiple corners are overlapped by the circles.
Unique in Repetitive Field

A field or network made from equal units in uniform relationships may be interrupted by a unique element. In the Artemis Temple (1), walls are located within a columnar field. Open courts that interrupt the structural system form the unique units in the Kimball Art Center (2) and the Student Union (4). At the Institute for Advanced Studies (3), unique geometric forms are placed within an orthogonal structural grid. A circulation element rotated in a structural field forms the unique element in the Brooklyn Museum (5), while at the Occupational Health Building (6), a skylight, rotated in the orthogonal grid, is unique. Structural fields are disrupted by a fireplace mass in the Robie House (7), by a dome in St. Stephen's (8), and by two different vertical circulation elements in the Villa Savoye (9).
Unique Added to Repetitive

When the scale and mass of the repetitive elements are dominant, the unique is viewed as added to the repetitive. In the Seinajoki Town Hall (1), the unique component, added to the end of the repetitive, becomes a terminus. The Kamioka Town Hall (2) has a unique form added to the midpoint of a series of multiple elements. Three unique units are placed into an implied arena in Boyer Hall (3), and a cloister is formed by the joining of the unique and repetitive at La Tourette (4). In the Unité d'Habitation (5) elevation, the special forms are added to the top and bottom of the main block. A different kind of end is created in the Wainwright Building (6) with the addition of the unique top. The unique form is added to the front of St. Nicholas (7). At the Olivetti Center (5), two unique elements are adjoined to the middle of the multiple units; while the two unique components at Leicester Engineering Building (9) are added adjacent to the main blocks of the building.
Unique Defined by Repetitive

Unique is defined by repetitive when the form of the unique element is established by the configuration of the repetitive elements. All of the examples have unique forms that are either interior or exterior spaces. In the Colosseum (1), Pompeii House (4), and Boston Public Library (5), a major exterior space is formed by the arrangement of the multiple units. This is also the case in Aalto’s town hall (6) and the Allegheny Courthouse (9). Major interior spaces that are expressed on the exterior are the singular units in Wagner’s Steinhof Church (2) and Wren’s St. Antholin (3). Multistoried, unique spaces that serve as the foci for surrounding repetitive spaces are exemplified in the Yale Architecture Building (7) and the Larkin Building (8).
Additive and subtractive are formative ideas which involve the assemblage of parts or the removal of pieces to create built form. In additive, the parts are dominant, while in subtractive, the whole is dominant.

Subtractive

All of the examples present simple orthogonal configurations that are eroded to generate the building design. At Homewood (1), terraces and the entry are developed by the subtractions, while in the Wainwright Building (2), a light well is made. The Whitney Museum (3) shows erosion in section, which allows for light to enter lower floors, the entry to be defined, and the building to establish a unique contact with the street. In Villa Savoye (4), the subtraction occurs within a bounded frame, and in the Stockholm Library (5), a drum is added into the courtyard created by the removal. The Venturi House (6) and Enso-Gutzeit Headquarters (7) are similar in that the subtraction establishes the entry. It also allows for the introduction of light into the interior at Enso. The major interior central space in Exeter Library (8) results from subtraction, while at the Student Union (9) a major exterior space, as well as the entry and smaller exterior spaces, is created by removal.
Additive designs are perceptually parts-dominant. In Villa Rotonda (1), the parts are attached to a major central unit. At Richards Medical Labs (2), a series of aggregations occur; service towers added to individual research labs form a composite unit, which is added to other similar parts and to a central service core. In Salutation (3), the servants' quarters are a minor element that is joined to the major form. A major use-space is added into the dominant building form in the Lister Courthouse (4). In the Florey Building (5), a series of segments aggregate to create an exterior space into which the unique common space is added. The units at Sea Ranch (6), each a collection of forms, are assembled under a common roof. Two sets of repetitive, orthogonal units are joined to make the two dominant building parts in Unity Temple (7). In the Allegheny Courthouse (8), the parts form a central open space. Lesser units are assembled around the nave in Saint George-in-the-East (9), and components that are generally consistent with use areas are aggregative to form the Wolfsburg Cultural Center (10). In San Maria (11) and San Vitale (12) a series of lesser spaces ring a major space.
Symmetry and Balance

Symmetry and balance are formative ideas in which states of perceived and conceived equilibrium are established between components to create built form. Illustrated are examples of axial, biaxial, rotational, and translational symmetry and balance by configuration, geometry, and positive and negative.

1. Salk Institute
   Louis I. Kahn
   1959–1966

2. Director's House
   Claude Nicholas Ledoux
   1775-1779

3. Unity Temple
   Frank Lloyd Wright
   1906

4. Christ Church
   Nicholas Hawksmoor
   1716–1729

5. Redentore Church
   Andrea Palladio
   1568–1592

6. Church of San Spirito
   Filippo Brunelleschi
   1434

7. San Maria degli Angeli
   Filippo Brunelleschi
   1454–1456

8. Lister County Courthouse
   Eino Gisalas Asplund
   1910–1911

9. Stockholm Public Library
   Eino Gisalas Asplund
   1920–1928

Symmetry

Symmetry, a specialized form of balance, entails the use of equal units on each side of an implied line or about a point. At Salk Institute (1), the line of axial symmetry is established through the major exterior space. In the Director's House (2), Unity Temple (3), Christ Church (4), Redentore Church (5), and San Spirito (6), it is through the major use spaces. In Santa Maria (7), radial symmetry is changed to axial by the location of two opposite entries. Symmetry occurs through the main interior space in the Lister Courthouse (8) and the Stockholm Library (9). Biaxial symmetry in the Temple of Venus and Rome (10) is through and between the major spaces. In Exeter Library (11), it bisects the dominant space, and in La Rotonda (12), it occurs in the main circulation area. Symmetry by rotation in St. Mark's Tower (13) has four units about a point, while Castle del Monte (14) shows eight, and St. John Nepomuk (15) has five. St. Ivo (16), the Pilgrimage Church (17), and the Sepulchral Church (18) each has three units in symmetry by rotation. Units as rooms and groups of rooms are symmetrically translated into linear configurations at St. Andrews (19) and in a school by Botta (20). Two sets of units are translated in different directions in Utzon's atrium housing (21).
Balance by Configuration

Balance by configuration occurs when equilibrium between components that are different in form or shape is established. The Olivetti Training Center (1) balances the older existing building. Within it, the long wing equalizes the short wing plus the special space. The Ospedale (2) exemplifies balance of masses—one with a void, the other with an additional unit. In Sea Ranch (3), a diagonal balance line is established with six living units on one side, and four units with two garages on the other. Equal cores are rendered differently by the addition of secondary units in Unity Temple (4). Public and private separation creates one line of balance in the Robie House (5) and the Glessner House (6). In Giurgola’s Research Labs (7), the balance is developed through geometry and mass. San Giorgio (8) is symmetrical in one direction and balanced in the other with simple and complex shapes that reflect the sacred and secular areas.

The configuration differences in the Brant House (9) occur at changes of floor plane and mass. At Ronchamp (10) in plan and at the Riola Parish Center (14) in section, single, larger units balance multiple smaller units. Fallingwater (11) is balanced between smaller enclosed and larger open spaces. In one direction, Lister Courthouse (23) and Dulwich Gallery (13) are symmetrical; in the other, the differences between public areas for Lister and gallery size for Dulwich define the balance. External symmetry in Hotel Guimard (15) is shifted to balance by location of three major living spaces. Balance in the Florey Building (16) occurs between a form weighted with a pair of towers and another with a special space. A special space, with a detached form, balances the remainder of the town hall (17), and the tower balances the void of the main space in two directions in the Auditorium Building (18). At Easton Neston (19), the two unique two-story spaces create the difference in configuration. Balance at Homewood (20) occurs at the line of shift between front and back arrangement. The configuration change at Snellman House (21) occurs between servant and main use-spaces in two directions. At Unité d’Habitation (22), the shopping street locates the balance line between the subtracted base and the additive top. At Leicester Engineering (12), the difference is between vertical and horizontal, and in the Venturi House (24), symmetry is shifted to balance by the window pattern.
10. CHAPEL AT RONCHAMP
LE CORBUSIER
1950-1955
11. FALLINGWATER
FRANK LLOYD WRIGHT
1935
12. LEICESTER ENGINEERING BUILDING
JAMES STIRLING
1969
13. DULWICH GALLERY
JOHN SOANE
1811-1814
14. BIOLA PARISH CENTER
ALVAR AALTO
1970
15. HOTEL GUIMARD
CLAUDE NICHOLAS LEDOUX
1770
16. FLOREY BUILDING
JAMES STIRLING
1966
17. SAINATSALO TOWN HALL
ALVAR AALTO
1950-1952
18. AUDITORIUM BUILDING
LOUIS SULLIVAN
1887-1890
19. EASTON NESTON
NICHOLAS HAWESMOOR
c. 1595-1719
20. HOMWOOD
EDWIN LUTTENS
1931
21. SNELLMAN HOUSE
ERIK GUNNAR ASPLUND
1917-1918
22. UNITE D' HABITATION
LE CORBUSIER
1946-1952
23. LISTER COUNTY COURTHOUSE
ERIK GUNNAR ASPLUND
1917-1921
24. VANNA VENTURI HOUSE
ROBERT VENTURI
1962
Balance by Geometry

Balance by geometry exists when components with two different form languages occur on opposite sides of a balance line. In St. Paul’s (1), a wall separates the orthogonal support spaces from the semicircular worship space. Different simple geometries are balanced in the Oita Medical Hall (2) and the Mellon Center (3). In the Observatory (4) and Redentore Church (5), a single, subdivided form is balanced by a series of additive forms. Santa Marta (6) exemplifies two manifestations of a circle, while the church in Imatra (7) is an example of two varied form languages that meet at the main aisle to create perceptual tension. Tension also results from varied form languages in Aalto’s Wolfsburg Cultural Center (8). At Tredyffrin Library (9), the curved geometry is balanced by the straight lines of the opposite side. Different geometric configurations balance about two perpendicular lines in the Domus Aurea (10). In S. Maria della Pace (11), differences in geometry and orientation establish the balance. Bramante’s architectural setting (12) exemplifies the essence of the idea of balance by geometry with two complete and different geometric forms.
Balance by Positive and Negative

Balance by positive and negative occurs when equivalent components differ only in the manner in which they are made manifest, as solid or void. In the Smith House (1), the closed private area is balanced by the open public area. The two major use-spaces in Lang Music Building (2) are the enclosed auditorium and the open lobby. Balanced by configuration in one direction, the Wolfsburg Cultural Center (3) is balanced in the other direction by the largest special space and the defined court. The building is the positive form, and the entry forecourt its negative manifestation in the Hanselmann House (4), the Woodland Chapel (6), and the Crooks House (7). A similar condition exists at Power Center (5), where the building is the positive, and an adjacent park the negative. In the Ford Foundation Building (8), the volume of the interior greenhouse is the void, and the office spaces are the positive configuration. Differences between the interior and exterior living spaces establish the positive-negative balance line in Villa Savoye (9).
GEOMETRY

Geometry is a formative idea in which the concepts of plane and solid geometry are used to determine built form. Besides examples of the basic geometries, illustrated are combinations, multiples, derivatives, and manipulations of geometries. Also included are examples of grids.

Basic Geometry

The basic geometric configurations used to determine a building's form include the square as used in the Moore House (1), the Tucker House (2), the Rufener House (3), and the churches of Sant' Eligio degli Orefici (4) and St. Mary Woolnoth (5). Squares were also used to design the Villa Savoye (6), a private residence in Switzerland (7), the Boston Public Library (8), and the New National Gallery (9) by Mies van der Rohe. The circle appears as the generator for the Tholos (10), the M.I.T. Chapel (11), St. Costanza (13), and the Pantheon in Rome (15). Thomas Jefferson used the circle in designing the Rotunda at the University of Virginia (14). Konstantin Melnikov used two circles in the design of his house (12), and the basic shape of the triangle in the Rusakov Club (16). Triangles also determined the Arena Building (17) and the Church and Parish Center in Hyvinkää, Finland (18). The hexagon was used in designing the North Christian Church (19), a desert Synagogue (20), and Pflieffer Chapel (21). Finally, the Baptistery at Ravenna (22), Poplar Forest (23), and San Maria degli Angeli (24) are developed from the octagon.
Circle and Square

The most direct combination of circle and square, where both forms are whole or easily implied, and share a common center, occurs at Villa Rotonda (1), the Old Sacristy (2), the Tempietto (3), and University Hall (4). Woodland Chapel (5) contains whole figures, while Stockholm Library (6) consists of a strongly implied square and a complete circle. The circle is a court in the Palace of Charles V (7), a cone in the Tomb of Metella (8), and an interior elevation opening in Exeter Library (9). The square is embodied in a larger form in St. Peter's (10) and the Customshouse (11), and is adjacent to a circle in St. Mary's Cathedral (12). In the Museum of Art (13), Stirling uses two circle and square forms. The square contains the circle in the Arnhem Pavilion (14) and the Palace of Assembly (15). In Knights of Columbus (16), four circles are added to the corners of a square, while at Montmorency (17) a square contains a circle and its transformation. The Olympic Arena (18) and the Tomb at Tarquinia (19) exemplify circles containing squares. Aalto's Studio (20) is derived from a shifted circle in a square, and Storza Chapel (21) is an elaboration of a circle holding a square. The Cathedral (22), Tucker House (23), and Venturi House (24), are examples of the combination of circle, square, and triangle.
Rectangle Overlapped by Circle

A specific geometric combination is a rectangle overlapped by a smaller circle. The Lister Courthouse (1), the Ranger Lodge (2), the Casino (3), the Thermae (4), and the Swan House (5) exemplify the circle as a major use-space half engaged on the centerline of the long side of a rectangle. The residence by Botta (6) has the same configuration with the circle, a stair, reduced in scale. In Castlegar (7), the rectangle is overlapped by an ellipse at the centerline, and in Tendering Hall (8), a circle and an ellipse overlap the rectangle. In Austin Hall (9), two rectangles are intersected by two circles with a third circle that overlaps at the entry. Richardson's Higginson House (10) has circles on opposite corners implying the diagonal, while in the Planetarium (11) two circles occur on the same side. Double major and minor circles overlap the rectangle in the Wheels of Heaven Church (12). In the castles, Rair (13) and Pittichie (14), the circle overlaps the corner in two directions, and in Chateau de Chambord (15) multiple corners are overlapped by the circles.
Two Squares

Two adjacent squares directly determine the limits of the plans of Sever Hall (1), Christ Church (2), and the Venturi House (3). In the Brant House (4), two adjacent squares have a common side that is the radius of the major circular form in plan, and the same two squares set the limits of the total plan configuration. Two squares can overlap to create a special condition of the common area. In Easton Neston (5), the shared part of the two squares denotes the central hall, and in the Allegheny Courthouse (6), the overlap locates the towers. Villa Trissino (7), by Palladio, and Drayton Hall (8) exemplify two overlapping squares which define a major central use-space and entry. In the Farnese Palace (9), two adjacent squares set the limits of the major elevation.
Nine-Square

Nine-square is a classic geometric form created by joining three sets of three adjacent squares each to form a larger square. It is the three cell by three cell arrangement that is most commonly referred to as a nine-square configuration, even though the shape of the cells may be other than squares. Villa Rotonda (1), Chiswick House (2), York House (3), St. Louis des Invalides (4), and Santa Maria di Carignano (5) are examples of this classic configuration. Hagia Sophia (6) and Hotel de Montmorency (7) demonstrate nine-square arrangements of rectangles. By combining select cells within the nine cell array, specific patterns can be created. Sao Frutuoso (8) is an example of the cross variation with the corners implied. Flanking the center cell with two rows of three cells creates the 'H' configuration, as in the Capitol at Williamsburg (9). An 'X' configuration is suggested in the Supreme Court Building (10), by the pattern of the major articulated courts and the center cell. The three, two, one stepped configuration is exhibited in Le Corbusier's Weekend House (11), and the square ring with the center void is seen in the Exeter Library (12).
Four-Square

A four-square is a geometric configuration that is two cells by two cells and has a common central point of contact. The most direct example is the Viking Fortress (9). Le Corbusier's theater (1) and Villa Savoye (4) have overall plans, and St. George-in-the-East (2) has an internal spatial organization developed from this construct. Four-squares are used in combination at Giurgola's Research Lab (3) and at the Frankfurt Museum (5) where the existing building becomes one quadrant of a four-square, which in turn becomes one quadrant of a larger four-square. It is not necessary to articulate the four cells equally, for instance, at the Trubeck House (6) there are two sets of different sized cells. The Ella-Bash House (7) contains implied quadrants about a defined center, and Villa Mairea (8) has three cells as built form, with the fourth being a garden. In Kahn's British Art Center (10), the nine-square and four-square configurations are combined with the overall plan developed from overlapping nine-squares, each cell of which is subdivided into a four-square, while at the Salk Institute (11) the inverse occurs. In Homewood (12), a nine-square shares two edges with a four-square in a nested configuration.
1.4 and 1.6 Rectangles

The 1.4 rectangle is created by rotating the diagonal of a square 45 degrees to determine the length of the long side. This configuration sets the overall plan or internal spatial limits for the Shamberg House (1), the Old Sacristy (2), the Lang Music Center (3), and St. James Church (4). A square with both diagonals rotated creates a configuration which determines the plans for Lister County Courthouse (5) and Nashdom (6). The 1.6 rectangle, created by rotating the diagonal of one-half a square, sets the overall plan of Schinkel’s museum (7), San Miguel (8), and the Council Chamber (9). With appendages excluded, Villa Stein (10) is developed within a 1.6 rectangle, and Le Corbusier also uses the 1.6 figure to set the limits of the court at La Tourette (11). The theater in Venice (12) has two concentric squares in plan with a 1:1.4 ratio relationship to each other. The larger square determines the overall form, less the stairs; the smaller square is the limit of the seating.
Geometric Derivatives

A multitude and variety of forms can be derived from basic geometries through combination, division, and the use of the parts. Three adjacent squares form the plan of the Snellman House (1), while two squares and four 1:4 rectangles set the limits of Hotel Guimard (2). The One-Half House (3) is designed by combining one-half a circle with an orthogonal half and a diagonal half of two squares. Where the Lutheran Church (4) and the Jacobs House (5) are derived from parts of two concentric circles, the Wies Church (6) is developed from two circles with different centers. The common area of overlap of two circles determines the plan of Ortesi Church (7). Borromini used an ellipse derived from parts of four circles to design San Carlo alle Quattro Fontane (8). A series of complex forms developed from multiple sphere segments is utilized at the Sydney Opera House (9). The Postal Savings Bank (10), the Guild House (11), and the Royal Chancellery (12) are derived from triangles. The triangles in the latter two are implied by a series of points at the corners of the building. The Chancellery design is also a composite of two triangles.
Rotated, Shifted, and Overlapped

Rotating, shifting, and overlapping are manipulations applicable to basic geometries to create built form. Two equal squares with a common center are rotated 45 degrees in San Maria degli Angeli (1). In San Spirito (2), three sequential sets, each with two rotated squares, are used. Two different orthogonal configurations are rotated and overlapped in the Occupational Health Building (3), while minimum connection between similar, rotated forms establishes the plan of the Fisher House (4). A circular element becomes a pivot for rotation of two forms in the Landesbank (5). The Hermit Building (6), St. Andrews Dormitory (7), the Cuno House (8), and the Snellman House (9) are examples of hinge configurations—linear elements rotated about some common point of overlap. The change in the circulation element strengthens the shift about a common space in Deere West (10). In Carpenter Center (11), similar forms are inverted and shifted about a circulation ramp. Through a diagonal shift and overlap, Stirling creates the major use-space in the Cambridge History Faculty (12). Other examples of overlapping geometries are the Melnikov House, Drayton Hall, Easton Neston, and the Yale Center for British Arts.
Pinwheel, Radial, and Spiral

Pinwheel, radial, and spiral are formal or spatial configurations which have in common a center of origin. A pinwheel is a uniform arrangement of linear elements about a defined core, as exemplified by Wingspread (1), or an implied core, as at the Guggenheim Museum (2). In Newport (3), adjacent spaces pinwheel about a minor circulation core. Three complex units form a pinwheel about a service space in the Richards Medical Building (4). Two pinwheels, one within the main gallery, the second created by three built forms adjacent to the main building, are embodied in the Ahmedabad Museum (5). A radial configuration is denoted by a series of elements, defined or implied, which emanate from a center. The Florey Building (6) is developed from two centers, while the Mausoleum of Augustus (7) is a classic radial configuration. In the Wolfsburg Parish Center (8), the structure radiates from a single origin, and in the Neur Vahr Apartments (9) the walls radiate from multiple centers. The spiral form occurs in the Small Olympic Arena (10) and the St. Antonius Church (11). The New England Aquarium (12) is developed from two spirals: a central circular one and a rectilinear one at the perimeter.
**Grid**

Grids are developed from the repetition of the basic geometries. At Villa Foscari (1), Sea Ranch (2), Crown Hall (3), and the Temple of Apollo (4), the square grid is the generator. It is used with major and minor emphasis in Fallingwater (5) and in the elevation of Enso-Gutzeit (6). In Carson Pirie and Scott (7), Sainte Genevieve Library (8), and the Temple of Hera (12), a rectilinear grid, coincident with structure, occurs. Rectilinear grids occur in the Farnsworth House (9), the Larkin Building (10), and the A.E.G. Factory (11). Kimball Art Museum (13), the Bath House (14), and San Sebastiano (15) exemplify plaid grids. The Nebraska State Capitol (16) develops from a three-unit grid, as do Notre Dame Cathedral (17) and the Visser House (18). The Boomer Residence (19) and the Unitarian Church (21) have equilateral triangular grids, and the National Gallery (20) has an isosceles triangular grid. Leicester Engineering Labs (22), the Auditorium Building (23), and Turun Sanomat Offices (24) exemplify grid shifts that occur at junctures of major forms or spaces. Wells Library (25) developed from a plaid field created by grid rotation and overlap. The Anker Building (26) and the Gunna Museum (27) are examples of grids that are rotated.
13. Kimball Art Museum
  Louis I. Kahn
  1966-1972

14. Trenton Bath House
  Louis I. Kahn
  1955-1956

15. San Sebastiano
  Leon Battista Alberti
  1469

16. Nebraska State Capitol
  Bertram Goodhue
  1924

17. Notre Dame Cathedral
  Architect Unknown
  1163–c. 1250

18. Visser House
  Aldo Van Eyck
  1976

19. Jorgine Boomer Residence
  Frank Lloyd Wright
  1963

20. East Wing of National Gallery
  I. M. Pei
  1978–1978

21. Unitarian Church
  Frank Lloyd Wright
  1949

22. Leicester Engineering Building
  James Stirling
  1969

23. Auditorium Building
  Louis Sullivan
  1887–1890

24. Turun Sanomat Offices
  Alvar Aalto
  1927–1929

25. Wells College Library
  Skidmore, Owings & Merrill
  1968

26. The Anker Building
  Otto Wagner
  1895

27. Gumma Museum of Fine Arts
  Arata Isozaki
  1971–1974
Configuration patterns describe the relative disposition of parts, and are themes for designing space and organizing groups of spaces and forms. Illustrated are examples of linear, central, double-centered, clustered, nested, concentric, and binuclear configurations.

Linear: Use

There are two types of configuration patterns in which path through use-spaces creates a linear organization. In the first, spaces are linked, and circulation is from space to space. In the second, one engages a singular space longitudinally. At the temple in Malta (1) the spaces are linked on the transverse axis, thus changing each longitudinal space into three implied spaces. The axial movement through a series of spaces places accent on the beginning and end of the path, and is exemplified at Solomon's Temple (2) and at the Temple of Horus, Edfu (4). At Ledoux's Hotel de Montmorency (3), the path doubles back on itself on the second floor so that beginning and end are above one another. The spaces in the linear configuration at the Tomb of Setnakht (5) are both longitudinal and transverse. The change provides accent. At Soane's Dulwich Gallery (6), the entrance is in the middle of the linearly linked spaces. In Jacobsen's house (7), the center between the linked spaces is solid, and the circulation is along the edges. Redentore (8) and the Laurentian Library (9) are examples of singular spaces that are organized linearly. At Redentore, as at the Tomb of Setnakht, there is an accent along the path.
Linear: Circulation

Linear configurations in which the circulation is separated from the use-space are spine or corridor organizations. A Greek stoa (1) is the simplest form of this organization, while the gymnasium at Exeter (2) represents a typical spine scheme. In this case, the spine dominates the form. The spine in Utzon’s church (3) embodies a repetitive form vocabulary that is deployed to create places for use-spaces. Examples of single-loaded corridors are the Irish Fort Shannon house (4) and the Snellman House (5). Aalto’s dormitory (6) illustrates that the linear circulation need not be straight or symmetrical, while in Le Corbusier’s Unite d’Habitation (7) circulation is significant in section. The circulation in the two buildings by Stirling (8 and 9) is visible externally and indicates the potential for the path to be not straight. It is also possible for two circulation spines to exist, as at Moore’s Stern House (10), where they cross. At Centre Beaubourg (11), the two spines are parallel; one is for vertical circulation and the other for horizontal. Venturi’s Pearson House (12) utilizes both types of linear configuration patterns. The private spaces are linked by a separate circulation path, while the public spaces have implied circulation through them.
Central: Use

Configurations that place the most important space in the central position are engaged by going to or around this space. At Kahn's Unitarian Church (1) and at Wollaton Hall (2), the central hall, which is lit from above and dominant in form, is surrounded by minor use-spaces and separate circulation. Circulation at the Shaker barn (3) is around a central haymow, which has symbolic, functional, and formal importance. The octagonal central hall in Schinkel's Hunting Lodge (4) has minor use-spaces on only four sides, with circulation at the perimeter. At the Palace of Charles V (5) and Farnese Palace (6), the central space is a court with a colonnade for circulation. At the center of St. Costanza (7) is the most sacred space, while at Trinity Church (8) and St. Mary Woolnoth (9) the center is located within a larger space. Strickland's Second Bank of the United States (10) has a dominant space that is central, with implied circulation and minor use-spaces on only two sides. Circulation at the Stockholm Library (11) is at the perimeter of the central space. Brunelleschi's San Maria degli Angeli (12) has a dominant central space that is surrounded by lesser spaces. Circulation is to and around the central space, but through the lesser spaces.
Central: Circulation

La Rotonda (1), the U.S. Capitol (2), and the North Carolina Capitol (3) are examples of classic rotundas. In these cases, the central space, though dominant on the exterior, is used for circulation and as an organizer of other spaces. The courtyards at the House in Ur (4) and the Hotel de Beaunoirs (5) are alternatives to the classic rotunda. In these two buildings, the courts are dominant plan forms and are used to organize circulation and lesser spaces, but they have no external expression. At the House by van de Velde (6), Furness’s railroad station (7), Soane’s Burn Hall (8), and Lutyens’s Salutation (9), the central space is used for vertical circulation and organizes the building vertically. Kahn’s library (10) has a central space that is a rotunda at the main level, while at the upper levels the circulation is around this space. In a somewhat similar fashion, the courtyard at La Tourette (11) incorporates the qualities of both types of central organizations. In some instances the circulation is around the court, as at a cloister, and at other times it is through the court. The central space at Stratford Hall (12) is the main use-space, and serves as a rotunda with circulation through it to lesser spaces.
Double Center

Double centers are two equally important foci located within a precinct or field. The Temple of Venus and Rome (1) has two equal, primary rooms, oriented in opposite directions, within a field that is the remainder of the Temple. Each center is an object located within a precinct that is seen as a void. At the Horyu-ji Temple (2) and the Market in Leptis Magna (3), the precinct is an outdoor court, whereas at Moore’s Orinda House (4) and the Palace of Assembly (5), the precinct is a room and indoor space. The Cemetery by Scarpa (6) has one center as an object in an outdoor precinct, while the other center is a room inside the field of the building. If the precinct is solid, then the centers might be voids carved from that solid. At Dover Castle (7) the voids are major rooms, and at the Academy of Art (8) the voids are special places. The remainder of the building is poche. It is also possible that the voids as double centers might organize surrounding spaces and allow light to enter the interior of the building as at the Center for British Arts (9), the Ospedale (10), the Chancellery Palace (11), and Casa Milà (12).
Cluster

Spaces or forms that are grouped without discernible pattern are considered clustered. The clustering of spaces often can determine the form, or at least, have impact on the form, as in the Tower of London (1) and the Watts Sherman House (4). However, spaces might also be clustered within a form whose exterior configuration is predetermined. The fortress in Germany (2) and the House of Vizier Nakht (3) exemplify this category of spatial cluster. Both types of spatial clusters are apparent in the James House (5), with the cluster-determining form variation dominant. The castles in Finland (6) and Denmark (7) are clusters of both forms and spaces. One criterion of clustering is the necessity for proximity between clustered elements. To a certain extent, the walls in the castles create that proximity, while in the Occupational Health Center (8) proximity is established by the large room in which the forms are gathered. Clustered forms may have spatial subdivisions within them as long as those subdivisions are minor. The Convex by Kahn (9), the Bermuda house by Venturi (10), the training center by Stirling (11), and Fonthill (12) are all examples of forms that are clustered.
Nested configurations are patterns in which each unit in consecutive order is located inside the next larger unit so that each unit has a different center. At the Temple of Apollo (1) and the Temple of Kom Ombo (2) the units have a common centerline. The geometry change at the Palace of Assembly (3) illustrates that it is not necessary for the nested units to have the same form language. Charles Moore's house in Orinda (4) contains a double set of nested forms. Since nested units do not share a common center, they may have other parts of their configurations in common. This might entail having one side common to all units, as at Aalto's Enso-Gutzeit Headquarters (5). More commonly, though, two sides and a corner are shared by the nested units. The units, then, generally nest diagonally. Stirling's History Building (6), Richardson's Glessner House (7), Price's Chandler House (8), and Lutens's Homewood (9) exemplify this kind of nesting.
Concentric

Concentric configurations are patterns in which each unit in consecutive order is located inside the next larger unit so that each unit has the same center. The Exeter Library (1) is an example of concentric configuration created with simple geometric forms. Simple forms of different languages are utilized by Asplund in the Stockholm Library (2). Somewhat more complex, but basically repetitive, units are used at the Pantheon in Paris (3). At Santo Stefano (4), simple geometric forms are repeated, but each ring is articulated in a different manner. The Allegheny Courthouse (5) illustrates a configuration in which each concentric unit is different in function. At Unity Temple (6), the concentric layering is in the major space only. Fontevrault Abbey (7), Villa Farnese (8), and San Lorenzo (9) exemplify the complexity that may result from changing geometries in each of the concentric units. Both nested and concentric configurations are employed by Hawksmoor at St. George (10). Ledoux’s theater (11) is nested with half of the plan implied so that the total can be considered a concentric configuration. At the Parthenon (12), the pattern changes from concentric in the outer layers to nested at the inner units.
Binuclear

Binuclear is a configuration pattern with two equally dominant parts. The link between the binuclear components can be a built form which is an entrance space, as in the Robinson House (1), the Capitòl at Williamsburg (2), and Unity Temple (4). The built link can also be the major use-space, as in Stratford (3), or a bridge, as in the Queen’s House (5). Binuclear elements can be connected by a void or a space, which can be actual, as in the Salk Institute (9), or implied, as in the Postal Savings Bank (6), Olivetti (8), and Nashdom (7). Oita Medical Hall (10), Helsinki House of Culture (11), and the Mellon Arts Center (12) exemplify configurations with different geometries which are separated. St. Paul’s (13) and Djöll Center (19) have two varied geometries united directly. The Observatory (14) and Redentore Church (15) bring complex and simple forms together. Binuclear elements as positive and negative forms occur in the Farnsworth House (16), the American Academy (17), and Power Center (18). Similar binuclear forms can have different orientations, as in the Carpenter Center (20) and Fisher House (21). Two elements can be similar in form and different in function, as in Lang Music Center (22) and the Robie House (23). Binuclear can also be made manifest in elevations like Le Corbusier’s pavilion (24).
20. ANNEX TO OITA MEDICAL HALL
ARATA ISUZUKI
1970-1972

11. HOUSE OF CULTURE IN HELSINKI
ALVAR AALTO
1968-1970

12. PAUL MELLON ARTS CENTER
J. M. PEI
1970-1973

13. ST. PETER'S CHURCH
LOUIS SULLIVAN
1910-1914

14. OBSERVATORY IN BERLIN
KARL FRIEDRICH SCHINKEL
1835

15. REDENTORE CHURCH
ANDREA PALLADIO
1579-1591

16. FARNBROOK HOUSE
LUDWIG MIES VAN DER ROHE
1945-1950

17. THE AMERICAN ACADEMY IN ROME
MCKIM, MEAD, AND WHITE
1913

18. POWER CENTER
ROCHE-DINXELLOO
1965-1971

19. DIPOLO CONFERENCE CENTER
REIMA PIETALA
C. 1966

20. CARPENTER CENTER
LE CORBUSIER
1961-1963

21. NORMAN FISHER HOUSE
LOUIS I. KAHN
1963

22. LANG MUSIC BUILDING
ROMALDO GIUDOLA
1973

23. FREDERICK G. ROBIE HOUSE
FRANK LLOYD WRIGHT
1909

24. ZURICH EXHIBITION PAVILION
LE CORBUSIER
1964-1965
PROGRESSIONS

Progressions are patterns of incremental change that imply movement from one condition or attribute to another. The nature of the change determines the type of progression. Illustrated are examples of hierarchy, transition, transformation, and mediation.

Hierarchy

Hierarchy is the rank ordering of elements relative to the range of an attribute, such that importance or value is ascribed according to the presence or absence of the attribute. The hierarchy in Osterlars Church (1) is determined by size of interior space. Deal Castle (2), an example of concentric configuration, exhibits a rank ordering of centrality: the closer to the center, the more important the space. The Police Headquarters (3) has a hierarchy that is determined by the size, integrity, and memorability of the forms and spaces, and it ranges from dominant figure to background or poche. Sacred to profane establishes the hierarchies in Einsiedeln Abbey (4), Edfu Temple (5), and the Director's House (7). The difference among the three is that the sacred space occurs in two locations in Einsiedeln Abbey, and terminates in a single direction at Edfu Temple and the Director's House. The last example also shows the hierarchy in section. In Richards Lab (6), the hierarchy progresses from collective servant to individual servant to non-servant spaces. Heathcote's (8) elevation exhibits a rank ordering based on proximity to center, and in the Chapel at Ronchamp (9), hierarchy is a function of height and complexity of opening.
Transition

Transition is the incremental change of an attribute within a finite limit. In the Guild House (1), the configuration of the walls progresses from simple on one side of the building to complex on the other. The Malta Tombs (2), Boyer Hall (3), the House of the Faun (4), and the Jacobsen House in Pennsylvania (5) are examples of transitions of size. This is also the case at Holy Trinity Church (6), the Temple at Monte Alban (7), and the Moore House at Orinda (8). The Pazzi Chapel (9), the Woodland Chapel (10), the Palace of Assembly (11), and Frank Lloyd Wright's Fallingwater (12) exemplify progressions from open to closed.
Transformation

Transformation is the incremental change from one form to a different form. San Lorenzo (1), Fontevraud Abbey (2), Hadrian’s Villa (3), San Maria della Consolazione (4), and the National Assembly (5) are examples of concentric transformations. In these buildings the form at the center transforms, through a series of changes, to a different form at the perimeter. In St. Mary’s Cathedral (6) and the Church at Firminy (7), the transformation occurs vertically from ground level to top. St. Mary’s changes from a diamond to a cruciform, and at Firminy a square is transformed into a circular form. The Lister County Courthouse (8) and the Adult Learning Research Lab (9) exemplify form change, from outside to inside, of significant elements within the building. Transformation of direction and change of adjacent forms occur in Karlskirche (10). In the Baths at Ostia (11) and Hotel de Montmorency (12), a transformation of adjacent units occurs.
Mediation

Mediation is the insertion of some form of progression between two conditions which occur outside the limits of the building. It is common for mediation to occur between two natural conditions, an element in nature and a built form, or two built situations. The Royal Chancellery (1), the Euram Building (2), the Aalajarvi Town Hall (3), the Allen Art Center (4), and the AIA Headquarters (5) are buildings designed to mediate between existing contextual conditions within a built environment. The weekend house (6) mediates between two natural situations: the horizontality of the water and the verticality of the woods. The Atheneum (7), Tredyffrin Library (8), and Aalto’s Church at Intra (9) mediate between a component in nature and a condition in built form. The Atheneum occurs between the curvilinear form of the river and the orthogonal grid of the town. At Tredyffrin, the mediation is between a special point marked by a tree and the orthogonal built environment. In Intra the design is inserted between other buildings and the natural context of the woods.
REDUCTION

Reduction is the miniaturization of the whole or a major part of a building. This scaled down component can be included as a part within the whole or as a secondary element added to the primary form.

Large Plus Small Reduction

It is common for the reduced form to be the servant element, as at Salutation (1), Villa Shodhan (2), Shukosha Building (3), Snellman House (6), Robie House (7), and Coonley House (8). Unity Temple (9) is similar in that the reduced form is also servant, but the reduction occurs in elevation. Scaled down forms for comparable use occur in the Sydney Opera House (3), the Goetheanum I (4), the Murners Theater (11), the Woodland Crematory (12), the Van Buren House (13), and the Wolfsburg Parish Center (14). Large plus small reduction is not limited to one form at each scale. Castle del Monte (10) is an example of multiple smaller units added to the original form. Interesting uses of this reduction concept include the design of an addition that is a miniaturization of the existing Claythorn House (15), and the design of the Council Chamber, as a reduction of the entire building, in Aalto's Säynätsalo Town Hall (16).
Part of Whole Reduction

Major rooms, spaces, or groupings of spaces form the reductions of the whole building in Easton Neston (1), Salutation (2), Stratford Hall (3), and the Bank of Pennsylvania (4). This is also the case in Bryn Mawr Dormitories (5), the Allegheny County Building (6), and Guild House (14). In the Old Sacristy (7) and the Landerbank (8), the part, an altar space and main stair, respectively, is a reduction of the dominant space or form of the building. Christ Church (9) and St. Clement Danes (10) are similar in that adjacent spaces defined by columns are the buildings and towers reduced. Two aedicula in the Moore House (11) reflect the whole, and in St. Mary's Cathedral (12) the nave is reduced to a smaller dome and adjacent space. At Heathcote (13), the plan configuration of the garden side of the house is reduced to form the entry side. In the Parthenon (15), the reduction includes a reversal in space definition by walls or columns. The positive-negative configuration of the Hanselmann House (16), with its forecourt, is reduced to create the main living spaces. In the Yano House (17) the plan is reduced to form part of the section, and an elevation reduction forms the fireplace in the Tuckter House. (18).
9. CHRIST CHURCH
NICHOLAS HAWKESMOOR
1722-1729

10. ST. CLEMENT DANES
CHRISTOPHER WREN
1680

11. MOORE HOUSE
CHARLES MOORE
1962

12. ST. MARY'S CATHEDRAL
BENJAMIN HENRY LATROBE
1814-1819

13. HEATHERCOTE
EDWIN LUTYENS
1900

14. GUILD HOUSE
ROBERT VENTURI
1961

15. FALSTERBO
ICTINUS
447 B.C.-409 B.C.

16. HANSSELMAN HOUSE
MICHAEL GRAVES
1967

17. YANO HOUSE
ARATA ISZAKI
1975

18. CARL TUCKER III HOUSE
ROBERT VENTURI
1975
INDEX BY ARCHITECT

The information in this book has been indexed twice—by architect and by common building name. The index by architect includes the life dates of the person when known, the buildings by that architect that are included in this volume, and the dates of those buildings followed by the page number.

Aalto, Alvar 1898–1976
Alajarvi Town Hall 1966 287
Baker Dormitory 1947–1948 275
Enso-Gutzeit Headquarters 1959–1962 12, 235, 252, 272, 280
Finlandia Concert Hall 1967–1971 241
House of Culture in Helsinki 1955–1958 283
Paimio Sanatorium 1929–1933 243
Riola Parish Center 1970 257
Studio House 1955 283
Saynatsalo Town Hall 1950–1952 8, 231, 243, 251, 257, 289
Selmajoki Town Hall 1962–1965 250
Turun Sanomat Offices 1927–1929 273
Villa Mairea 1937–1939 267
Vuoksenniska Church 1956–1958 10, 238, 243, 258, 287
Wolfsburg Cultural Center 1958–1962 14, 235, 243, 253, 258, 259
Wolfsburg Parish Center Church 1960–1962 271
Wolfsburg Parish Center Hall 1960–1962 289
Adams, Robert 1728–1792
Green Park Ranger's House 1768 264
Alberti, Leon Battista 1404–1472
San Sebastiano 1459 273
Alessi, Galeazzo 1513–1572
Santa Maria di Carignano 1552 266
Ando, Tadao 1941–
Chapel on Mt. Rokko 1985–1986 16
Church on the Water 1985–1988 18
Antemius of Tralles 6th Century
Hagia Sophia 532 266
Asplund, Erik Gunnar 1885–1940
Lister County Courthouse 1917–1921 24, 237, 244, 253, 254, 257, 264, 268, 286
Royal Chancellery 1922 269, 287
Stockholm Public Library 1920–1928 20, 238, 243, 247, 252, 254, 262, 276, 281
Woodland Chapel 1918–1920 22, 259, 262, 285
Woodland Crematorium 1935–1940 289
Barnes, Edward Larabee 1922–
Cathedral of the Immaculate Conception 1977 263
Mt. Desert Island Residence 1975 245
Weekend House on Fisher's Island c. 1963 238, 287
Behrens, Peter 1864–1940
A. E. G. High Tension Factory 1910 272
Cuno House 1906–1907 270
Bohlin, Peter Q. 1887–
Gaffney Residence 1977–1980 30
Guest House, Gates Residence 1990–1993 34
Weekend Residence for Mr. and Mrs. Eric Q. Bohlin 1973–1975 28
Bohlin and Powell
See Peter Q. Bohlin
Bohinl Cywinski Jackson
See Peter Q. Bohlin

Bohinl Cywinski Jackson / James Cutler Architects
See Peter Q. Bohlin

Botta, Mario 1945–
Blianda Residence 1987–1989 40
Church of San Giovanni Battista 1986–1995 38
Residence in Cadenazzo, Ticino 1970–1971 237
Residence in Massagno, Switzerland 1979 264
Residence in Riva San Vitale 1972–1973 36, 239, 260
Residence in Stabio 1981 245
Secondary School in Morbio Inferiore 1972–1977 255
The Church of Beato Odorico 1987–1992 42

Boromini, Francesco 1599–1667
San Carlo alle Quattro Fontane 1638–1641 269
S. Ivo della Sapienza 1642–1650 255

Boyle, Richard (Lord Burlington) 1694–1753
Chiswick House 1729 266

Bramante, Donato 1444–1514
Architectural Setting 1473 258
S. Maria della Pace 1478–1483 258
Tempietto of San Pietro 1502 262

Breuer, Marcel 1902–1981
Robinson House 1947 282
St. John’s Abbey 1953–1961 233
Whitney Museum of Art 1966 252

Brueelleschi, Filippo 1377–1446
Old Sacristy of San Lorenzo 1421–1440 44, 232, 240, 262, 268, 290
Ospedale degli Innocenti 1421–1445 46, 256, 278
Pazzi Chapel 1430–1461 285
Sansa Maria degli Angeli 1434–1436 48, 220, 222, 243, 247, 253, 254, 261, 270, 276
San Spirito 1434 50, 240, 247, 254, 270

Bulfinch, Charles 1768–1844
James Swan House 1796 264

Burlington, Earl of
See Boyle, Richard

Cambridge Seven Associates
New England Aquarium 1962 271

Castle, Richard C. 1685–1715
Annaglee 1740–1770 241

Chambers, William 1726–1796
Casino in Rome 1754 264
York House 1759 266

Cortona, Domenica da c. 1470–1549
Chateau de Chambord 1519–1547 265

Dahinden, Justus 1925–
St. Antonius Church 1966–1969 271

De Meuron, Pierre 1950–
See Herzog & de Meuron

Dientzenhofer, Georg 1643–1689
Pilgrimage Church 1654–1689 255

Doroisman, Adrien 1625–1652
New Lutheran Church 1663 269

Fehn, Sverre 1925–
The Glacier Museum 1991 54
Villa Busk 1990 52

Fischer von Erlach, Johann 1656–1723
Karlskirche 1715–1737 243, 286

Furness, Frank 1839–1912
Baltimore–Ohio Railroad Depot 1886 277
Pennsylvania Academy of Art 1872 278

Gaudi, Antonio 1852–1926
Casa Mila 1905–1907 278

G.B.Q.C.
See Geddes, Brecher, Qualls, and Cunningham

Geddes, Brecher, Qualls, and Cunningham
Institute for Advanced Studies 1968–1972 249

Gilbert, Cass 1859–1934
United States Supreme Court 1935 266

Giurygola, Romaldo 1920–
See Mitchell/Giurygola
Goodhue, Bertram 1869–1924
Nebraska State Capitol 1924 273
Graves, Michael 1934–
Claghorn House 1974 289
Crooks House 1976 259
Hanselmann House 1967 259, 291
Greene, Charles Sumner 1868–1957
See Greene & Greene
Greene, Henry Mather 1870–1954
See Greene & Greene
Greene and Greene
D. L. James House 1918 279
Guarini, Guarino 1624–1683
San Lorenzo 1666–1679 251, 286
Gwathmey, Charles 1938–
See Gwathmey-Siegel
Gwathmey-Siegel
Charof Residence 1974–1976 236
Cooper Residence 1965–1969 244
Elia-Bash Residence 1971–1973 267
Residence in Bridgehampton 1969–1971 244

Hadrian 76–138
Temple of Venus and Rome 123–135 255, 278
Hardy, Hugh 1932–
See Hardy-Holzman-Pfeiffer
Hardy-Holzman-Pfeiffer
Brooklyn Children's Museum 1977 249
Occupational Health Center 1973 244, 249, 270, 279
Pratt Residence 1974 244
Salisbury School 1972–1977 244
Hartman-Cox
Euram Building 1971 287
Hawksmoor, Nicholas 1661–1736
Christ. Church, Spitalfields 1715–1729 68, 220, 237, 240,
246, 254, 265, 291

Easton Neston c. 1695–1710 64, 242, 248, 257, 265,
290
St. George-in-the-East 1714–1729 66, 242, 246, 253,
267, 281
St. Mary Woolnoth 1716–1724 70, 237, 240, 260, 276
Herzog, Jacques 1950–
See Herzog & de Meuron
Herzog & de Meuron
Dominus Winery 1995–1998 74
Goetz Collection Museum 1989–1992 72
Holl, Steven 1947–
Chapel of St. Ignatius 1994–1997 78
Kiasma, Museum of Contemporary Art 1992–1997 76
Hecker, Svi 1931–
Hejduk, John 1929–2000
One-Ralp House 1966 269

Ictinus 5th Century B.C.
Parthenon 447 B.C.–430 B.C. 281, 291
Isozaki, Arata 1931–
Annex to Oita Medical Hall 1970–1972 238, 258, 283
Kamioka Town Hall 1976–1978 250
Nakayama House 1964 233
Shukosha Building 1974–1975 288
Yano House 1975 220, 231, 291

Jacobsen, Hugh Newell 1929–
House in Central Pennsylvania 1980 274, 285
Jefferson, Thomas 1743–1826
Poplar Forest c. 1806 224, 261
The University of Virginia Rotunda 1826 261
Johansen, John M. 1916–
Mummers Theater 1970 289
Jones, Inigo 1573–1652
The Queen's House 1629–1635 282
Kahn, Louis I. 1901–1974
Convent for Dominican Sisters 1965–1968 243, 247, 279
Erdman Hall Dormitories 1960–1965 244, 290
First Unitarian Church 1959–1967 276
Fisher House 1960 276, 283
Kimball Art Museum 1966–1972 84, 238, 243, 249, 273
National Assembly in Dacca 1962–1974 245, 286
Richards Medical Research Building 1957–1961 80, 253, 271, 284
Salk Institute 1959–1965 82, 237, 254, 267, 282
Trenton Bath House 1955–1956 273
Yale Center for British Art 1969–1974 267, 278
Kallmann and McKinnell
Exeter Physical Education Facility 1970 275
Kampmann, Hack 1856–1920
Police Headquarters 1918–1924 284
Kurokawa, Kisho 1934–
Tateshina Planetarium 1978 264
Labrouste, Henri 1801–1875
Sainte Genevieve Library 1838–1850 272
Latrobe, Benjamin Henry 1764–1820
Bank of Pennsylvania 1798–1800 290
St. Mary's Cathedral 1814–1818 263, 291
Le Corbusier 1887–1965
Carpenter Center 1961–1963 270, 283
Church at Firminy-Vert 1963 286
Convent of La Tourette 1957–1960 250, 268, 277
House at Weissenhof 1927 239
Museum at Ahmedabad 1953–1957 271
Notre Dame du Haut Chapel 1950–1955 92, 233, 245, 257, 284
Stockholm Exhibition Hall 1962 233
Unite d'Habitation 1946–1952 90, 236, 250, 257, 275
Villa Savoye 1928–1931 88, 236, 243, 249, 252, 259, 260, 267
Villa Shodhan 1951 288
Villa Stein 1927 232, 268
Weekend House 1935 266
Zurich Exhibition Pavilion 1964–1965 288
Ledoux, Claude Nicholas 1735–1806
Director's House 1775–1779 102, 240, 254, 284
Hotel Guimard 1770 98, 240, 257, 269
Hotel de Montmorency 1769 96, 238, 241, 245, 263, 266, 274, 286
Theater in Besançon 1775 100, 235, 242, 247, 267, 281
Le Pautre, Antoine 1674–1691
Hotel de Beauvais 1656 277
Lewerentz, Sigurd 1885–1975
Chapel of the Resurrection 1923–1925 104
Church of St. Peter 1965–1966 196
Loos, Adolf 1870–1933
Khuner Villa 1930 237, 246
Ruhe House 1922 239, 260
Steiner House 1910 248
Lutyens, Edwin 1869–1944
Heathcote 1906 112, 284, 291
Homewood 1901 108, 248, 252, 257, 267, 280
Nashdom 1905–1909 110, 242, 268, 282
The Salutation 1911 114, 235, 253, 277, 288, 290
McKim, Mead, and White
American Academy in Rome 1913 283
Boston Public Library 1895 251, 260
J. Pierpont Morgan Library 1906 241
New York Herald Building 1894 270
Rhode Island State Capitol 1895–1903 246
Machuca, Pedro 1485–1550
Palace of Charles V 1527 262, 276
Maki, Fumihiko 1928–
Shenboku Archives 1970 246
Mansart, Jules Hardouin 1645–1708
St. Louis des Invalides 1676 266
Meier, Richard 1934–
Museum for Decorative Arts 1981 267
Shambagh House 1972–1974 268
The Athenæum 1975–1979 118, 231, 287
Ulm Exhibition and Assembly Building 1986–1992 120
Melnikov, Konstantin 1890–1974
Melnikov House 1927 261
Rusakov Club 1927 232, 261
Mercer, Henry 1858–1930
Mercer Castle 1908–1910 279
Michela, Costanzo 1684–1754
Santa Marta Church 1746 268
Michelangelo 1475–1564
Laurentian Library 1525 274
Sforza Chapel c. 1558 263
St. Peter’s 1506–1626 263
Mitchell/Giorgola
Adult Learning Research Laboratory 1972 56, 234, 247, 256, 267, 286
A.I.A. Headquarters 1967 287
Lang Music Building 1973 58, 237, 240, 247, 259, 293, 283
Student Union, SUNY Plattsburgh 1974 60, 246, 249, 252
Tredyffrin Public Library 1976 62, 241, 258, 287
Moneo, Rafael 1937–
Don Benito Cultural Center 1991–1997 124
Murcia Town Hall 1991–1998 126
Moore, Charles W. 1925–1993
Burns House 1974 134
Hines House 1967 132, 235
Sea Ranch Condominium I 1964–1965 130, 241, 253, 256, 272
Stern House 1970 275
Moosbrugger, Kaspar 1656–1733

Einsiedeln Abbey 1719–1735 284
Morrison, Richard 1767–1849
Castlegar 1807 264

Nouvel, Jean 1945–
Cartier Foundation 1991–1995 142
Institute of the Arab World 1981–1987 140

Paeonius (Paionios) and Daphnis
Temple of Apollo c. 310 B.C. 272
Paeonius (Paionios) and Demetrius
Temple of Artemis c. 356 B.C. 249
Palladio, Andrea 1508–1580
La Rotonda – See Villa Capra
Redentore Church 1576–1591 150, 235, 240, 254, 258, 274, 283
San Giorgio Maggiore Church 1560–1580 146, 233, 240, 256
Villa Capra (Almerico or La Rotonda) 1566–1571 148, 219, 233, 243, 247, 253, 255, 262, 266, 277
Villa Foscarì c. 1549–1563 144, 247, 272
Villa Trissino 1553–1576 265
Pei, Ieoh Ming 1917–
East Wing of National Gallery 1975–1978 273
Everson Museum of Art 1968 245
Paul Mellon Arts Center 1970–1973 245, 258, 283
Piano and Rogers
Centre Beaubourg 1972–1977 275
Pietila, Reima 1923–1993
Dipoli Conference Center c. 1966 283
Polykleitos the Younger 4th Century B.C.
Tholos c. 365 B.C. 261
Pope, John Russell 1874–1837
Johns Hopkins University Hall c. 1930 262.
Temple of the Scottish Rite 1910 234
Price, Bruce 1845–1903
Chandler House 1885–1886 280
Travis Van Buren House 1885 289
Raphael 1483–1520
Sant’ Eligio degli Orefici 1509 260

Rhikos of Samos c. 540 B.C.
Fourth Temple of Hera 575–550 B.C. 272

Richardson, Henry Hobson 1838–1886
Allegheny County Courthouse 1883–1888 156, 220, 242, 251, 253, 265, 281, 290
Austin Hall 1881–1884 264
J. J. Glessner House 1885–1887 158, 256, 280
F. L. Higginson House 1881–1883 264
Sever Hall 1878–1880 154, 235, 244, 265
W. Watts Sherman House 1874 279
Trinity Church 1872–1877 152, 242, 247, 276

Roche, Kevin 1922–
See Roche Dinkeloo

Roche Dinkeloo
College Life Insurance Company 1967–1971 245
Deere West Office Building 1975–1976 245, 270
Knights of Columbus Headquarters 1965–1969 263
Power Center 1965–1971 259, 283
The Ford Foundation Building 1963–1968 234, 259
United Nations Plaza 1969–1975 239

Rossi, Aldo 1931–1997
Il Teatro del Mondo 1979 268

Rudolph, Paul 1918–1997
Yale Art and Architecture 1958 244, 251

Ruusuvuori, Aarno 1925–
Church in Hyvinkää 1959–1961 261

Saarinen, Eero 1910–1961
Kresge Auditorium 1955 239
Kresge Chapel 1955 251
North Christian Church 1959–1963 261
Yale Hockey Rink 1956–1958 283

Sangallo, Antonio da 1484–1546
Farnese Palace 1534 266, 276

Santini-Aichel, Jan Blazej Unknown
St. John Nepomuk Church 1719–1720 255

Scarpa, Carlo 1906–1978
Brion-Vega Cemetery 1970–1972 278

Schinkel, Carl Friedrich 1781–1841
Altes Museum 1824–1830 246, 268
Hunting Lodge 1922 246, 276
Observatory in Berlin 1835 258, 283
Residence in Berlin 1823 236

Severus and Celer 1st Century
Domus Aurea c. 64 255

Siret, Hekki 1918–
Orivesi Church 1961 269

Skidmore, Owings, and Merrill
Wells College Library 1968 273

Smythson, Robert c. 1535–1614
Wollaton Hall 1580–1588 276

Soane, John 1753–1837
Burn Hall c. 1785 277
Dulwich Gallery 1811–1814 257, 274
Sepulchral Church 1796 255
Tendering Hall 1734–1790 241, 248, 264

Sonck, Lars 1870–1956
Arena Building 1923 261

Soufflot, Jacques Germain 1713–1780
Pantheon in Paris, France 1766–1797 281

Steiner, Rudolf 1861–1905
Goetheanum I 1913–1920 288

Stirling, James 1926–1992
Cambridge History Faculty Building 1964 162, 234, 242, 247, 270, 280
Dusseldorf Art Museum 1980 263
Florey Building 1966 164, 234, 242, 247, 253, 271, 275
Leicester Engineering Building 1956 168, 238, 242, 250, 257, 273
Olivetti Training School 1969 166, 250, 256, 279, 282
St. Andrews Dormitory 1984 255, 270, 275

Strickland, William 1787–1854
Second Bank of the United States 1818–1824 276

Sullivan, Louis Henry 1856–1924
Auditorium Building 1887–1890 168, 240, 247, 257, 273
Carson Pirie and Scott Store 1899–1903 172, 237, 240, 248, 272
National Farmers' Bank 1907–1908 174, 235
St. Paul's Church 1910–1914 258, 283
Wainwright Building 1900–1891 170, 250, 252

Tange, Kenzo 1913–
St. Mary's Cathedral 1963 286
Olympic Arena 1961–1964 245, 263
Small Olympic Arena 1961–1964 239, 271

Taniguchi, Yoshiro 1937–
Kasai Rinkai Park View Point Visitors Center 1995 178
Shiseido Art Museum 1978 176

Terragni, Giuseppe 1904–1943
Casa del Fascio 1932–1936 182
Novocomum Apartment House 1927 180
Sant' Elia Nursery School 1936–1937 184
Villa Bianca 1937 186

Thorton, William 1759–1828
United States Capitol 1793–1830 277

Tigerman, Stanley 1830–
Frog Hollow 1973–1974 239

Town and Davis
North Carolina State Capitol 1833–1840 277
United States Custom House 1833–1842 263

Utzon, Jørn 1918–
Atrium Housing 1956 224, 255
Bagsvaerd Church 1973–1976 275
Sydney Opera House 1957–1968 269, 288

UNKNOWN ARCHITECT
Baptistry of the Orthodox  c. 425 261
Basilica of San Vitale  c. 530–548 253
Baths at Ostia, Italy  c. 150 286
Capitol of Williamsburg  1701 266, 282
Castle del Monte  c. 1240 255, 289
Castle in Soborg, Denmark  c. 1150 279
Chancellory Palace 1483–1517 278
Cheops Pyramid  c. 2733 B.C. 221, 239
Colosseum 70–82 251
Council Chamber of Miletos 170 B.C. 268
Deal Castle  c. 1540 284
Dover Castle  c. 1180 278
Drayton Hall 1738–1742 265, 270
Elphinstone Tower 16th Century 239
Fontevrault Abbey 1115 281, 286
Fortress near Rudesheim 1000–1050 279
Fort Shannon 1800–1835 275
Hadrian's Maritime Theater 125–135 286
Horyu-Ji Temple 670 278
House in Ur 2000 B.C. 277
House of the Menander  c. 300 B.C. 251
House of the Faun 2nd Century B.C. 285
House of Vizier Nakht 1372 B.C.–1535 B.C. 279
Market in Leptis Magna, Libya 8 B.C. 278
Mausoleum of Augustus  c. 25 B.C. 271
Musgum Village  Unknown  241
New Park  c. 1775 271
Notre Dame Cathedral 1163–c. 1250 273
Olavinlinna Castle 1475 279
Osterlars Church 12th Century 284
Pantheon  c. 100 232, 261
Pitiichie Castle  c. 1550 265
Raif Castle  c. 1300 265
St. Constanza  c. 350 261, 276
Sao Frutuosos de Montelios 665 266
Santa Maria della Consolazione 1508 286
San Miguel 913 268
Santo Stefano Rotondo 468–483 281
Shaker Barn 1865 276
Solomon's Temple 1000 B.C. 274
South Platform at Monte Alban  c. 500 285
Stoa in Sikyon, Greece  c. 300 275
Stratford Hall 1725 277, 282, 290
Temple at Tarxien, Malta 2100 B.C.–1900 B.C. 274, 285
UNKNOWN ARCHITECT (continued)
Temple of Apollo    c. 400 B.C.  250
Temple of Kom Ombo  181 B.C.–30 A.D.  230
Thermes of Caracalla  218–216  264
Tomb at Tarquinia    c. 600 B.C.  263
Tomb of Caecilia Metella  c. 25 B.C.  262
Tomb of Setnakht  13th Century B.C.  274
Tower of London  1070–1090  279
Viking Fortress    c. 1000  267
van der Rohe, Ludwig Mies  1886–1969
Barcelona Pavilion  1928–1929  188, 244
Crown Hall  1950–1956  194, 272
Farnsworth House  1945–1950  192, 236, 272, 283
New National Gallery  1968  260
Tugendhat House  1928–1930  190
van de Velde, Henry  1863–1957
Bloemenwerf House  1895–1896  277
Van Eyck, Aldo  1918–1999
Pavilion in Arnhem  1966  263
Visser House  1975  273
Wheels of Heaven Church  1966  264
Vignola, Giacomo da  1507–1573
Villa Farnese  1559–1564  281
Venturi, Robert  1925–
See Venturi and Rauch

Venturi and Rauch
Brant House  1973  200, 237, 243, 256, 265
Fire Station Number 4  1966  198, 238, 243
House In Tucker Town, Bermuda  1975  279
Pearson House  1957  275
Trubek House  1972  267
Tucker House  1975  208, 232, 244, 248, 260, 263, 291
Venturi House  1962  196, 252, 257, 263, 265

Wagner, Otto  1841–1918

Anker Building  1895  273
Church of St. Leopold am Steinhof  1905–1907  251
Landerbank  1883–1884  270, 290
Post Office Savings Bank  1904–1906  269, 282
Wren, Christopher  1632–1723
St. Antholin  1678–1691  251
St. Clement Danes  1680  235, 291
St. James  1674–1678  266
St. Mary Le Bow  1670–1683  238
St. Nicholas Cole Abbey  1671–1681  250
St. Stephens Walbrook  1672–1687  249
Wright, Frank Lloyd  1867–1959
Boomer Residence  1953  273
Cooley House  1907  289
Guggenheim Museum  1956  210, 243, 246, 271
Jacobs House  1948  269
Johnson House (Wingspread)  1937  271
Kaufmann House (Fallingwater)  1935  208, 235, 241, 248, 257, 272, 285
Larkin Building  1908  251, 272
Peiffer Chapel  1938  281
Robie House  1909  206, 244, 249, 256, 283, 289
St. Mark's Tower  1929  255
Unitarian Church  1949  273
Unity Temple  1906  204, 243, 246, 253, 254, 256, 281, 282, 289

Zimmerman Brothers
Wies Pilgrimage Church  1754  269

Zimmerman, Dominikus  1685–1766
See Zimmerman Brothers

Zimmerman, Johann  1680–1758
See Zimmerman Brothers

Zuk, Radoslav  Unknown
Holy Trinity Ukranian Church  1977  285
Zumthor, Peter  1943–
Art Museum Bregenz  1990–1997  214
Chapel of St. Benedict  1987–1988  212
INDEX BY BUILDING

Adult Learning Research Laboratory 1972 56, 234, 247, 256, 267, 286
A. E. G. High Tension Factory 1910 272
A. I. A. Headquarters 1967 287
Alajärvi Town Hall 1966 287
Allegheny County Courthouse 1883–1888 156, 220, 242, 251, 253, 265, 281, 290
Altes Museum 1824 246, 268
Anker Building 1895 273
American Academy in Rome 1913 283
Annaglee 1740–1770 241
Annex to Oita Medical Hall 1970–1972 238, 258, 283
Architectural Setting 1473 258
Arena Building 1923 261
Arnheim Pavilion 1966 263
Art Museum Dregenz 1990–1997 214
Atrium Housing, Helsingør, Denmark 1955 224, 255
Auditorium Building 1887–1890 168, 240, 247, 257, 273
Austin Hall 1881–1884 264

Bagsvaerd Church 1973–1976 275
Baker Dormitory 1947–1948 275
Baltimore-Ohio Railroad Depot 1986 277
Bank of Pennsylvania 1798–1800 290
Baptistry of the Orthodox c. 425 261
Barcelona Pavilion 1928–1929 188, 244
Baths at Ostia, Italy c. 150 286
Blanda Residence 1887–1889 40
Bloemenwerf House 1895–1896 277
Boomer Residence 1953 273

Boston Public Library 1898 251, 260
Brant House 1973 200, 237, 243, 256, 265
Bregenz Art Museum—See Art Museum Bregenz
Brion-Vega Cemetery 1970–1972 278
Brooklyn Children’s Museum 1977 249
Burn Hall c. 1785 277
BURNS HOUSE 1974 134

Cambridge History Faculty Building 1964 162, 234, 242, 247, 270, 280
Capitol at Williamsburg 1701 266, 282
Carpenter Center 1961–1963 270, 283
Carson Pirie and Scott Store 1899–1903 172, 237, 240, 248, 272
Cartier Foundation 1991–1995 142
Casa del Fascio 1882–1936 182
Casa Mila 1905–1907 278
Casino in Rome 1754 264
Castle del Monte c. 1240 255, 289
Castlegar 1807 264
Castle in Soborg, Denmark c. 1150 279
Cathedral of the Immaculate Conception 1977 263
Central Pennsylvania House 1980 274, 285
Centre Beaubourg 1972–1977 275
Chancellery Palace 1483–1517 278
Chandler House 1855–1886 280
Chapel of St. Benedict 1978–1988 212
Chapel of St. Ignatius 1994–1997 78
Chapel of the Resurrection 1923–1925 104
Chapel on Mt. Rokko 1985–1986 16
Charnof Residence 1974–1976 236
Chateau de Chambord 1519–1547 265
Creops Pyramid c. 3733 B.C. 221, 239
Chiswick House 1729 265
Christ Church, Spitalfields 1715–1729 68, 220, 237, 240, 246, 254, 265, 291
Church at Firminy-Vert 1963 286
Church at St. Leopold am Steinhof 1905–1907 251
Church of San Giovanni Battista 1986–1995 38
Church of St. Peter 1963–1966 106
Church on the Water 1985–1988 18
Claghorn House 1974 268
College Life Insurance Company 1967–1971 245
Colosseum 70–82 251
Convent for Dominican Sisters 1965–1968 243, 247, 279
Convent of La Tourette 1957–1960 250, 268, 277
Coonley House 1907 289
Cooper Residence 1968–1969 244
Council Chamber of Miletos 170 B.C. 268
Crooks House 1976 259
Crown Hall 1950–1956 194, 272
Cuno House 1906–1907 270

Deal Castle c. 1540 284
Deere West Office Building 1975–1976 245, 270
Diplomatic Conference Center c. 1966 283
Director's House 1775–1779 102, 240, 254, 284
Dominus Winery 1995–1998 74
Domus Aurea c. 64 258
Don Benito Cultural Center 1991–1997 124
Dover Castle c. 1180 278
Drayton Hall 1738–1742 265
Duilwich Gallery 1811–1814 257, 274
Dusseldorf Art Museum 1980 263

East Wing of National Gallery 1975–1978 273
Easton Neston c. 1695–1710 64, 242, 248, 257, 265, 290
Einsiedeln Abbey 1719–1735 284

Elia-Bash Residence 1971–1973 267
Elphinestone Tower 16th Century 239
Enso-Gutzeit Headquarters 1959–1962 12, 235, 252, 272, 280
Erdman Hall Dormitories 1960–1965 244, 290
Euram Building 1971 287
Everson Museum of Art 1968 245
Exeter Physical Education Facility 1970 275

Fallingwater—See Kaufmann House
Farnese Palace 1534 265, 276
Farnsworth House 1945–1950 192, 236, 272, 283
Finlandia Concert Hall 1967–1971 241
Five Station Number 4 1966 198, 238, 243
First Unitarian Church 1959–1967 276
Fisher House 1960 270, 283
Florey Building 1966 164, 234, 242, 247, 253, 257, 271, 275
Fontevraud Abbey 1115 281, 286
Fortress near Rudesheim 1000–1050 270
Fort Shannon 1800–1835 275
Fourth Temple of Hera 575 B.C.–550 B.C. 272
Frog Hollow 1973–1974 239

Gaffney Residence 1977–1980 50
Glessner House 1885–1887 158, 256, 280
Goetheanum I 1913–1920 288
Goetz Collection Museum 1989–1992 72
Green Park Ranger's House 1768 264
Guest House, Gates Residence 1990–1993 34
Guggenheim Museum 1956 210, 243, 246, 271

Hadrian's Maritime Theater 125–135 286
Hagia Sophia 532 266
Hanselmann House 1967 259, 291
Heathcote 1906 112, 284, 291
Higgison House 1881-1883 264
Hines House 1967 132, 235
Holy Trinity Ukrainian Church 1977 285
Homewood 1901 108, 248, 252, 257, 267, 280
Horyu-Ji Temple 607 278
Hotel de Beauvais 1655 277
Hotel de Montmorency 1769 96, 236, 241, 248, 263, 266, 274, 286
Hotel Guimard 1770 98, 240, 257, 269
House at Weissenhof 1927 239
House in the Adirondacks 1937-1992 52
House in Tucker Town, Bermuda 1975 279
House in Ur 2000 B.C. 277
House of Culture in Helsinki 1955-1958 283
House of the Menander c. 300 B.C. 251
House of the Faun 2nd Century B.C. 285
House of Vizier Nakht 1372 B.C.-1850 B.C. 279
Hunting Lodge 1822 246, 276
Hyvinkaa Church 1959-1961 261
Il Teatro del Mondo 1979 266
Institute for Advanced Studies 1966-1972 249
Institute of the Arab World 1981-1987 140
Jacobs House 1948 269
James House 1918 279
Johnson House (Wingspread) 1987 271
Johns Hopkins University Hall c. 1890 262
J. Pierpont Morgan Library 1906 241
Kamiooka Town Hall 1976-1978 250
Kappel Pilgrimage Church 1854-1869 255
Karlskirche 1715-1737 243, 286
Kazai Rinkai Park View Point Visitors Center 1955 178
Kaufmann House (Fallingwater) 1935 208, 235, 241, 248, 257, 272, 285
Khuner Villa 1930 237, 246
Kiasma, Museum of Contemporary Art 1992-1997 76
Kimball Art Museum 1906-1972 84, 238, 243, 249, 273
Knights of Columbus Headquarters 1965-1969 263
Kresge Auditorium 1955 239
Kresge Chapel 1955 251
Landerbank 1888-1884 270, 290
Lang Music Building 1973 58, 237, 240, 247, 259, 268, 283
La Rotonda—See Villa Capra
Larkin Building 1953 251, 272
Laurentian Library 1525 274
Leicester Engineering Building 1959 160, 238, 242, 250, 257, 273
Lister County Courthouse 1917-1921 24, 237, 244, 253, 254, 257, 264, 266, 286
Magney House 1982-1984 156
Market in Leptis Magna, Libya 8 B.C. 278
Mausoleum of Augustus c. 2 B.C. 271
Melnikov House 1927 261
Mercer Castle 1908-1910 279
Mt. Desert Island Residence 1973 245
Mummers Theater 1970 289
Murdia Town Hall 1991-1998 126
Museum at Ahmedabad 1953-1957 271
Museum of Decorative Arts 1981 267
Museum Village 1930 241
Nakayama House 1964 233
Nashdom 1905-1909 110, 242, 268, 282
National Assembly in Dacca 1962-1974 245, 286
National Farmers’ Bank 1907-1908 174, 235
Nebraska State Capitol 1924 273
Negev Desert Synagogue 1967-1969 261
Neur Vahr Apartments 1958-1962 271
New England Aquarium 1962 271
New Lutheran Church 1688 269
New National Gallery 1968 260
New Park c. 1775 271
New York Herald Building 1894 276
North Carolina State Capitol 1883–1846 277
North Christian Church 1959–1963 261
Notre Dame Cathedral 1163–c. 1250 273
Novocomun Apartment House 1927 180

Observatory in Berlin 1835 258, 283
Occupational Health Center 1973 244, 249, 270, 279
Olavinlinna Castle 1475 279
Old Sacristy of San Lorenzo 1421–1440 44, 232, 240, 262, 268, 290
Olivetti Training School 1969 166, 250, 256, 279, 282
Olympic Arena, Tokyo 1961–1964 245, 263
One-Half House 1966 269
Ospedale degli Inuocenti 1421–1445 46, 256, 278
Orivesi Church 1961 269
Osterlars Church 12th Century 284

Paamio Sanatorium 1929–1933 243
Palace of Charles V 1527 262, 276
Pantheon in Paris 1756–1797 281
Pantheon in Rome c. 100 232, 261
Parthenon 447 B.C.–430 B.C. 281, 291
Paul Mellon Arts Center 1970–1973 245, 258, 283
Pazzi Chapel 1430–1461 285
Pearson House 1957 275
Pennsylvania Academy of Art 1872 278
Pfeiffer Chapel 1938 261
Pitichie Castle c. 1550 265
Plattsburg Student Union 1974 60, 240, 249, 252

Police Headquarters 1918–1924 284
Poplar Forest c. 1806 234, 261
Post Office Savings Bank 1904–1906 269, 282
Power Center 1965–1971 250, 283
Pratt Residence 1974 244

Rait Castle c. 1800 265
Redentore Church 1576–1591 150, 235, 240, 254, 258, 274, 283
Residence in Berlin 1823 236
Residence in Bridgehampton 1969–1971 244
Residence in Cadenasso, Switzerland 1970–1971 237
Residence in Massagno, Switzerland 1979 264
Residence in Riva San Vitale 1972–1973 36, 239, 260
Residence in Stabio 1981 245
Rhode Island State Capitol 1895–1903 246
Richards Medical Research Building 1957–1961 80, 253, 271, 284
Rioia Parish Center 1970 257
Robie House 1909 206, 244, 249, 256, 283, 289
Robinson House 1947 282
Royal Chancellery 1922 269, 287
Ruder House 1922 239, 260
Rusakov Club 1927 233, 261

St. Andrews Dormitory 1964 255, 270, 275
St. Antholin 1678–1691 251
St. Antonius Church 1966–1969 271
San Carlo Alle Quattro Fontane 1638–1641 269
St. Constanza c. 350 261, 276
St. Clement Danes 1680 235, 291
Sant' Elia Nursery School 1936–1937 184
Sant’ Eligio Degli Orefici 1509 260
Sao Frutuoso de Montelios 665 266
Sainte Genevieve Library 1838–1850 272
St. George-in-the-East 1714–1729 66, 242, 246, 253, 287, 281
San Giorgio Maggiore 1560–1580 146, 233, 240, 256
San Ivo Della Sapienza 1642–1650 255
St. James 1674–1687 268
St. John's Abbey 1053–1061 233
St. John Nepomuk Church 1719–1720 255
San Lorenzo 1668–1679 281, 286
St. Louis des Invalides 1676 266
Sant' Anna degli Angeli 1434–1436 48, 220, 222, 243, 247, 253, 254, 261, 270, 276
Santa Maria della Consolazione 1508 286
S. Maria della Pace 1473–1483 258
Santa Maria di Carignano 1552 266
St. Mark's Tower 1929 255
Santa Marta Church 1746 258
St. Mary's Cathedral, Baltimore 1814–1815 263, 291
St. Mary's Cathedral, Tokyo 1963 286
St. Mary Le Bow 1670–1683 238
St. Mary Woolnoth 1716–1724 70, 237, 240, 260, 276
San Miguel 913 265
St. Nicholas Cole Abbey 1671–1681 250
St. Paul's Church 1910–1914 288, 283
Saint Peter's 1506–1626 263
Santo Stefano Rotondo 468–463 281
St. Stephens Walbrook 1672–1687 249
San Vitale c. 530–548 253
Salisbury School 1872–1877 244
Salk Institute 1959–1965 82, 257, 254, 267, 282
San Sebastiano 1459 273
San Spirito 1434 50, 249, 247, 254, 270
Saynatsalo Town Hall 1950–1952 8, 231, 243, 251, 257, 279
Sea Ranch Condominium 1 1964–1965 130, 241, 283, 256, 272
Second Bank of the United States 1818–1824 276
Secondary School in Morbio Inferiore 1972–1977 255
Seinaiko Town Hall 1962–1965 250
Sepulchral Church 1796 255
Sever Hall 1878–1880 154, 235, 244, 265
Sforza Chapel c. 1555 263
Shaker Barn 1865 276
Shambler House 1971–1974 268
Shenboku Archives 1970 246
Shiseido Art Museum 1978 176
Shukosha Building 1974–1975 288
Snellman House 1917–1918 20, 232, 248, 257, 269, 270, 275, 288
Solomon's Temple 1000 B.C. 274
South Platform at Monte Alban c. 500 285
Steiner House 1910 248
Stern House 1970 275
Stoa in Sikyon, Greece c. 300 275
Stockholm Public Library 1920–1928 26, 238, 243, 247, 252, 254, 262, 276, 281
Stockholm Exhibition Hall 1962 233
Stratford Hall 1725 277, 282, 290
Studio House 1955 263
Swan House 1795 264
Sydney Opera House 1957–1968 269, 288
Tateshina Planetarium 1976 264
Tempietto di San Pietro 1502 262
Temple at Tarxien, Malta 2100 B.C.–1900 B.C. 274, 285
Temple of Apollo, Pompeii, Italy c. 400 B.C. 260
Temple of Apollo near Miletus, Greece c. 310 B.C. 272
Temple of Artemis c. 356 B.C. 249
Temple of Kom Ombo 181 B.C.–3 A.D. 280
Temple of the Scottish Rite 1910 234
Temple of Venus and Rome 123–135 255, 278
Tendering Hall 1784–1790 241, 248, 264
The Athenaeum 1975–1979 118, 231, 287
The Church of Beato Odorico 1987–1992 42
The Ford Foundation Building 1963–1968 234, 259
The Glacier Museum 1991 54
The Queen's House 1629–1635 282
The Salutation 1911 114, 235, 253, 277, 288, 290
Theater in Besançon 1773 100, 235, 242, 247, 267, 281
Thermae of Caracalla 212–216 264
The University of Virginia Rotunda 1826 261
Tholos c. 365 B.C. 261
Tomb of Caecilia Metella c. 25 B.C. 262
Tomb of Setnakht 13th Century B.C. 274
Tomb at Tarquinia c. 600 B.C. 269
Tower of London 1070–1090 279
Tredyffrin Public Library 1976 62, 241, 253, 287
Trenton Bath House 1955–1956 273
Trinity Church 1872–1877 152, 242, 247, 276
Trubek House 1972 267
Tucker House 1975 202, 232, 244, 248, 260, 263, 291
Tugendhat House 1928–1930 190
Turun Sanomat Office 1927–1929 273

Ulm Exhibition and Assembly Building 1986–1992 120
United Nations Plaza 1969–1975 239
Unite d'Habitation 1946–1952 90, 236, 250, 257, 275
Unitarian Church 1949 273
United States Capitol 1793–1830 277
United States Custom House 1833–1842 263
United States Supreme Court 1935 266
Unity Temple 1906 204, 243, 246, 253, 254, 256, 281, 282, 289

Van Buren House 1885 289
Venturi House 1962 196, 252, 257, 263, 265
Viking Fortress c. 1000 267
Villa Bianca 1937 186
Villa Busk 1990 52
Villa Capra (Almerico or La Rotonda) 1566–1571 143, 213, 233, 243, 247, 253, 255, 262, 266, 277
Villa Farnese 1559–1564 281
Villa Foscarri c. 1549–1563 144, 247, 272

Villa Marea 1937–1939 267
Villa Savoye 1929–1931 88, 236, 243, 249, 252, 259, 260, 267
Villa Schodhan 1951 288
Villa Stein 1927 232, 268
Villa Trissino 1553–1576 265
Visser House 1975 273
Voukænniska Church 1956–1958 10, 238, 243, 258, 287

Wainwright Building 1890–1891 170, 250, 252
Weekend House near Paris 1935 266
Weekend House on Fisher's Island c. 1963 238, 287
Weekend Residence for Mr. and Mrs. Eric Q. Bohlin 1973–1975 28
Wells College Library 1968 273
Wheels of Heaven Church 1966 264
Whitney Museum of Art 1966 252
Wies Pilgrimage Church 1754 269
Wingspread—See Johnson House
Wolfsburg Cultural Center 1958–1962 14, 235, 243, 253, 258, 259

Wolfsburg Parish Center Church 1960–1962 271
Wolfsburg Parish Center Hall 1960–1962 289
Wollaton Hall 1580–1585 276
Woodland Chapel 1918–1920 22, 259, 262, 285
Woodland Crematorium 1935–1940 239
W. Watts Sherman House 1874 279

Yale Art and Architecture 1958 244, 251
Yale Center for British Art 1969–1974 267, 278
Yale Hockey Rink 1956–1958 233
Yano House 1975 220, 231, 291
York House 1759 266

Zurich Exhibition Pavilion 1964–1965 283