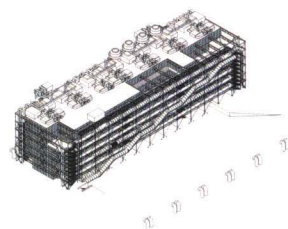
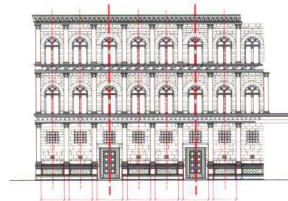
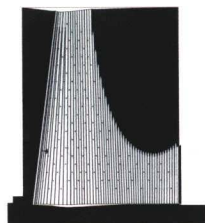
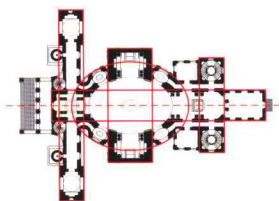


ARCHITECTURE PRINCIPIA

ARCHITECTURAL PRINCIPLES OF MATERIAL FORM



GAIL PETER BORDEN

BRIAN DELFORD ANDREWS

ARCHITECTURE PRINCIPIA

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Preface

The history of architecture is defined by trends and principles that repeat and reoccur. The evolutionary nature of function and form, and the interrelationship of the way in which building types are conceived, define the meaning of our largest cultural objects. The built world as a mediator of daily life and a snapshot of cultural technology and humanity embodies a moment of time and an associated way of thinking. Every piece of architecture emerges from a context that is specific and rational. This book attempts to unpack the lineage of architecture into primary veins of thinking and re-occurring issues, which remain despite all of our cultural, intellectual, and social advancements. These theories are attempts to resolve known problems that are fundamental to how we think, understand, and make architecture. These principles establish a genealogy of thought manifested through form.

The book is entitled *Principia* as a nod to Sir Isaac Newton's seminal three-volume work *Philosophiae Naturalis Principia Mathematica*, containing explanations of his laws of motion and his law of universal gravitation. Similarly this book focuses its lens of inquiry on the fundamental principles underpinning the history and practice of architecture. Written by designers, for designers, the text is intended to serve as an analytical handbook of the concepts behind these diverse, formal principles as viewed through the history of architecture. It is simultaneously fundamental and advanced.

This book deploys a case study methodology. Using precedents to illustrate and depict the primary aspects of architectural formalism, the analytical diagram and the associated textual description attempt to reveal strands of thought and references embedded within architecture. Through the highlighting of types (functional, formal, geometric, and material, for instance), the catalog of ways of thinking presents, both geographically and chronologically, a broad and comprehensive vision of the evolution of contemporary material form.

Organization

To tackle the breadth of thinking, the book is broken down into 15 chapters. Each takes a specific and critical theme fundamental to architecture and explicates the different modalities and sub-themes within each one. Describing the contextual, formal, and experiential significance of each theme, the book uses both textual and visual illustrations of the project's application.

The book is thematically organized as follows:

01 - Organization Systems

Beginning with the fundamental organization systems of the plan, the relationship of the practicalities of position, placement, and function interrelate to define over-arching principles of order and parti (the organizing diagram of an idea). This realm, governed mostly by geometry and the relative relationships of hierarchies in space, deals with the arrangements and the related social, functional, spatial, and conceptual intentions of a design agenda. Centralized systems (square, circle, Greek Cross, Latin Cross, and radial) deal with self-resolving geometries. Linear systems (single-loaded, double-loaded, and point-to-point) allow for the extrusion of a form. Grid systems (position, form, structure, and module) develop a multivalent system. Dispersed fields (including organized and disorganized systems) establish the interrelationship of discrete objects within a fabric. The free plan of modernity, through technological, material, and structural advancements, allows the elimination of the load-bearing wall, which enables the subdivision of space and fluidity of form to be dependent upon other considerations. Raumplan evolves the organization of spatial zones through the deployment of varied sectional relationships. Hybrid systems combine, splice, mix, juxtapose, and bastardize aspects of all of these organizational approaches.

02 - Precedent

From the focus on organization principles, the book moves towards an overt examination of precedent. Precedent involves the role of history and formal iteration based on referential tactics. Precedent analysis is examined through the lens of vernacular, cultural, and intellectual evolutions and their affect on the iterative production of form. Using a "lineage" methodology, the analysis picks strains of façades, plans, spatial types, and ultimately hybridized assemblies that cross-pollinate multiple precedents to produce a new precedent. The morphological examination allows for the cataloging of referential layers and the rationale for their adoption.

03 - Typology

Directly associated with the use of precedent is the development of typology. Typology deals with the classification of trends, based upon either form or function. It engages geometric typologies that include square, circle, oval, triangle, polygon, spiral, and star. In addition, functional or programmatic typologies include the temple / church, palace, house, museum, library, school, prison, theater, office / high rise, parking garage, and campus. The textual and visual trending of these strains allows for the iterative evolution to be documented and presented.

04 - Form

Form, as the most visually dominant figural shape of a building, is classified based on the primary driver of its derivation. These classifications are broad and varied. Platonic formalism relies upon the purity of geometric relationships. Functional formalism allows for the pragmatics of need and purpose of architecture to derive form. Contextual formalism relies upon surrounding physical and cultural factors to determine form. Typological formalism relies upon referential imagery of function, which is based on a response to historical practices. Performative, or technological, formalism depends upon systems and building construction knowledge to produce formal, environmental, and effectual response. Organizational formalism is dominated by the organization's system (discussed in Chapter 1) as derivational ideals that have universal compositional implications. Geometric formalism uses geometric rationale (traditional and descriptive as well as digitally advanced techniques) to predicate form. A related classification, symmetrical formalism, uses axial geometries to establish reflection lines to establish order. Hierarchical formalism deploys form to produce contrasting gradients that allow for relative readings within a system. Material formalism uses the material and tectonic to define form. Experiential formalism relies upon the perceptive nature of human interaction (that of the viewer or user) to define form. Sequential formalism, a subset of experiential formalism, deploys chronology of movement and perception to define form. Axial formalism, linked to sequential formalism, defines the hierarchy and perception through the privilege of line.

05 - Figure / Ground

Associated with the legibility of form is the dialectical balance of figure and field engaging the graphic and physical ramifications of the interrelationship of positive and negative. This chapter begins with the graphic reading of Nolli's map of Rome, which deploys the idea of poche as a thickened mass. The theme of poche is further examined through position (plan, section, and urban) and function (defense, monument, structure, service, and material).

06 - Context

Context is the relationship of the object to its surroundings. Its classifications include the natural condition; the local, cultural, and broader urban condition; historical context as a condition of cultural, time, and technology; material context as a physical and technological relationship with matter; and cultural context relating to social norms, interactions, and traditions.

07 - Geometry and Proportion

Geometry and proportion refers to the mathematical rules of idealized form. The interrelationship of these principles to architectural form establishes the proportional systems, which include both the two- and three-dimensional modules in elevation and plan, and their implications on space, construction, and perception. Included in the study of these systems are the advanced techniques of distorted geometries and computational complexities that allow for more dynamic spaces with more intricate ornamentation of a structure's skin.

08 - Symmetry

Symmetry focuses on the relationship of form to axis through axial, bi-axial, radial, asymmetric (denial of the axis), local, material, and programmatic methods.

09 - Hierarchy

Hierarchy focuses on the ordered valuation of objects within a composition through formal, axial, visual / perceptual, scalar, monument, control, geometric, program / function, color, and material methods.

10 - Material

The theme of materiality examines the physicality of the matter with which we build through form (geometry / system / pattern / ornament), the relationship of surface, the engagement of material with tectonic, the perceptual nature of materials, the role of material relative to physics and structure, the engagement of the detail as a conceptual and material factor, the ecology of materials (origin and production), the function of material, and ultimately the meaning and association of materiality.

11 - Ornament

Ornament is the articulation and embellishment of material intended to lend grace and beauty to a building or structure. It has been defined as an element not belonging to the essential harmony or melody. It has been said that ornament is, in fact, all that separates architecture from building. This chapter divides ornament into a number of different types that include material (the physical way in which we make things and the ordering and composition of segmented construction); religious (the iconographic cultural reference of form); performative (the responsive nature of articulated materials toward a specific agenda); structural (the physics of forces and their engagement with functional verse ornamental); referential (creating a relationship to another premise or topic); organic (that tries to evoke specifically the natural condition); and historical (that directly relates to architecture or another identifiable form).

12 - Pattern

Pattern refers to the field effect of aggregated units accomplished through the method of repetition and rhythm, employing material elements such as shape, color, and composition. These variables may occur on varying scales of piece/unit, portion/panel, bay/module, or chunk.

13 - Sequence

The sequential nature of chronology, narrative, and experience of movement through space is engaged through the focused analysis of both horizontal and vertical movement, which include axial, ceremonial, experiential, organizational, and programmatic circulation.

14 - Perception

Perception is the most significant factor in the understanding of architecture and yet one of the most elusive and difficult to govern. The following factors are the primary categories relative to perception: light, color, visual focal point, perspectives (both real and false), material, sound, memory, and environment. Designers employ these factors and their impact on perception of composition to affect the user's experience and ultimately satisfy the programmatic requirements of the building or space. Examining the perceptual qualities of the body and the palette of manipulable factors that influence our five senses, the thematic investigation includes an examination of light, color, focal point, vantage or perspective (Constructed, False, and Multiple), material, sound, memory (history) and environment, and their impact on perception and composition.

15 - Meaning

This chapter focuses on the intellectual content and underpinning theoretical agenda of architectural movements, relative to broader themes and precedents, and their implications on form. An understanding of these movements is critical in comprehending how this book works. The movements discussed follow the primary architectural beliefs chronologically by era, covering classicism, Romanesque, Gothic, Renaissance, baroque, mannerism, neo-Gothic, industrialism, art nouveau, neo-classicism, arts and crafts, modernism, rationalism, brutalism, postmodernism, structuralism, post-structuralism, deconstructivism, hi-tech, regional modernism, pluralism, and globalism.

Layout and Key Features

The specific layout was carefully considered and graphically standardized to produce a consistent analytical lens that engages the diverse themes. In a spread, there is a series of descriptive devices that aid the reader in understanding the theme relative to a vein of thinking and a specific moment within architecture.

Each of the aforementioned chapters has an introductory essay that outlines the primary principles, conceptual evolution, and associated subthemes. Each two-page spread then pursues the illustration and unpacking of these subthemes through a comparative sequence of analytical case studies. Each spread is divided into four columns. The first is dedicated to a textual description followed by three chronologically organized case studies. Each case study is identified by a caption, the first line of which identifies the project name and architect. The second line contains the geographic location and a date of completion. For some urban projects, a larger time span was adopted so as not to minimize the scale and duration of the project. The third caption line then positions the project within the larger conceptual movement in which it was designed and built, followed by a condensed and primary description of the project relative to the theme, and finally the primary materials, illustrating both the level of technology and the associative physical-to-conceptual limitations. The brief description then tries to textually unpack the diagram and reference the significance of the case study relative to the broader principle. Certain case studies occur in multiple chapters of the book and have different visual and textual descriptions as the complexity of their thinking makes them applicable to diverse issues. An effort to use such case studies was intentional to illustrate the sophistication and multi-principled nature of architecture, which is rarely about a single system or reading.

Atop each page is a running band (see example above) that establishes a classification system, allowing the book to be used as a reference tool. This serves as a way-finding system that marks specifically where you are within the text and provides the contextual issues surrounding the case studies being presented. They are an indicator flag of where you are within the larger thinking. In addition to the page number, there are five categories to aid in this classification system: principle, organization, geometry, reading, and scale. The *principle* is the chapter title and the diagrammatic lens through which that section of examination is being viewed. This occurs on both the left and right pages of the spread as it is the fundamental underpinning of the analysis. The *organization* describes the subtheme (typically based in methodology) that establishes the specific thinking within the larger principle. *Geometry* describes the sub-subtheme and typically references the formal methodology of the use. *Reading* refers to the specific drawing type used in the illustration, linking the representational model and vantage to the specific method (for instance, plan, section, elevation, or axonometric). *Scale* refers to the level of operation at which the principle is deployed; for example, the scale of the city, the scale of the building, or the scale of the detail. Occasionally, one of these categorical cells is left intentionally blank. In this situation, the intermediate tier was not needed and thus skipped over. The uniformity of the thematic position is, however, consistently maintained throughout the book.

The unique approach and design of the book includes:

- a comprehensive look at the fundamental themes of architecture;
- the use of comparative precedents;
- case studies from across the history of architecture;
- consistent and clear graphic language;
- a parallel visual and textual unpacking of each principle.

Supplements

A complete image bank is available in PowerPoint format by going to the Instructor Resource Center.

Download Instructor Resources from the Instructor Resource Center

To access supplementary materials online, instructors need to request an instructor access code. Go to www.pearsonhighered.com/irc to register for an instructor access code. Within 48 hours of registering, you will receive a confirming e-mail including an instructor access code. Once you have received your code, locate your text in the online catalog and click on the Instructor Resources button on the left side of the catalog product page. Select a supplement, and a login page will appear. Once you have logged in, you can access instructor material for all Prentice Hall textbooks. If you have any difficulties accessing the site or downloading a supplement, please contact Customer Service at <http://247pearsoned.custhelp.com/>.

Principia

The collection of these themes results in a methodical unpacking of the lineages of architectural reference of material form. The simultaneous presentation of the graphic documentation and the analytical highlighting, coupled with the textual description and historical position, establishes a catalog of contemporary principles in relationship to form. This handbook will serve the designer, historian, and layman alike in understanding the complexity of the social, cultural, functional, material, and formal lineage of architecture.

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Brian Delford Andrews

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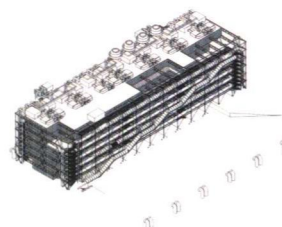
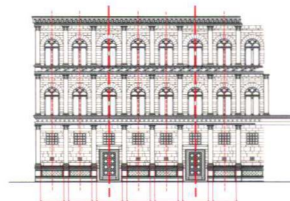
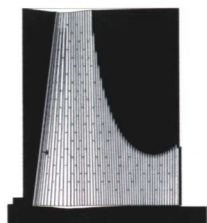
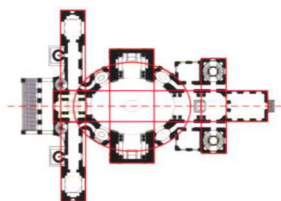
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GAIL PETER BORDEN

BRIAN DELFORD ANDREWS



Organization Systems

01 – Organization Systems: Parti and Order

Primary to the creation and comprehension of architecture is the development or adoption of an ordering or organizational system. Organizational systems are the geometric principles utilized to create the form and layout of an architectural composition. The combination of shape with an associated plan typology generates a building's identity and form. Through time, there are distinct and discrete classification systems that have arisen. The following pages dissect this history through the primary geometric ordering system, focusing both on form and interrelationships of pieces, or parti.

A parti refers to an overall idea or concept that diagrammatically informs a design. It originated as a term used at the Beaux Arts, denoting the essential diagram for a solution to an architectural problem. An architectural parti can take numerous forms and be applied either separately to different aspects of a project, (such as the plan or elevation) or inclusively, impacting many or all aspects of a design. A parti is a way of distilling a diagram down to one word or phrase, thereby allowing easier access to the designer's intent.

The formal organizational systems, or partis, include the following types: centralized, linear, **grid**, dispersed field, free plan, Raumplan, and hybrid. The definitions of these principles and the resulting subclassification of their genealogies establish a handbook of formal types. These types account for a classification methodology that encompasses every building through time. The purity of the parti's deployment, clarity, and visual legibility varies with architect, project, material technology, and era, though the formal organizational premise remains constant.

Organizations systems in architecture are concerned primarily with methods of composition and design. These systems form the basis of most architecture and allow the analysis of buildings and urban plans. Architecture is often defined by an organization system. It connects any building with those of similar systems and aids in their overall understanding. Every building contains and is categorized by some form of organizational system. Either straightforward and immediately recognizable, or hybridized and grafted from a combination of systems, the basic physical organizational systems are finite, and thus the reading of these underpinning principles is discernable and significant. The various systems, their possibilities or characteristics, and the history and precedents behind these systems are essential. These systems derive a catalog of spatial types and functional organizations.

Centralized Historically, centralized systems have been the most common organization system. A centralized system is one that focuses on a central space or object in the plan. Centralized systems come in the form of squares, circles, ovals, triangles, and stars. Often the space can be recognized as a singular, self-resolving, and formally complete entity, such as a church interior or a courtyard. In other examples, it might take the form of a solid structure or object, either as an architectural (building) or urban (city) element.

Linear A linear system is one that organizes elements along a line or axis. A linear system can be single-loaded or double-loaded, or have a point-to-point arrangement. These schemes can be either architectural in scale (such as a simple hallway) or urban in scale (such as a boulevard). A single-loaded system implies that one side is given priority and weighted with ancillary spaces; a double-loaded system uses both sides, whereas a point-to-point system is concerned with the elements being connected at either end.

Grid Grids are very common and often are recognized in both urban plans and structural systems. Grids are ways of deploying **multivalent**, repetitive organizational fields. The grid works equally in all directions through the establishment and repetition of a standard base unit. Present as both positive and negative figures, these systems can be recognized as a grid of **bays** or **modules** within a project. Their intensity of repetition and infinite expandability at either the architectural or urban scale is often adapted to respond to specific and local needs. As a way of either negotiating topography or attempting to emphasize a portion of a design project, deformations, interruptions, and disassociations to the grid establish relative relationships of object to field.

Dispersed Field A dispersed **field** first refers to buildings that separate the components into discrete objects and then deals with the interrelationships of the piece-to-piece, piece-to-field, and the field as a whole. The geometric association of one component to another can be overtly organized into legible patterns, surreptitiously organized through more concealed ordering, or fully disorganized to intentionally disregard a collective order. This system can be employed at both the architectural and urban scale. The typical Roman encampment is a prime example of an organized dispersed field system. It arrays disparately dimensioned objects within a regimented field. A disorganized and dispersed field is typified by the ubiquitous sprawl of suburban development, where independent local decisions outweigh the collective vision of the total composition, resulting in juxtapositions and anomalies.

Free Plan Free plan is a twentieth-century invention that allows a new type of space founded in continuity. In architecture, it allows the walls and spaces to be free of the structural grid. As the champion of this planning, Le Corbusier designed several prominent residential projects using this strategy. On an urban level, the various buildings are free to be placed in situations where they are related, though not by the typical urban qualities of axis and symmetry. The campus of IIT, by Mies van der Rohe, exemplifies this approach.

Raumplan Raumplan (developed and primarily used by Adolf Loos) deploys sectional differentiation between rooms as a way of distinguishing them in addition to their organization or position in plan. The complexity of this model results in limited applications, but allows for visual and spatial hierarchies between adjacent spaces. These hierarchies create intricate dialectics of dominant and subordinate spaces and positions. The Villa Moller and Villa Müller, in Vienna and Prague respectively, are excellent examples of this unusual system.

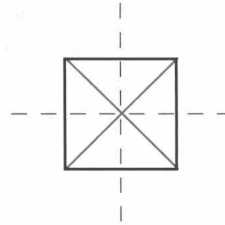
Hybrid The hybrid system combines two or more of the aforementioned systems into one building plan. Examples include the crossbreeding of both regular and irregular spaces (Guggenheim Bilbao, Frank Gehry), or the synthesis of a traditional, centralized courtyard figure with an internalized free plan (Bo Bardi House, Lina Bo Bardi). There is a long history of these organizational systems; architects throughout time have analyzed the hybrid and attempted to modify, adapt, and synthesize it for contemporary needs and applications. Hybridizations of centralized, linear, grid, and dispersed field of almost every configuration have been in use since architecture began. The Renaissance made large contributions to the refinement and formal usage of all of these methods. Modernism ushered in new spatial and organizational types such as free plan and Raumplan, and accelerated the use of the hybrid systems. The resulting forms and their driving rationale have evolved through associated conceptual intentions and technological capabilities.

It is critical that architects and designers understand these systems not as a series of formulas, but as a classification of principles. All projects are comparable to their historical antecedents, thereby making this knowledge, lineage, and associative sensibility essential.

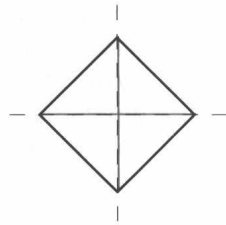
Centralized

Centrally organized buildings rely upon a **radial geometry** to emphasize a central point. Defined geometrically through the square, circle, Greek Cross, Latin Cross, or other radial geometries, the hierarchy of their geometric system dominates the entire composition. Secondary formal systems are subordinated by the power and dominance of the primary geometry. Easily identifiable and rationally derived, the geometric purity of form provides clarity of understanding to the occupant, allowing construction of a mental map that defines the entire composition. This understanding of the whole allows for a continuous positioning of the self relative to the hierarchy and form of the centralized system. The result is an awareness of one's own location, purpose, and hierarchy relative to the whole.

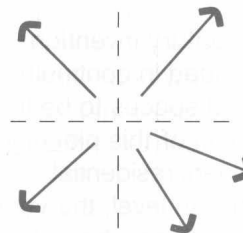
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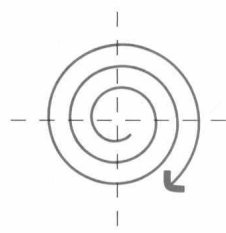
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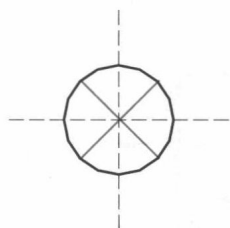
RADIAL



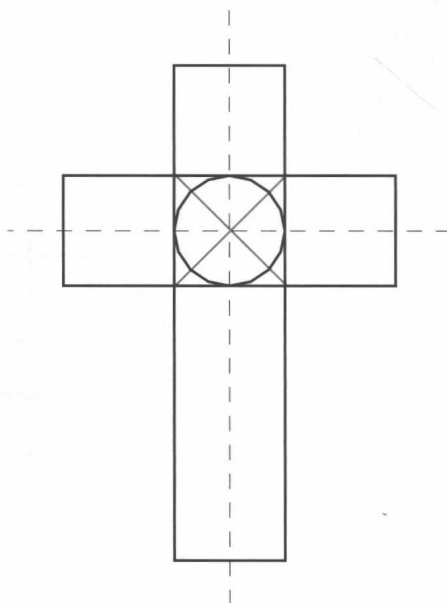
CENTRIFUGAL



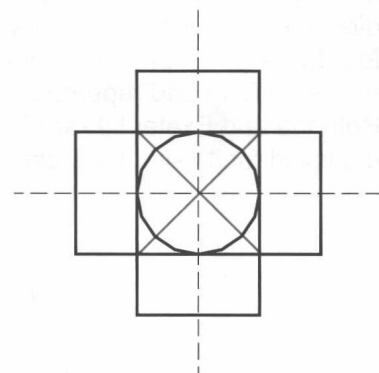
CIRCLE



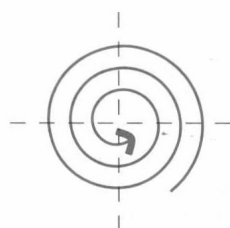
LATIN CROSS



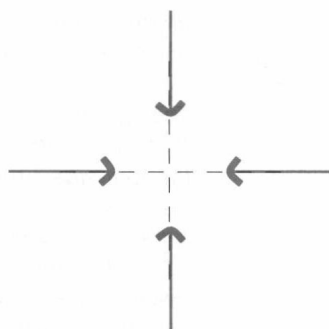
GREEK CROSS



CENTRIPITAL



CENTRAL



CENTRAL WITH AXIS

