Theorizing a contradiction between form and function in architecture

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The contradiction between form and function should be seen as an important element in architecture. Modernist functionalism prioritized the necessity that form is seen as a consequence of function, adapting Louis Sullivan's credo that "form follows function," although Sullivan was not talking about the functional requirements of a building in relation to its form - he was talking about relationships in nature and the creative process. Nevertheless, architecture needs to be understood beyond the formula of "form follows function." This is not to deny the importance of functionalism in architecture, or to deny that there is a necessary relation between form and function in architecture, but only to reveal that the contradiction between form and function also plays an important role in architecture.

Key words: form, function, eidos, functionalism, natura naturans, lineament, uitbeelding, phenomenal transparency, deep structure, pictorial ambiguity, transformational relation, Bioconstructivism

The thesis is that the contradiction between form and function should be seen as an important element in architecture. The contradiction between form and function in architecture is proposed as a historical architectural construction that has not been theorized, a historical philosophy underlying theories of architectural practice that has not been articulated. By "form" is meant the visual appearance of a building (line, outline, shape, composition); by "function" the structural and functional requirements of a building (construction, shelter, program, organization, use, occupancy, materials, social purpose). Form of course can be said to have a metaphysical "function" to represent or express an idea, but that sense of the word is not used here. Both terms have modern connotations, related to the dictum "form follows function," but both have also played a role in architecture throughout history. In the twentieth century, form is the visual shape or appearance of a building. This is made clear in books ranging from Paul Frankl's *Principles of Architectural History*, to Rudolf Arnheim's *The Dynamics of Architectural Form*, to Peter Eisenman's *The Formal Basis of Modern Architecture*.

Form as appearance goes back to the classical distinction between eidos and hyle, form and matter. Plato defined eidos or idea as an archetype, separate from matter. Aristotle maintained the distinction, but said that eidos participates in hyle, and is in fact the ousia or being of the natural world. The Latin forma was used by the Romans as a synonym for both eidos (conceptual form) and morphe (sensual or sensible form). Vitruvius, in De architectura in the first century BCE, used the words imago, idea, species, and eurhythmia, all referring to form or visual appearance (either conceptual or sensible). He distinguished between ratiocinatio, the intellectual apprehension of architecture, and fabrica, the craft of architecture. In dispositio (arrangement), orthographia is the image (imago) of a building, and the result of cogitatio is the visual effect. The elements of dispositio—ichnographia (plan), orthographia (elevation), and scenographia (perspective)—are described as ideae (eidos or forma). Eurhythmia is venusta species (beautiful form); eurhythmia is derived from rhythmos, or form.

The Aristotelean commentators and Scholastics distinguished between sensible form (morphe, species sensibilis) and intelligible form (eidos, species apprehensibilis), form as property of the object and form as a product of the mind, as an incorporeal likeness of matter.

Kant defined form as an a priori intuition, a transcendental idea, of phenomena. The distinction between sensible and intelligible is related to the distinction between signifier and signified in language or rhetoric, which also has a modern connotation, in twentieth-century Structural Linguistics, but has played a role in visual theory since Vitruvius. According to Vitruvius, architecture consists of "that which signifies and that which is signified" (quod significatur et quod significat, in De architectura I.I.3).[1] That which signifies is the verba, or words in rhetoric, the material vocabulary of architecture, and that which is signified is the res (proposed thing, relation). As Leandro Madrazo Agudin says in The Concept of Type in Architecture: An Inquiry into the Nature of Architectural Form, "the concept of Form in architecture will reveal itself as permanent and ubiquitous" (51), and the three kinds of form defined by Vitruvius, structural, sculptural, and geometric, "exist in architectural works of all times" (81).[2]

The modern connotation of the function of a building is related to its use or utility (as defined for example by Hitchcock and Johnson in The International Style, 1932). This concept also goes back to Vitruvius, in that a building must have utilitas (usefulness), firmitas (firmness), and venustas (beauty), and these have also played a role throughout the history of architecture, with different cultural and historical nuances. According to Edward Robert de Zurko in *Origins of Functionalist Theory*, "Functionalism is generally associated with…the practical, material needs of the occupants of the building and the expression of structure" (7).[3] As Peter Eisenman wrote, in "Notes on Conceptual Architecture," "there is no conceptual aspect in architecture which can be thought of without the concept of pragmatic and functional objects…" (Eisenman *Inside Out: Selected Writings* 1963–1988, 16).[4] But as Le Corbusier wrote in the early twentieth century, "Architecture has a different meaning and different tasks from showing constructions and fulfilling purposes. Purpose is here understood as a matter of pure utility, of comfort, and of practical elegance" (as quoted in Adolf Behne, The Modern Functional Building, 134).[5] While the emphasis in the functionalism of the twentieth century has been on utility and program, structure plays a role as well, and each has been present throughout the history of architecture in various ways. In the nineteenth and twentieth centuries, geometrical form replaced sculptural form, and "functional goals merely replaced the orders of classical composition as the starting point for architectural design," as Eisenman wrote in "The End of the Classical" (Eisenman *Inside Out: Selected Writings* 1963–1988, 154).[6]

There are many examples in the history of architecture which display the contradiction between form and both structure and program. The goal of this thesis is not to challenge or criticize the legitimacy of functionalism in architecture. The synthesis of form and function plays a dominant and valuable role in architectural design. The present thesis is only intended to add another dimension to architectural composition and expression, without diminishing the importance of functionalism. In fact, successful contradiction between form and function can only be achieved after the functional requirements are fully understood. If the definitions of the terms throughout the history of architecture are examined, it can be seen that a contradiction between form and function is often present in architecture.

The distinction between form and function is related to what are seen as the "communicative" roles of architecture, in expression or representation, and the "instrumental" roles of architecture, in utility and technology; this distinction can in turn be related to the distinction between "culture" and "civilization," described by various authors, including C.P. Snow in The Two Cultures, and Nikolaos-Ion Terzoglou in "Architectural Creation between 'Culture' and 'Civilization'", in *The Cultural Role of Architecture*. According to Christian Herrmann, the duality of form and utility plays a role in every aspect of human life, including the life of the soul. Architecture has a role, as a work of art, to express a metaphysical or transcendental idea which is not connected to its

material presence. This is the definition of art. The transcendental can be the formal, conceptual, expressionistic, intellectual, numinous, spiritual, or aesthetic aspect of architecture.

According to Friedrich Schelling, in *The Philosophy of Art* (1859), because architecture is always necessarily tied to the material, to its physical and structural requirements, in order for architecture to be art, to communicate an idea not connected to its material requirements, architecture must be the "imitation of itself as the art of need" (§ 111),[7] that is, its visual appearance must contradict its physical requirements, its form must contradict its function. As Karl Friedrich Schinkel said, "Two elements must be distinguished precisely" in architecture: "the one intended to work for practical necessity and the one that is meant only to express directly the pure idea" (as quoted in Adolf Behne, *The Modern Functional Building*, 88).

As twentieth-century architectural discourse was dominated by the idea that there should be a causal relation between form and function in architecture, that "form follows function," the purpose of this thesis is to suggest that the contradiction between form and function also plays a role in architecture. As Madrazo Agudin points out, "in spite of their adherence to functionalism, the architects of the Modern Movement did not leave out the aesthetic significance of form. As a matter of fact, functionalism alone cannot explain the forms of modern buildings" (380). As Rudolf Arnheim asserted in *The Dynamics of Architectural Form*, "Physical function does not sufficiently determine form and no such determination explains why a visible kinship should result between function and expression" (256).[8] With expression based in form, "expression is not identical with a building's physical properties: a building may be soundly built yet look flimsy and precarious. Nor is expression identical with what the viewer, rightly or wrongly, believes the physical structure of a building to be" (254).

According to Adolf Behne in *The Modern Functional Building*, while function is the consequence of individual need, form is "the consequence of establishing a relationship between human beings" (137). Architecture in its form is an expression of human identity and the human condition, a poetic expression of the human spirit. The juxtaposition of function and form stages a dichotomy between the material and transcendent, the real and the ideal, matter and mind, the instrumental and the communicative, which results in artistic expression and communication.

Geoffrey Scott, in *The Architecture of Humanism*, defined the humanism of architecture as the "tendency to project the image of our functions into concrete forms…" (213).[9] In *The Architecture of Humanism*, there are examples given throughout history in which the appearance of structure in a building contradicts the fact of structure, the form of a building is unrelated to its social purpose, aesthetics are unrelated to construction, forms are produced irrespective of mechanical means or materials, forms are designed in excess of structural requirements, and the art of architecture is detached from mechanical science, all of which results in a humanistic architecture. An architecture that displays the contradiction between form and function is a humanistic architecture, an architecture that reveals the relationship between the human mind and the material world. Form is a product of the mind, while function is a product of matter.

In ancient Egypt, the symbolism of the pyramids can be seen in contradiction to their structure and accommodation of funerary programs. The non-structural role of peripteral colonnades on classical Greek temples, and optical adjustments to the temples, such as entasis, can be seen in relation to the deceptive nature of the objects of sense perception in the Allegory of the Cave in the *Republic* of Plato, and the conceptions of optics and perspective found in the *De architectura* of Vitruvius, and the *Enneads* of Plotinus. Optical refinements to the Greek temple, discovered in around 1837 by John Pennethorne and Joseph Hoffer, include horizontal

curvatures of the stylobate, entablature and gable; the leaning of columns, walls, antae, architrave, and frieze; and unequal sizing and spacing of columns and capitals. As Geoffrey Scott wrote in *The Architecture of Humanism*, "The Parthenon deceives us in a hundred ways, with its curved pediment and stylobate, its inclined and thickened columns" (157). The Doric column itself, he pointed out, "provides a support immeasurably in excess of what is required" (102).

Theories of *natura naturans* (imitation of the forming principles of nature) versus *natura naturata* (mimesis of natural forms) in classical architecture, involving the distinction between *eidos* and *morphe*, intelligible form and sensible form, are developed in the writings of Johann Joachim Winckelmann (*Histoire de l'art chez les anciens*), Francesco Algarotti (*Saggio sopra l'architettura*), Antoine Chrysostome Quatremère de Quincy (*Encyclopédie méthodique*, *De l'architecture égyptienne*), and Marc Antoine Laugier (*Essai sur l'architecture*). According to Johann Joachim Winckelmann in *Histoire de l'art chez les anciens* (1801), architecture is more "ideal" than the other arts because it does not imitate objects in nature; its forms are rather derived from the rules and laws of proportion, which are abstract concepts. Francesco Algarotti, in *Saggio sopra l'architettura* (1784), explained that architecture "must raise itself up with intellect and must derive a system of imitation from ideas about things that are the most universal and farthest from what can be seen…," that is, perceived by the senses. Thus "architecture is to the arts what metaphysics is to the sciences" (quoted in Sylvia Lavin, *Quatremère de Quincy and the Invention of a Modern Language of Architecture*, 107).[10] Architecture is necessarily metaphysical, because its design is derived from systems which are not directly connected to sensible perception.

According to Quatremère de Quincy, in the *Encyclopédie méthodique* (1788), classical Greek architecture was based on an underlying conceptual organization of abstracted forms and principles from nature, but it required in addition a dressing or costume that was completely disconnected from the forms of nature, and purely ideal. The result is that the "imitative system disguises the object imitated under a veil of invention and masks the truth with the appearance of fiction" (1:467) (quoted in Sylvia Lavin, *Quatremère de Quincy and the Invention of a Modern Language of Architecture*, 111). The imitation of imitation was necessary because of the transposition of the forms of the primitive hut from wood to stone. According to Quatremère, architecture has a moral responsibility to present the relation between human reason and nature as false, in the deliberate artificiality of its imitation. The contradiction between form and function in architecture can be found in the Tabularium Motif in Roman architecture, and the construction of the Pantheon.

The contradiction between physical and spiritual worlds is a constant theme in the symbolism of Christian and Byzantine architecture, the iconostasis, and Byzantine mosaics. The contradiction between form and structure can be seen in English Gothic architecture in the development of the rib vault beginning at Durham Cathedral. According to Paul Frankl in *Gothic Architecture*, the Gothic style began when diagonal ribs were added to the Romanesque groin vault, the rib being defined as an arch added to the surface of the vault. The Gothic is thus defined as involving the articulation of structure, beyond structure itself. The rib can be seen as a signifier for structure, a linguistic element in architecture, which removes the reading of the form of the architecture from the immediate presence of the architecture, in its structure or function, in the same way that language functions as a system of signifiers which is removed from that which it purports to signify.

The undermining of the French Gothic system began at Canterbury Cathedral, in the work of William of Sens and William the Englishman, which resulted in contradictions between form

and structure. The contradiction in the architecture is related to the contradiction between reason and faith in the dialectical process of the Scholasticism of Anselm of Canterbury (*Monologion*, *Oratio ad sanctum Nicolaum*), the "Father of Scholasticism." In the architecture, the sensible form, the design of the elevation, contradicts the intelligible form, the structural logic of the building. In the dialectic, the intelligible can be represented in terms of vision, "by the progress of sight from shadows" (Plato, *Republic* 532),[11] from the dark beyond human understanding, as described by Anselm in his *Oratio ad sanctum Nicolaum*. The exercise of the dialectic is ultimately carried out by reason in the realm of faith without the aid of the senses, and culminates in pure thought, *noesis*, the "summit of the intellectual realm."

Figure 1
Saint Hugh's Choir, Lincoln Cathedral, c. 1200.

The contradiction between form and structure in the asymmetrical vaulting of Saint Hugh's Choir at Lincoln Cathedral (figure 1), possibly designed by Geoffrey de Noyers, can be seen in relation to precedents at Canterbury and possible symbolic purposes relating to the mathematical and geometrical organization of the architecture. The vault is composed of non-structural ribs: the ridge pole and tiercerons, forming triradial ribs. Nikolaus Pevsner called the vault "the first rib-vault with purely decorative intentions" (*An Outline of European Architecture*, 207),[12] as it is composed of non-structural geometries posing as structural elements.

The mathematical and geometrical symbolism can be understood in relation to the writings of Robert Grosseteste, Bishop of Lincoln 1235–53. The geometries used in the architecture at Lincoln Cathedral—bent and curved lines of varying lengths, conic sections, convex and concave surfaces—correspond to the geometries described by Grosseteste in his treatises on light and optics, *De Luce* and *De Lineis, Angulis et Figuris*. The geometries are described by Grosseteste

for the purpose of explaining the functioning of natural phenomena, in particular the diffusion and rarefaction of light. Grosseteste's description of the functioning of natural phenomena in geometrical terms is an architectonic catechism which corresponds to the architecture of the cathedral, the form of which represents the Scholastic understanding of the structure and function of the natural world, as a cosmology, in contradiction to the actual structure of the building.

Contradictions in English Gothic architecture are related to the contradiction between the organic and inorganic in architecture as discussed by Georg Wilhelm Friedrich Hegel (*Introductory Lectures on Aesthetics*) and Friedrich Wilhelm Joseph von Schelling (*The Philosophy of Art*) at the beginning of the nineteenth century. A call for the necessity of the contradiction between form and function in architecture is found in the writings of Hegel and Schelling, in order for architecture to be art. According to Hegel, the art form "refers us away from itself to something spiritual which it is meant to bring before the mind's eye" (*Introductory Lectures on Aesthetics*, XV),[13] and the forms of architecture are "merely set in order in conformity with relations of the abstract understanding" (CIX), in mathematics and geometry, rather than material function. The beauty of art is beauty that is born "of the mind" (I, II), and not of the material. According to Schelling, "Architecture can appear as free and beautiful art only insofar as it becomes the expression of *ideas*, an image of the universe and of the absolute" (*The Philosophy of Art*, §107), as architecture must be the "imitation of itself as the art of need" (§ 111). Architecture cannot be organic form, so it must represent organic form in the idea, as in the vaulting of English Gothic architecture, to which Nikolaus Pevsner refers as "palm-fronds." The symbolic contradicts the organic as the human mind contradicts nature. The symbolic is the self-realization of the artificial construction of meaning. Philosophy is "symbolic science," as described by Schelling, as seen in Scholasticism.

How architecture is perceived (in the apperception of intelligible form as opposed to perception of sensible form) and the contradiction between sensible forms and intelligible forms in perception and intellection, can be found in the writings of Aristotle, Plotinus, Grosseteste, Leon Battista Alberti, Gottfried Wilhelm Leibniz, Immanuel Kant, Rudolf Arnheim, and Peter Eisenman, to name a few. As Rudolf Arnheim asserted, a view of a building is synthesized from a multiplicity of views, and a work of architecture is "a mental image synthesized with greater or lesser success from partial views" (*The Dynamics of Architectural Form*, 111), leading Arnheim to conclude that "expression is not identical with a building's physical properties," nor its physical structure, as is the case in English Gothic architecture.

In the Renaissance, the contradictions between the facades and the structures and symbolic programs of the buildings in the architecture of Leon Battista Alberti (Palazzo Rucellai, Santa Maria Novella, Sant'Andrea in Mantua), and Alberti's designs based in syncretic combinations and underlying proportioning systems, can be understood in relation to the writings of Alberti (*De re aedificatoria*) and Marsilio Ficino (*De amore*), for example, derived from classical sources (Plato, *Timaeus*, *Phaedrus*; Aristotle, *De anima*; Vitruvius, *De architectura*; Plotinus, *Enneads*; Proclus, *Elements of Theology*). The writings include Alberti's distinction between lineament (the lines in the mind of the architect) and matter, and his theory of *concinnitas* or visual harmony. Lineaments are the outline of a building, consisting of lines and angles, as conceived in the mind (as *eidos* or *species apprehensibilis* in intellect and imagination), separate from matter, as in the *ratiocinatio* of Vitruvius. In the *De re aedificatoria*, "It is quite possible to project whole forms in the mind without any recourse to the material…" (I.1).[14] *Concinnitas* is defined as the "form and figure" of a building, that which is "pleasing to the eyes," and is "the main object of the art of building" (IX.5). Alberti followed Vitruvius in his definition of *concinnitas* or beauty in *De re aedificatoria*: "It is the task and aim of *concinnitas* to compose

parts that are quite separate from each other by their nature, according to some precise rule, so that they correspond to one another in appearance" (VII.4). *Concinnitas*, like apperception, transforms disparate and unrelated sensible perceptions into a coherent whole, in a disjunction between perception and what is perceived, a contradiction between visual form and material function.

On the façade of the Palazzo Rucellai (figure 2), the forms of structural classical columns perform no structural function, and the bays of the façade do not correspond to the structure of the building. On the façade of Sant'Andrea in Mantua, the forms of a Greek temple front and Roman triumphal arch are combined for a Catholic church, a contradiction in representation and purpose. The trabeated elevations on the interior of the basilica conceal Gothic-style buttressing in the bays, as at St. Peter's in Rome. The contradiction between the lineament (as *archê* or archetypal principle) and matter is expressed in Renaissance painting as well, and is found in the theories of vision of Ficino (*De amore*, *Theologia Platonica*) and Alberti (*De pictura*). As Alberti explained, a building consists of "lineaments and matter, the one the product of thought, the other of Nature; the one requiring the mind and the power of reason, the other dependent on preparation and selection" (*De re aedificatoria*, Prologue), in the realms of form and function.

Figure 2
Leon Battista Alberti, Palazzo Rucellai, Florence, 1452–70.

According to Geoffrey Scott in *The Architecture of Humanism*, the humanistic architecture of the Renaissance, and the visual expression of humanistic ideals, entailed a contradiction between form and function. The form of the building was often "disproportionate, and even unrelated, to the social purpose it ostensibly fulfils…" (26). The decorative use of the Orders

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did not express structure and was contrary to construction. Forms in architecture were not used in relation to "the mechanical means by which they were produced," the "materials out of which they were constructed," or "the actual purposes they were to serve" (32). Arches and pilasters on Renaissance buildings were employed in ways that contradicted the structural purpose for which they were designed, a phenomenon that can be found throughout Renaissance, Baroque, and Neoclassical architecture.

Alberti's theory of vision was applied to his prescriptions for composition in painting and architecture. The contradiction between form and function can be seen in Donato Bramante's trompe l'oeil compositions in Milan, where trompe l'oeil space contradicts real space, as in the trompe l'oeil perspective devices in the paintings of Andrea Mantegna and Leonardo da Vinci. The contradiction between form and structure is seen in the Mannerist devices of Michelangelo (Laurentian Library, Porta Pia) and Giulio Romano (Palazzo del Tè, figure 3). The contradiction between form and structure in the Mannerist devices of Giuilo Romano is related to the architectural use of tropes or figures of speech, and the inherent contradictions in rhetorical language. Tropes in poetic language, such as metaphor, metonymy, or synecdoche, contradict the ability of the language to convey literal meaning, but result in poetic expression. In language or architecture, poetic expression requires the contradiction between form and function. Mannerist compositions culminate in the architecture of Federico Zuccari in Rome (Palazzo Zuccari), which is related to the theoretical discussions of the Accademia di San Luca (Federico Zuccari, *L'Idea de' pittori, scultori ed architetti*; Romano Alberti, *Origine et Progresso dell'Academia del Disegno*; Pietro da Cortona, *Trattato della Pittura e Scultura*), and in particular the distinction between *disegno interno* (the design in the mind of the artist, *eidos*) and *disegno esterno* (the physical design, *morphe*).

Figure 3
Giulio Romano, Palazzo del Tè, Mantua, 1526–35.

The contradiction between form and structure abounds in the architecture of Francesco Borromini (San Carlo alle Quattro Fontane, figure 4), influenced by classical philosophy,

Renaissance Humanism, the Accademia di San Luca, and the mysticism of the Counter Reformation. At San Carlo, the trabeated elevations again conceal structural buttressing; an exhaustive structural system is presented which serves no structural purpose, as if it were shadows on the wall of the cave in the *Republic* of Plato. Balusters are turned upside down, volutes are inverted, and straight and concave entablature sections alternate, without apparent rational purpose. But the seemingly bizarre formal juxtapositions have underlying rational explanations. Borromini's architectural forms can be related to the contradiction between dream thoughts and dream images in Sigmund Freud's *The Interpretation of Dreams* (1900), and the *coincidentia oppositorum*, or coincidence of opposites, which is found in philosophy, language, and psychoanalysis. According to Freud, while "little attention is paid to the logical relations between the thoughts, those relations are ultimately given a disguised representation in certain formal characteristics of dreams" (544–5),[15] as rational structures are disguised by Borromini's forms. As Freud describes, "Dreams feel themselves at liberty…to represent any element by its wishful contrary…" (353), as in the forms of Borromini, which contradict their functions.

Figure 4
Francesco Borromini, San Carlo alle Quattro Fontane, Rome, c. 1638.

Elements of the architecture of Karl Friedrich Schinkel (the Schauspielhaus in Berlin, figure 5) can be understood in relation to the writings of Friedrich Schelling and Georg Hegel. The ideas of Immanuel Kant (*Critique of Pure Reason*), Johann Gottlieb Fichte, Schelling (*The Philosophy of Art*), and Hegel (*Introductory Lectures on Aesthetics*) were understood by Schinkel through his friends Karl Wilhelm Ferdinand Solger and Wilhelm von Humboldt. Schinkel saw architecture as a theatrical stage set, and as a representation of the true underlying structure of reality, in contradiction to perceived reality. As Schinkel said, "Two elements must be distinguished precisely: the one intended to work for practical necessity and the one that is meant only to

express directly the pure idea." The trabeated façade of the Schauspielhaus in Berlin contradicts the structure and program of the building; according to Schelling, architecture must contradict itself in its form in order to express an idea and in order to be art. The Transcendental Idealism of Schinkel's architecture would influence the architecture of Ludwig Mies van der Rohe in the twentieth century, in the contradiction between mind and perception, form and function.

Figure 5
Karl Friedrich Schinkel, Schauspielhaus (Konzerthaus Berlin), 1818–21.

In the *Critique of Pure Reason* (1781) of Kant, space and time, and geometry and mathematics in architecture, are transcendental a priori categories of mind which do not exist in the world of matter as given by perception, but are applied by experience, as influenced by the thought of George Berkeley. The form of architecture is an a priori representation in relation to its structure and program. As Kant wrote, when "I make the empirical intuition of a house by apprehension of the manifold contained therein into a perception, the *necessary unity* of space and of my external sensuous intuition lies at the foundation of this act…" (92).[16] Without the a priori intuition, apperception, cognition and discursive reason would not be possible. The form of the house is drawn according to the synthetical unity of the manifold in space, which does not exist in material phenomena, but rather only in the mind.

As geometry and mathematics, as a language or a form of representation, architectural form mediates between thought and the sensible world given by perception. Objects of perception are given by signs or representations in the thought of Berkeley (*An Essay Towards a New Theory of Vision*; *Alciphron*; *The Theory of Vision or Visual Language Vindicated and Explained*); and words in language as signs do not correspond to the objects they signify according to René Descartes (*The World, or a Treatise on Light and the Other Principal Objects of the Senses*). The relation between the signifier and the signified in language is arbitrary, corresponding to a contradiction between form and function in the language of architecture, and anticipating the theories of Structural Linguistics and Deconstruction in the twentieth century.

In the Structural Rationalism of Eugène-Emmanuel Viollet-le-Duc (*Dictionnaire raisonné de l'architecture*, 1854–68), style in architecture is seen as a conception of the mind, not a physical quality of a building. Style in art is "the manifestation of an ideal based on a principle" (232), a manifestation of *eidos* rather than *morphe*, of form rather than function.[17] The terra cotta ornament designed by Louis Henry Sullivan (Wainwright Building, Guaranty Building), contradicts the dictum for which Sullivan is known, that "form ever follows function" ("The Tall Office Building Artistically Considered," *Kindergarten Chats* 208).[18] Sullivan said that form should follow function in the creative process of the architect, and that "the essence of things is taking shape in the matter of things" in nature, but he did not say that the form of the building should follow the function of the building, its functional or structural requirements. As Robert Woods Kennedy wrote in the *Journal of the American Institute of Architects*, 1950, the dictum "was not interpreted by him as it was by the functionalists. He considers the business of properly relating them a matter of *professional technique*, not an end in itself" (199),[19] in the design of the building. As Marcel Breuer said, "Sullivan did not eat his functionalism quite as hot as he cooked it" (as quoted in Peter Blake, *Form Follows Fiasco*, 16).[20] Sullivan's causal relation is an example of organic functionalism, but as Richard Neutra suggested in *Survival Through Design*, operation also can follow appearance in nature, so function can follow form.

The relation between form and function in architecture for Sullivan is a dialectical relation, between the metaphysical and the material, the infinite and finite, life and death. In the "Kindergarten Chats" (1918), all forms "stand for relationships between the immaterial and the material, between the subjective and the objective—between the Infinite Spirit and the finite mind" (45), independent of the function of the building. Sullivan's ideas were influenced by Leopold Eidlitz (*Nature and Function of Art*), Ralph Waldo Emerson, Walt Whitman, and Hegel. According to Eidlitz, the design of a building is the expression of a transcendental idea manifesting itself in form through nature. For Sullivan, the essence of a building is in its appearance, not its structural or functional requirements. The gridded façade of the Bayard Building, for example, expresses the rhythms of life and death, eros and thanatos, growth and aspiration, as expressed in the *Leaves of Grass* of Walt Whitman. Sullivan was familiar with the Hegelian dialectic (*Philosophy of Mind*) through his friend John Edelmann, the dialectic of subjective and objective, particular and universal, organic and geometrical, which he incorporated in his architectural theory.

The dialectic of organic and geometrical, and form and structure, can also be found in the architecture of Victor Horta in Belgium (Tassel House, Maison du Peuple, Maison et Atelier Victor Horta). Forms which appear to be structural are in fact non-structural, producing a double reading of the forms in the contradiction between form and function. In the Tassel House (1893), a filigree iron bracket only plays a role visually, to affirm the continuity of a line. Rivets and bolts are used as ornamentation, extending to beams with rivets which serve no structural purpose. In the Maison et Atelier Victor Horta, rue Américaine 25 (1898–1900), non-structural plaster vaulting appears around the stairwell. Gilded metalwork under curved beams in the dining room appear to function as tie bars but do not, and a column at the entrance of the house appears to support a marble cantilevered ledge but does not. The fantastical architecture of Horta involves the dialectic of the human mind and nature, the transcendental idea and material forms, literal and figural, rationalist and poetic. The architecture suggests the Symbolist *chambre rêve*, involving the dissolution of the subject in space that would be described as psychasthenia by Roger Caillois ("Mimicry and Legendary Psychasthenia," *Minotaure*; *Le Myth et l'Homme*; *The Necessity of the Mind*), and the quality of *informe*, the dissolution of the boundaries of form. Horta's architecture evokes the Symbolist interior environment of artificiality celebrated in Joris-

Karl Huysmans' *A Rebours*, and the Symbolist landscape of artificiality and death celebrated in Georges Rodenbach's *Bruges-la-Morte*.

The theories and works of the De Stijl movement in Holland (Theo van Doesburg, *Spatial Diagram*; Gerrit Rietveld, Schröder House; Piet Mondrian) were influenced by the Hegelian philosophies of Mathieu Schoenmaekers and Gerard Bolland. Schoenmaekers distinguished between *uitbeelding* and *afbeelding*, between representation in visual depiction and the visual representation of an inner reality beyond visual appearance, as in the *Vorstellung* and *Geist* of Hegel (*Introductory Lectures on Aesthetics*), the manifestation of *Geist* or Spirit through *Vorstellung* or picture-thinking. The Absolute Spirit, beyond picture-thinking, can be invoked in the pure plastic work of art, according to van Doesburg. Categories of thought defined by van Doesburg in the perception of art, following Hegel, are based on classical conceptions of thought (Plato, *Republic*; Aristotle, *Metaphysics*, *De anima*; Proclus, *Commentary on the First Book of Euclid's Elements*) in the formation of a *Kunstreligion* towards a utopian society. The fixed panels on the exterior of the Schröder House have been called "trompe l'oeil" and "illusionistic": they are not the material they purport to be, they do not serve the function that they represent, and they mask the structure of the house. The form of the architecture contradicts the functional and structural requirements of the building, and the architecture can thus express the idea of the Absolute Spirit, the dialectic of the inner essence of being and the *Vorstellung*, representation in visual form and language.

Figure 6
Ludwig Mies van der Rohe, Classroom Building, Illinois Institute of Technology, Chicago, c. 1945.

The influence of De Stijl, and the contradiction between form and function, can be seen in the Barcelona Pavilion of Ludwig Mies van der Rohe, where there are no enclosing walls to provide shelter. The architecture can be seen as an architecture of text or signification in form, in the evocation of *Geist*, in the tradition of Transcendental Idealism. From Schelling (*The Philosophy of Art*), architecture must be a free imitation of itself; forms which are not functional must be functional in appearance, as in the I-columns on the facades of Mies' buildings in America. In the evocation of *Geist*, an absence is contained within the presence of the architecture, as in

the false column of the Miesian Corner (figure 6), wherein the form contradicts the structure. The trace of absence in presence corresponds to the instituted trace in language as described by Jacques Derrida in *Of Grammatology*. The trace or absence in language makes meaning and signification possible, according to Derrida. The absence at the core of presence in language can also be found in the *point de capiton* of Jacques Lacan, the connection between the signifier and signified which produces signification. Language for Derrida is *différance*, a play of differences which constantly defers meaning, revealing the absence at the core of presence.

The contradiction between form and structure can be found in the architecture of Frank Lloyd Wright (Robie House, Fallingwater) where hidden steel beams produce an organic Prairie Style aesthetic, and the architecture of Le Corbusier (Villa Savoye), where painted wood panels masquerade as machined forms according to the Purist aesthetic. At the Chapel of Notre Dame du Haut at Ronchamp, Surrealist forms contradict the structural requirements of the building, in the same way that in the dream work of Sigmund Freud (*The Interpretation of Dreams*, *On Dreams*), dream images contradict dream thoughts, being transformed through condensation and displacement, mechanisms which are applied to Surrealist compositions. At the Villa Stein at Garches, overlays and intersections of grids create spaces which contradict the organization of the building. Colin Rowe and Robert Slutzky ("Transparency: Literal and Phenomenal" (1955–6), *Mathematics of the Ideal Villa*) compared the phenomenon to a Cubist painting, and contrasted literal transparency with "phenomenal transparency," or real space with formal space in a conceptual reading of a work, following Gyorgy Kepes in *Language and Vision*. There is a "continuous dialectic between fact and implication" (169)[21] in the architecture of Le Corbusier, according to Rowe and Slutzky, a dialectic of form and function. Le Corbusier said that architecture is a "product of the mind," and that it is "art in the highest sense, mathematical order, speculation, perfect harmony through the proportionality of all relationships…" (as quoted in Adolf Behne, *The Modern Functional Building*, 134), apart from the material presence of the building.

Figure 7
Giuseppe Terragni, Casa Giuliani Frigerio, Como, 1939–40.

The contradiction between form and function, between the irrational appearance of the facades and the rational organization of the buildings, in the architecture of Giuseppe Terragni in Como (Casa del Fascio, Casa Giuliani Frigerio, figure 7), is attributable to the shifting and rotating of nine square grids in plan, and the overlapping of centripetal and centrifugal plan organizations, according to the analysis of Peter Eisenman ("From Object to Relationship II: Giuseppe Terragni, Casa Giuliani Frigerio," *Perspecta* 13). According to Eisenman, the architecture can be read within the framework of the "phenomenal transparency" of Colin Rowe, as a dialectic of surface structure (the appearance) and deep structure (the organization), borrowing the terms from the linguistics of Noam Chomsky (*Language and Mind*, *Cartesian Linguistics*), where surface structure is the phonetic symbol or syntax of a sentence, and the deep structure is the meaning produced or the idea communicated by language. The dialectic of surface structure and deep structure in the architecture, like the dialectic of Alberti's matter and lineament in the Renaissance, entails the contradiction of form and function. As Eisenman says in *The Formal Basis of Modern Architecture*, "the dictates of form are not always wholly reconcilable with the requirements of function…" (27).[22]

The visual experience of Terragni's buildings is fragmented, and is a composite of individual perceptions, in what can be called apperception, as described by Plotinus, Leibniz, and Kant. The experience of architecture as multiple perceptions, gathered together in a coherent conceptual totality, was also described by Paul Frankl in *Principles of Architectural History*, and Rudolf Arnheim in *The Dynamics of Architectural Form*. In the Casa Giuliani Frigerio, pictorial ambiguity is identified in the simultaneous occurrence of both an additive and subtractive compositional process, and centripetal and centrifugal organizations of forms, and in the dialectics of planar/recession, solid/void, horizontal/vertical, and in the juxtaposition of forms generated by the superimposition and shifting of grids in plan. Pictorial ambiguity is seen as a compositional strategy in architecture to transform conceptual structures into formal structures, and to allow formal structures to be read as conceptual structures. Pictorial ambiguity enacts the dialectic of thought in perception and what is perceived, and the contradiction between form and function in perception, and the contradiction between form and function in architecture.

The oscillation between the fragmented and shifting appearance in the surface structure in Terragni's buildings, and the conceptual organization in the deep structure, which are connected by "transformational relations," corresponds to the fragmented and shifting play of words in the *différance* described by Derrida, which reveals the presence of absence in signification. It is only through the absences, the gaps and oscillations in language, that the unconscious can be known, according to Jacques Lacan (*Écrits: A Selection*), following the influence of Freud (*An Outline of Psycho-Analysis*, *The Ego and the Id*). A late project by Le Corbusier, the Villa Shodhan in Ahmadabad, displays the same oscillation of readings and pictorial ambiguity as the buildings by Terragni, through manipulations of the nine square grid rendered in *béton brute*.

The manifesto of Postmodern architecture, Robert Venturi's *Complexity and Contradiction in Architecture*, posits contradiction as an important aspect of architectural composition, as a reflection of human identity. In his design of the Vanna Venturi House in Chestnut Hill, Venturi was inspired by the Casa del Girasole in Rome, designed by the Italian Neorationalist Luigi Moretti, which combines multiple historicist references to create an ambiguous, oscillating reading in relation to the program and organization of the building. In early house compositions by Peter Eisenman (Barenholtz Pavilion or House I, Falk House or House II, figure 8), and later projects (IBA Housing in Berlin, Wexner Center, figure 9), the form contradicts the structure as a column does not support anything, or a column does not reach the floor, or a gridded façade does not correspond to the structure of the building, for the purpose of displaying the contradiction

between the material presence of the building and the conceptual organization of the building, surface structure and deep structure, matter and idea.

Figure 8
Peter Eisenman, Falk House (House II), Hardwick, Vermont, 1969–70.

Figure 9
Peter Eisenman, Wexner Center for the Arts, Ohio State University, 1983–89.

In House I, beams clearly do not support anything; they in fact have "nothing to do with the structure of the building" (174), as Eisenman explains in *House of Cards*.[23] House II has two

structural systems, of columns and walls, creating a "nonfunctional redundancy" in which "each system's function was to signify its own lack of function," in an architecture which is an "imitation of itself as the art of need" in the words of Schelling. A hole in the floor or a false entrance contradict the program and organization of the buildings. Columns "'intrude on' and 'disrupt' the living and dining areas…" (169), according to Eisenman. The syntax of the compositions is as the syntax of language, using rhetorical devices to produce signification and to challenge the logic of signification at the same time. Eisenman borrows the syntactical structures of the architecture of Terragni, and the syntactical structures in the linguistics of Chomsky, to compose the trace or absence of presence in language, the void at the core of signification, in relation to the *différance* of Derrida (as described in *Positions*).

Figure 10
Renzo Piano and Richard Rogers, Pompidou Center, Paris, 1972–76.

Form contradicts function in several icons of Postmodernist architecture, including the Pompidou Center in Paris (figure 10) by Renzo Piano and Richard Rogers, where the structural and functional elements of the interior of the building are placed on the exterior of the building, in excess of the functional requirements of the building, displaying the excess production of Late Capitalism. The architects were again inspired by an Italian Neorationalist, Franco Albini, in a design for La Rinascente in Rome. Works by Daniel Libeskind (Denver Art Museum) or Frank Gehry (Guggenheim Museum in Bilbao, Walt Disney Concert Hall, Pritzker Pavilion, figure 11), also display a contradiction between form and structure in the excess use of materials, for aesthetic affect or appearance, in relation to the functional requirements of the buildings. The form of the Piazza d'Italia in New Orleans by Charles Moore functioned as a media icon in contradiction to the actual failed function of the structure, to provide a place to eat, resulting in a postmodern ruin. The architecture displays the excess and artificiality of Late Capitalism in Western culture, as does the Gehry House, the form of which is in contradiction to the function of the house, in structure and program, and to its own ideological basis, a tenet of Deconstructivist architecture.
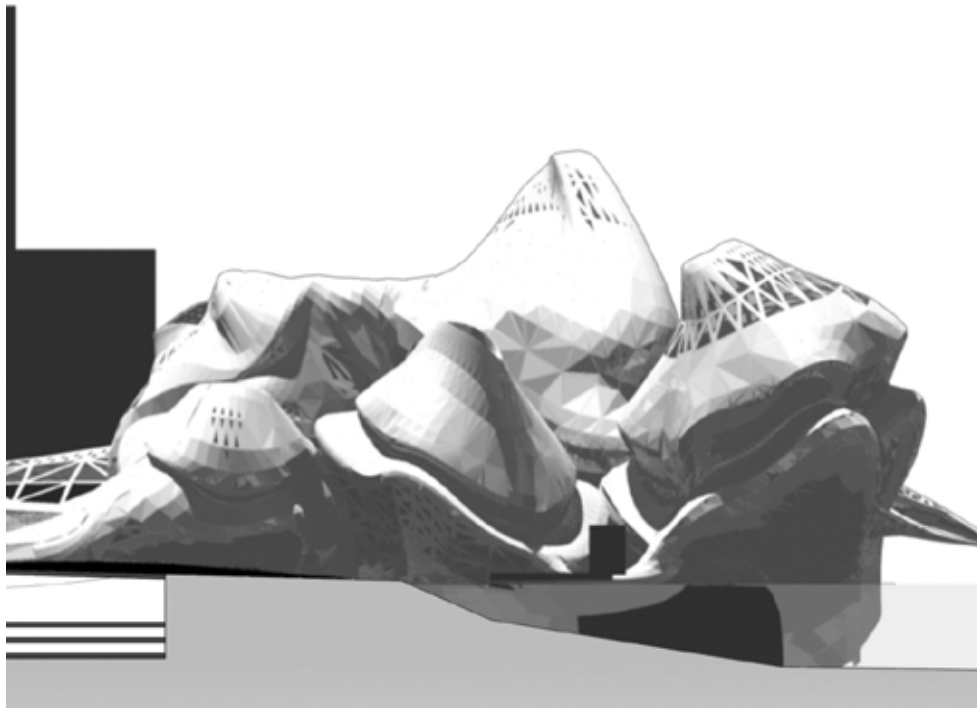
Figure 11
Frank Gehry, Pritzker Pavilion, Chicago, 1999–2004.

Deconstructivist works by Zaha Hadid (Vitra Fire Station) or Coop Himmelblau (Rooftop Remodelling Project, Vienna) display a Constructivist aesthetic in contradiction to both the historical origin of the aesthetic and the structure and function of the building, as do the follies of Bernard Tschumi at the Parc de la Villette in Paris, whose goal was to relate the disjunction between form and function in architecture to the disjunction between the signifier and signified in language, as described in *Architecture and Disjunction*. The follies represent the point of escape from the orthogonal grid of rational thought and the logocentrism of the signifier, the irrational within the rational, absence within presence. The absence within presence is a *chôra*, as in the *Timaeus* of Plato, a place of becoming which is not a place, the "in between" between signifiers, the trace between presences. Architecture, according to Tschumi in *Architecture and Disjunction*,[24] is a "thing of the mind" rather than a "pictorial or experiential art" (84), in which its vocabulary elements, "facades, arcades, squares" (90), even architectural concepts, "place a veil between what is assumed to be reality and its participants," as does language itself. The form of the architecture veils the function. The form of the follies does not correspond to their program as parts of the park. The *chôra* was also the theme for a collaboration between Peter Eisenman and Jacques Derrida for the site in Paris, attempting to define the space of *différance*, and the void in signification, the gap in the definition of the postmodern subject.

A theoretical basis for Bioconstructivism in architecture was developed in the 1990s, including concepts proposed by Sanford Kwinter ("Landscapes of Change: Boccioni's *Stati d'animo* as a General Theory of Models," *Assemblage* 19), such as topological theory, epigenesis, the epigenetic landscape, morphogenesis, catastrophe and catastrophe theory. This development did not continue in the first decade of the twenty-first century, giving way to a "death of theory" in architecture, in deference to an overriding emphasis on material production, technological development, and consumerist novelty, as indicated in essays by Detlef Mertins ("Bioconstructivisms," *NOX: machining architecture*), for example, in which "self-generation" and "immanence" are seen to have replaced "predetermination" and "transcendence," and by Jane and Mark Burry (*The New Mathematics of Architecture*), which celebrates the complex

geometries which computer systems are able to add to architecture, seen as dynamic in relation to the "dead geometries" and "rectilinear dogma" of modernist architecture.

Figure 12
Amy Lewis, Endless Dreamscape Project, 2011.

An experimental project by Amy Lewis in a Graduate Design Studio led by Andrew Thurlow at Roger Williams University (figure 12) enacts a theoretical basis for Bioconstructivism in combination with a poetic expression, in the contradiction between form and function, in structure and program. The project combines the immanence and self-generation of Biomimesis with the transcendence and predetermination of poetic expression, displaying the relation between the signifier and signified in the contradiction between the form and the function, and the topological, epigenetic landscape, and morphogenesis and catastrophe that the computer-designed form is capable of representing. The project combines the dynamism of computer-generated forms with a historicist approach in the treatment of typologies and formal relationships, continuing the development of theory-based architecture, or architecture as art.

Bioconstructivist projects that display a similar contradiction between form and function include the Cardiff Bay Opera House Competition project by Greg Lynn, the Oblique WTC project by Lars Spuybroek, and the Atlantis Sentosa project by Frank Gehry with contributions by Greg Lynn. The project by Amy Lewis recalls the dialectical relationships of Louis Sullivan, of organic and geometrical, horizontal and vertical, mind and nature, life and death, in a poetic expression facilitated by the contradiction between form and function. The dialectical relation is based on the contradiction between the thesis and antithesis, from which a synthesis is drawn. The dialectical relation of form and function in architecture is an important element in architectural expression. Contemporary architecture sees an increasing neglect of the relation between form and function. Contemporary architects generate forms and justify them with function. In architecture, forms should be generated in relation to function, either as a response to it, or in contradiction to it.

In the neglect of theory, emphasis has been placed instead on the development of the technological means of architectural production, in particular computer programs, at the expense of the development of a theoretical or conceptual basis for architectural form-making. As Nikolaos-Ion Terzoglou writes, for example, "Architecture has concentrated mainly on technological means and instrumental procedures that, in certain cases, manage empty forms without conceptual content."[25] The discipline of architecture has increased its dependence on other forms of technological production. Terzoglou continues: "This situation has marginalized architecture as a form of mental expression and spatial imagination. An almost exclusive and one-dimensional emphasis on material and technological means reduces the ontological complexity of architecture and often leads to results which lack mental depth and spiritual purposes." Theorizing a contradiction between form and function in architecture hopes to suggest an architecture of mental depth and ontological complexity, in the place of empty forms.

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