

Sullivan's Eagle: Form and Function Artistically Considered

JONATHAN OCHSHORN

Cornell University

Keywords: Sullivan, form, function.

The nature of the relationship between function and form was most famously postulated by Louis Sullivan at the end of the nineteenth century, yet the ramifications of “architecture’s double code of beauty and utility” continue to be debated. The problem with Sullivan’s formulation is not that it isn’t true (it is, in fact, often true for building elements). Rather, as this paper argues, two related objections can be raised: first, that Sullivan’s defense of his proposition on the basis of biological and inorganic analogies is flawed; and, second, that his writings promote a formal agenda by invoking a few functional considerations while strategically ignoring many others. Like many theories of architecture, Sullivan’s formulation carries a not-so-hidden agenda: to explain (justify) a formal preference on the basis of an incomplete, selective, and often self-serving functional analysis.

Architectural function in relation to architectural form is inherently ambiguous. Even the Vitruvian functional triad of *firmitas*, *utilitas*, and *venustas* (translated by Henry Wotton in 1624 as “firmness, commodity, and delight”) foreshadows the difficulty that theorists encounter when attempting to classify architecture on the basis of form vs. function, a classification some consider to be “regulated by architecture’s double code of beauty and utility.”¹ For while architecture can certainly be understood as having both utilitarian *functions* and non-utilitarian *formal qualities* (whether the latter are characterized as “expressive,” “symbolic,” “evocative,” “provocative,” or merely “beautiful”), it is equally true—as Vitruvius implicitly argued by including *venustas* in his famous list of architectural functions—that those formal qualities also constitute a function of architecture (i.e., to be expressive, symbolic, and so on). Of course, this apparent contradiction could be resolved simply by specifying that “function,” at least in its modernist incarnation, refers only to *utilitarian* function—i.e., to the practical or necessary things that buildings must provide, irrespective of the building’s potentially variable formal qualities. Unfortunately, even if this simple disclaimer is found within actual theories of form and function, virtually all such theories, especially those proposed by architects, carry a not-so-hidden agenda: to explain (justify) a formal preference on the basis of an incomplete, selective, and often self-serving functional analysis. In such theories, *utilitas/firmitas* may well be cited as the source of, or inspiration for, a formal solution, but it is

really the a priori pursuit of *venustas* that motivates the formal outcome: The distinction between form and function—or between *venustas* and *utilitas/firmitas*—becomes hopelessly inadequate when the goal of expressing, symbolizing, evoking, provoking, or creating something beautiful is, itself, the architectural function that, more than any utilitarian consideration, determines the building’s primary formal characteristics.

The desire to overcome this tension between form and function—between forms of expression on the one hand, and the necessity for utility on the other—has its most famous formulation in the writings of Louis Sullivan. While his aphorism about form following function has often been challenged, with countless pithy variations offered in rebuttal—e.g., form follows fiction, or finance, or force, or fiasco, or fascism, or environment, or energy, or emotion, or even libido² — the reasoning underlying Sullivan’s own arguments about the role of function in relation to form has not been adequately examined.

FUNCTION AS CODE FOR FORMAL PREFERENCES

Sullivan’s specific explanations of how the “function” of the office building influenced the formal articulation of his elevations is rarely critiqued, in part because both critics and architects generally prefer to argue about the subjective merits of particular modes of expression rather than about the actual functionality of the works that they examine or design. Of course, there are exceptions. Christopher Alexander’s *A Pattern Language* and Stewart Brand’s *How Buildings Learn* are both concerned with the actual functionality of buildings, as are handbooks like Neufert’s *Architects’ Data* and Littlefield’s *Metric Handbook: Planning and Design Data*.

Yet an underlying interest in modes of expression is more often at the root of arguments about function. William Jordy, to cite one example, writes: “Form may follow function in the *utilitarian* sense in that it more or less directly discloses the activities housed by the building. Form may follow function in the *technical* sense that form is substantially conditioned by the structural and mechanical needs of the building, as well as by the nature of the materials used to build it. Form may follow function in the *expressive* sense of the emphasis of certain emotive or symbolic qualities inherent in the nature of the building and in that of its program.”³ But why is the *utilitarian* sense of form following function a matter of “disclosing” what

the activities of the building are? A form that permits an activity to occur does not necessarily disclose that activity through its formal presence. For example, many utilitarian activities can occur within a bedroom: On the one hand, the bedroom's "form" need not assume any particular shape to enable these activities to occur; on the other hand, any particular bedroom shape does not necessarily "disclose" the nature of those activities. It's just a room.

Jordy's description of a *technical* sense is also imprecise. For example, in what sense does structural or mechanical form "follow" the "needs of the building"? In many cases, the "needs" (functions) of the building are generic enough to support rather "generic" structural or mechanical forms. On the one hand, many different "functions" could occur within a generic structural/mechanical scheme; on the other hand, many different structural/mechanical "forms" could accommodate a particular building's needs. In the final analysis, invoking "utilitarian" and "technical" functions to explain the form of buildings is often just a cynical maneuver to justify an *expressive* (formal) function.

Formal qualities of architecture depend more on the prevailing stylistic milieus within which architects choose to situate themselves. The *function* of these formal qualities, therefore, is primarily to demonstrate an allegiance to a particular style, and only secondarily to express objective facts or subjective feelings relating to some particular subject. That a function attributed to the formal qualities of the work may appear entirely arbitrary, or may contradict any number of alternative critical analyses, is not surprising, since the point of most such analyses is not to scrutinize the work for objective evidence that specific formal qualities in the work were intended to produce, somehow, a particular functional outcome. Rather, as Juan Pablo Bonta persuasively argues: "Conflicting interpretations ... often result from placing the work within the context of different expressive systems."⁴

In other words, it is the critic's or artist's agenda in support of a particular stylistic preference ("expressive system") that primarily determines how and why formal qualities are both critiqued and created. Bonta's examination of critical appraisals of Sullivan's Carson, Pirie and Scott (CPS) building shows that even seemingly objective features of the façade are subject to critical disagreement. Where Nikolaus Pevsner, for example, sees "an almost complete absence of ornament," Bruno Zevi argues that "ornament was not a superimposed screen, but an element of poetry intimately integrated into the poetics of the structure." And on matters requiring more subjective judgments about the function of the building's form, the differences of opinion are more clearly split along ideological lines: Both Sigfried Giedion and Walter Behrendt see horizontality in the Carson, Pirie and Scott façade, while James Marston Fitch and Kurt Rowland see a more neutral grid with "neither a horizontal nor a vertical emphasis."⁵ It is the stylistic orientation of the

critic (i.e., the "expressive system" from within which the critic interprets the art world) that provides the pretext out of which a functional objective is alleged to emerge from the form. Thus, both Giedion and Zevi are "seeing" horizontality or appropriate decoration, not because those formal qualities are objectively present, but because these critics have broader, and opposing, ideological agendas.

Identifying a "function" provides the architectural form with a "reason" that allows both the immediate stylistic culture in which the work was conceived, as well as the overarching basis for its subjectivity—i.e., the never-ending and cut-throat competition that animates all artistic production—to escape scrutiny. Function, for both critics and architects, is most often a code word that allows entry into the subjective sphere of taste.

THE LAMARCKIAN FALLACY

Sullivan's famous aphorism first appears in "The Tall Office Building Artistically Considered," published in 1896: "Whether it be the sweeping eagle in his flight or the open apple-blossom, the toiling work-horse, the blithe swan, the branching oak, the winding stream at its base, the drifting clouds, over all the coursing sun, *form ever follows function*, and this is the law."⁶ Numerous critics have challenged this proposition by referencing the evolutionary theory of Charles Darwin, who showed conclusively that, at least with living species, it is more accurate to state that function follows (or coevolves with) form; in other words, that incremental deviations in form, arising in the offspring of any given species, create the preconditions for functional adaptations (or maladaptations), in which the "fittest" such adaptations survive.

The idea that natural forms evolve to reflect their function—that one precedes the other as in a design problem—is a teleological argument known as the Lamarckian fallacy. Using Sullivan's "sweeping eagle" as an example, the implicit idea is that there is something like an eagle that needs to fly and therefore a form (somehow) is created, or evolves, to perfectly enable that purpose. In other words, function precedes form (or using Sullivan's terminology, which amounts to the same thing, form *follows* function). Yet it is clear that birds did not evolve *in order to fly*; in fact the opposite is true: Birds can fly because a series of evolutionary changes, having nothing to do with an "intention" to fly, turned out to enable flying. Richard O. Prum, an evolutionary ornithologist, argues that "feathers originated and diversified in nearly all their morphological complexity prior to the origin of birds and prior to the origin of flight. ... Saying that feathers evolved for flight is like saying that digits evolved to play the piano."⁷ In other words, according to Prum: "Feathers did not evolve for flight; rather, flight evolved *from* feathers."⁸ There is no a priori functional necessity that determines formal characteristics: The eagle doesn't *need* to fly; rather, it can fly, and this ability enables all sorts of other (functional) attributes. Particular formal variations prevail, according to Darwin, not because they respond to some predetermined function, but

rather to the extent that “they be in any degree profitable to the individuals of a species, in their infinitely complex relations to other organic beings and to their physical conditions of life.”⁹

With countless random evolutionary experiments taking place over millions of years, and a virtually infinite assortment of interactions occurring between organic and inorganic matter, the appearance of equilibrium at any given moment masks a constant and precarious battleground in which species live, die, become extinct, and, at times, adapt. However, at least for those individuals that have survived, what they *do* or how they *function* does not, and did not, determine what they look like. It is the other way around: Random changes that affected their formal characteristics enabled, or improved, behaviors (functions) that turned out to be sustainable, at least for a certain period of time.¹⁰

Sullivan's extrapolation of this Lamarckian model of species evolution—a model where form is alleged to evolve in order to satisfy a function previously determined—to the relationship between architectural form and function provided perceptive critics with an easy target. But it is also true that architectural theorists and historians were most interested in the formal consequences of Sullivan's theory and practice, and were therefore often willing to overlook what Sullivan actually thought about the “function” of tall office buildings. Thus, when Sullivan characterizes his division of a tall office building into three parts (top, middle, and bottom) as a formal response to a functional condition (form purportedly following function), the specific formal and functional consequences of this claim are generally not challenged.

On the other hand, and *unlike* the evolution of biological species, architectural form often really does “follow” function, just as Sullivan argued: Many parts of buildings are designed (i.e., their form is configured) in direct response to previously existing functional programmatic interests. A toilet is designed to accommodate a known function, as is a bathroom, or a kitchen. Handles are meant to be gripped by human hands; heights of surfaces are meant to allow washing, cutting and so on. Supermarkets are configured so that products can be efficiently stocked, displayed, and purchased. In other words, humans did not randomly stumble upon spaces configured like supermarkets or bathrooms and then subsequently design or invent activities (e.g., shopping, musical performances, defecation) that would fit in such spaces.

However, just because the phrase “form follows function” accurately describes the process of architectural design in many cases, the evolutionary or co-evolutionary variant—where function follows or co-evolves with form—can also be found. For example, it is likely that the corner office, now a symbol of power and prestige within many corporate settings, was not invented in order to give form to that corporate function. Rather, the form of the corner office *preceded* that function. Buildings

had corners long before those corners were “discovered” to have the potential for hierarchical significance because they afforded greater privacy, more windows (views in two directions), and greater size. In other words, the “corner” was a formal outcome, but not of the desire to satisfy the function of articulating a corporate hierarchy. Rather, it emerged as an inevitable byproduct of rectangular building geometry that, in turn, came about both because of rectangular street grids which created uniform—and rectilinear—land parcels, and construction techniques whose orthogonal geometries corresponded to floor plates spanning between parallel load-bearing masonry walls and girders or, later, skeletal steel matrices of columns, girders, and beams. In this case, the function (of identifying hierarchical patterns of spatial organization) followed the form (of the rectangular building).

EXPRESSION OF INTERNAL FUNCTION

Another problem in Sullivan's formulation is his extrapolation from nature to architectural expression, based in part on Emerson's notion “that the essence of each being existing in nature is best symbolized by its own appearance.”¹¹ In his consideration of the tall building as a formal, or “artistic,” problem, Sullivan assumes that architects have an obligation to express internal function on the visible surfaces of their buildings. The idea that internal functions are expressed in the visible form of natural things, even if relevant to the creation of architecture, has no rational or evidentiary basis. The most self-evident counterexample is the external form of the human body. The human brain, for example, has complex internal divisions that are associated with various functional capabilities (fig. 1). None of these functional zones have any external formal manifestations, the discredited speculations of phrenologists notwithstanding.

Within the human body as a whole are countless additional organs that, in general, also have no outward, formal

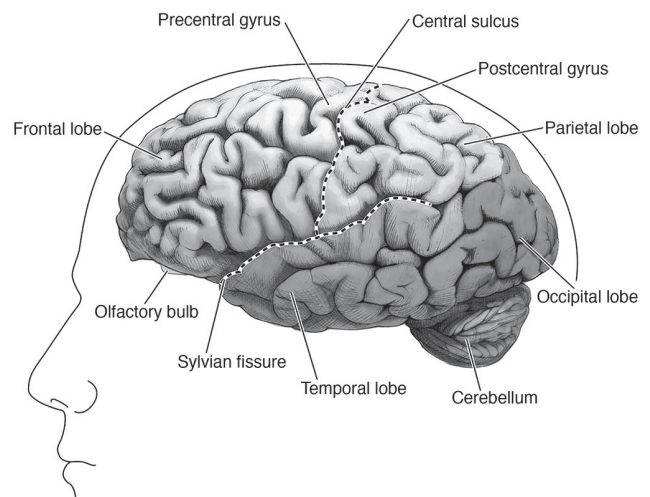


Figure 1. Lobes of the human brain (image by Allan Ajifo, aboutmodafinil.com, licensed under the Creative Commons Attribution 2.0 Generic license, and available at https://commons.wikimedia.org/wiki/File:Brain_areas.jpg).

manifestation or expression. We know where they are, and what they do, not because they show up symbolically on the surface of the skin, but because people figured out how to cut open human bodies and look inside (fig. 2). Of course, one can find instances where internal *structure*, in particular, seems to correspond to external form. Bones, muscles, tendons, and so on, can often be inferred from external form, but even there, the relationships are not necessarily obvious and still benefit from close internal study (fig. 3).¹²

Even so, this translation of internal structure onto external “skin” only applies to material literally stretched, or painted, over an underlying form and no larger implications about the expression of internal functionality on outward appearance should be inferred. The visible human form provides very little information about internal organs or even the underlying structure of bones.

Sullivan claims that this “law” of nature—that “form ever follows function”—applies to inorganic as well as organic form. Yet the idea that inorganic assemblages of stone or water have an intrinsic “function” is teleological in the extreme. There is no consistent sense in which the underlying structure of inorganic matter expresses itself in outward appearance. Sullivan’s superficial view of “ever-brooding hills” tells us nothing about the earth’s geology, since underlying geological structure is generally hidden by external form. Of course, geologists familiar with particular features on the surface of the earth may be able to infer what lies beneath based on their expertise and study, just as Renaissance painters learned about the appearance of human form by dissecting bodies.

None of this, however, has anything to do with the claim that these forms “follow” function. Both the internal “content” and external form of natural things obey their own laws and, however interrelated the former’s behavior may be to the latter’s form and appearance, this interrelationship has no bearing on the expressive qualities of one with respect to the other. Moreover, the obligation to express an object’s internal structure on its surface is something that—contrary to Sullivan’s poetic claims—has no basis in organic or inorganic conditions found in nature, and certainly cannot be validated by examining his own works of architecture. In fact, Sullivan’s tall building designs represent only a small variation on the prevalent mode of expression that he found so abhorrent (fig. 4).

The idea that either of the designs shown in figure 4 is better or worse at “expressing” the functions occurring within cannot be sustained with a logical argument. Both buildings provide a matrix of windows that actually do have a necessary function, i.e., to provide light, air, and views for the variable occupancies contained within the buildings. Both buildings have gratuitous decorative elements on their façades that draw upon the subjective aesthetic frameworks valued by their architects. Beyond that, nothing useful can be concluded about the



Figure 2. Rembrandt, *The Anatomy Lesson of Dr. Nicolaes Tulp*, 1632 (public domain).

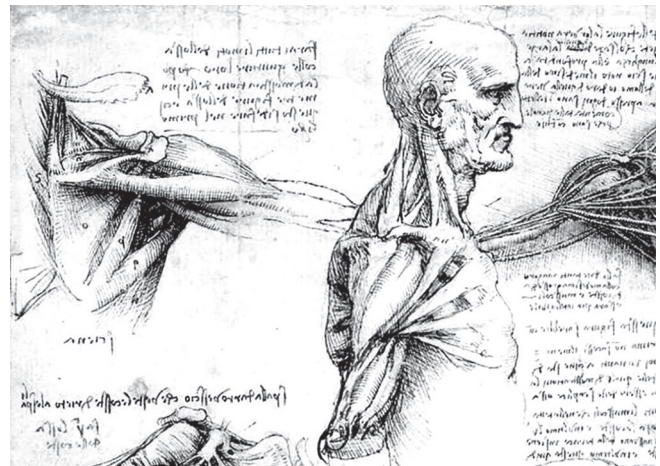


Figure 3. Leonardo da Vinci: *Anatomical Studies of the Shoulder*, ca. 1510, Royal Librarian, UK (public domain).

relationship of the building’s form to its internal function. The “artistic” consideration of tall buildings that has evolved over more than a century following Sullivan’s pronouncement on form and function offers nothing to support Sullivan’s vision: Formal expression has remained stubbornly independent of the skyscraper’s internal function.

INFLUENCE OF SEMPER AND BÖTTICHER

Sullivan’s ideas drew upon prior theories, especially those of Gottfried Semper, who wrote in 1860 about the relation of form to function. For Semper, any proper theory intended to “explore the inherent order that becomes apparent in phenomena of art during the process of becoming ... will identify the different values of a function composed of many variable coefficients, and will do this primarily with the intention of revealing the inner necessity that governs the world of artistic form, as it does in nature.”¹³ Semper’s analysis is fairly nuanced, in that he sees form not just as the literal projection of a static functional necessity, but also as being influenced by the “history of development within which old motives are discernable in

every new formation."¹⁴ Semper also admits that what he calls style (something—unlike beauty—that “seeks the constituent parts of form *that are not form itself*, but the idea, the force, the task, and the means, in other words, the basic preconditions of form”¹⁵) requires time to emerge within a culture, and surmises that the fast-paced industrial society of the mid-nineteenth century lacks “the millennia of popular usage by which a unique style could have developed.”¹⁶ Semper also remarks on the multiplicity of factors that influence form, claiming that the simplest formal expression is “modified in particular by the materials that are used in developing the form as well as by the tools that fashion it” along with “a number of influences extrinsic to the work ... such as place, climate, time, customs, particular characteristics, rank, position, and many others.”¹⁷

Thus, Sullivan's discussion of form and function can be seen as a rather self-serving and simplified variation on Semper's more complex formulation, in that Sullivan's claim to have solved the artistic (stylistic) problem of the tall building contradicts Semper's understanding of stylistic development as a long cultural process rather than an individual act of genius; while Sullivan's notion of proper formal expression based on a tripartite division of office building “functions” abstracts from the multiplicity of factors at work, not the least of which is the pleasure humans take in transcending “basic forms” that correspond to simple notions of function. Semper writes: “Every artistic creation, every artistic pleasure presupposes a certain carnival spirit, or to express myself in a modern way—the haze of carnival candles is the true atmosphere of art. The denial of reality, of the material, is necessary if form is to emerge as a meaningful symbol, as an autonomous creation of man.”¹⁸

In a way, Sullivan's notion of form and function is closer in spirit to the writings of Karl Bötticher, the nineteenth-century German architectural theorist whose study of Greek “tectonics” was influential in the development of Semper's own ideas. Bötticher, eager to explain (justify) the mimicking

of wooden joints on the surface of Greek temples constructed of stone, proposed a theoretical scheme in which a superficial or decorative “art-form” represents or expresses a necessary and internal “core-form.” The art-form, according to Harry Mallgrave, “came to be seen as the artistic dressing applied to the core-form, symbolizing in effect its mechanical or structural function.”¹⁹

For Bötticher, function is taken more as a building's resistance to load or the pragmatics of its construction, rather than as a rigorous examination of its occupancy or use. Sullivan, in fact, was interested neither in the building's occupancy as a determinant of functional requirements nor in the social conditions that created the need for tall buildings in the first place. The latter issue is dismissed in the first paragraph of his 1896 *Lippincott* essay: “It is not my purpose to discuss the social conditions; I accept them as the fact, and say at once that the design of the tall office building must be recognized and confronted at the outset as a problem to be solved, a vital problem pressing for a true solution.”²⁰

As to the former question, Sullivan's analysis of the office building's tripartite vertical divisions is not a functional analysis in any true sense, since the *actual* functioning of such a building—determined by examining the relationships among office modules, elevator and stair shafts, access corridors, mechanical and electrical equipment, and their various needs for light and air (windows, light shafts, and courtyards)—is not discussed, and was not, in fact, what Sullivan was asked to consider when hired by Adler “to design façades and ornamentation.”²¹ Sullivan does point to relationships among office size, window, and structural bay (“The practical horizontal and vertical division or office unit is naturally based on a room of comfortable area and height, and the size of this standard office room as naturally predetermines the standard structural unit, and, approximately, the size of window-openings.”²²) but nothing about other functional interrelationships is

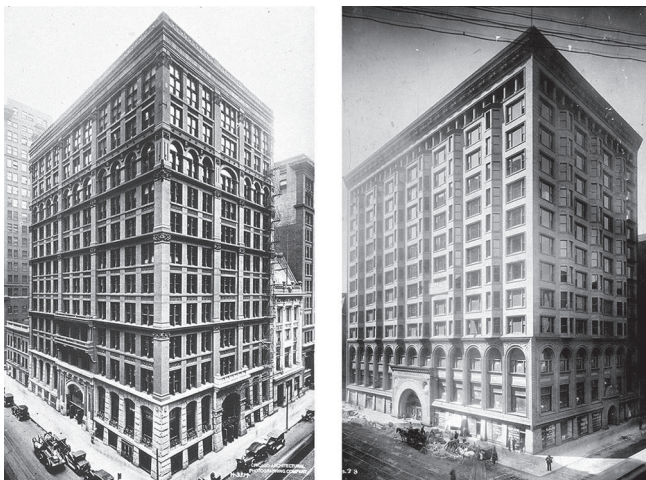


Figure 4. The Home Insurance Building (left) by William Le Baron Jenney, 1885 and the Old Stock Exchange Building (right) by Adler & Sullivan, 1894 (public domain).

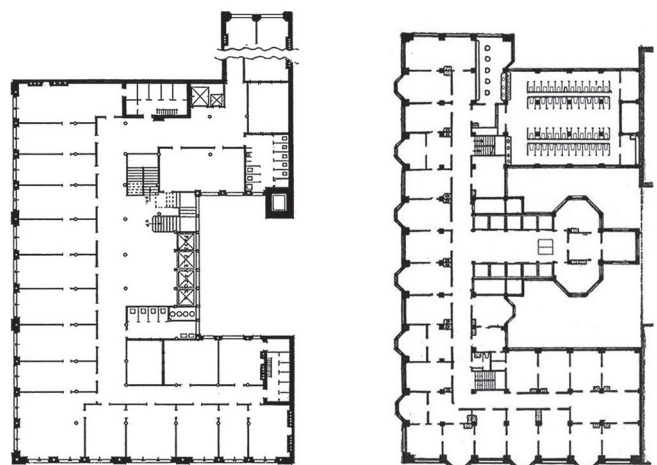


Figure 5. Typical floor plans of Jenney's Home Insurance Building (left) and Sullivan's Old Stock Exchange Building (right), both built in Chicago at the end of the nineteenth century (public domain).

mentioned. In fact, the conventional functional relationships within Sullivan's typical office floor plan in his Old Stock Exchange Building are virtually identical to those in Jenney's earlier "wedding-cake" Home Insurance Company building (fig. 5). Rather, like Bötticher, he is more interested in developing an expressive art-form to both hide and give meaning to the underlying functional core-form, a core-form that he denigrates as the "materialistic ... product of the speculator, the engineer, the builder."²³

The problem for Sullivan is to package this core-form, "this sterile pile, this crude, harsh, brutal agglomeration, this stark, staring exclamation of eternal strife"—i.e., to package the *actual* functional elements of the building—in a skin that can express "the graciousness of those higher forms of sensibility and culture."²⁴ The solution Sullivan arrives at, in opposition to what he considers "obnoxious" and "abhorrent" conventional office building design (where, for example, a "sixteen-story building" is expressed as "sixteen separate, distinct, and unrelated buildings piled one upon the other until the top of the pile is reached"²⁵), is to make the building appear tall, "without a single dissenting line."

Thus, the problem with Sullivan's formulation about form following function is not that it isn't true (it is, in fact, often true for buildings) but that, on the one hand, its argument on the basis of biological and inorganic analogies is flawed and, on the other hand, it abstracts from many of the functions that actually influence architectural form. Most architectural functions, for Sullivan, are not worthy of the architect's intellectual attention, both because they are the routine "product of the speculator, the engineer, the builder" and because they are "crude" and "materialistic." Instead, one small aspect of functionality—in this case, the tripartite functional division of an office building—is singled out because it supports Sullivan's argument that tall buildings should look, well ... like Sullivan wants them to look.

ENDNOTES

1. Patrik Schumacher, *Autopoiesis of Architecture* (Chichester, UK: John Wiley & Sons, 2011), 157. "Design decisions are regulated by architecture's double code of beauty and utility: functional vs dysfunctional (code of beauty), and formally resolved vs formally unresolved (code of utility)." This is, of course, a typo in the original manuscript, with the two codes in parentheses intended to be reversed.
2. Variations of "form follows..." include: "Form follows fiction" in, Vladimir Belogolovsky, "Bernard Tschumi: I Believe in Placing Architecture in the Realm of Ideas and Invention," *International Curatorial Project Inc.*, last modified January 2004. <http://curatorialproject.com/interviews/bernardtschumi.html>; "Form follows finance" in Carol Willis, *Form Follows Finance: Skyscrapers and Skylines in New York and Chicago* (New York: Princeton Architectural Press, 1995), 7.; "Form follows force" in Vladimir Belogolovsky, "I Prefer When Form Follows Force": An Interview with Helmut Jahn, *ArchDaily*, October 10, 2018. <https://www.archdaily.com/903456/i-prefer-when-form-follows-force-an-interview-with-helmut-jahn>; "Form follows fiasco" in Peter Blake, *Form Follows Fiasco: Why Modern Architecture Hasn't Worked* (Boston: Little Brown, 1977).; "Form follows fascism" in Mark Stevens, "Form Follows Fascism," *New York Times*, January 31, 2005.; "Form follows environment" in Lidia Badarnah, "Form Follows Environment: Bioclimatic Approaches to Building Envelope Design for Environmental Adaptation," *Buildings* 7, no. 2 (May 12, 2017), <http://www.mdpi.com/2075-5309/7/2/40>; "Form follows energy" in Brian Cody, *Form Follows Energy: Using Natural Forces to Maximize Performance* (Berlin: Birkhäuser, 2017); "Form follows emotion" in Fay Sweet, *FROG: Form Follows Emotion* (London: Thames & Hudson, 1999); "Form follows libido" in Silvia Lavin, *Form Follows Libido: Architecture and Richard Neutra in a Psychoanalytic Culture* (Cambridge, MA: MIT Press, 2004); "Form evokes function" in Robert Venturi, *Complexity and Contradiction in Architecture* (New York: The Museum of Modern Art, 1966), 40. Venturi, uncomfortable with the word "follows," proposes instead that "form evokes function" (my italics).
3. William H. Jordy, "Functionalism as Fact and Symbol: Louis Sullivan's Commercial Buildings, Tombs, and Banks," *American Buildings and Their Architects, Vol. 3* (New York: Doubleday, 1972), 87.
4. Juan Pablo Bonta, *Architecture and Its Interpretation: A Study of Expressive Systems in Architecture* (Rizzoli: New York: 1979), 91.
5. Bonta, *Architecture and Its Interpretation*, 93–95, 100, 103.
6. Louis Sullivan, "The Tall Office Building Artistically Considered," *Lippincott's Magazine* 57 (March 1896), 408 (my italics).
7. Richard O. Prum, *The Evolution of Beauty: How Darwin's Forgotten Theory of Mate Choice Shapes the Animal World—and Us* (Doubleday: New York: 2017), 144.
8. Prum, *The Evolution of Beauty*, 147.
9. Charles Darwin, *The Origin of Species by Means of Natural Selection, Or, the Preservation of Favored Races in the Struggle for Life*, based on sixth and last English edition (D. Appleton and Co.: New York: 1896), 76.
10. Jan Michl, "Form follows WHAT? The Modernist Notion of Function as a Carte Blanche," *1:50 – Magazine of the Faculty of Architecture & Town Planning* 10 (1995), 20–31. <http://janmichl.com/eng.fff-hai.html>. Michl critiques Sullivan's "form follows function" aphorism, noting: "It is important to stress that the dictum is difficult to square with the Darwinian (or Neo-Darwinian) explanation of functional adaptations in nature."
11. Narcisco G. Menocal, *Architecture as Nature: The Transcendentalist Idea of Louis Sullivan* (The University of Wisconsin Press: Madison, Wisconsin, 1981), 44.
12. Carmen Bambach, "Anatomy in the Renaissance," Heilbrunn Timeline of Art History, The Metropolitan Museum of Art (October 2002) http://www.metmuseum.org/toah/hd/anat/hd_anat.htm. Bambach writes: "The later innovators in the field, Leonardo da Vinci (1452–1519) and Michelangelo (1475–1564), who are known to have undertaken detailed anatomical dissections at various points in their long careers, set a new standard in their portrayals of the human figure. ... The patrons commissioning art in this period also came to expect such anatomical mastery" (my italics).
13. Gottfried Semper, "Style in the Technical and Tectonic Arts, or Practical Aesthetics: A Handbook for Technicians, Artists, and Patrons of Art," in *The Four Elements of Architecture and Other Writings*, translated by Harry Francis Mallgrave and Wolfgang Herrmann (Cambridge, England: Cambridge University Press, 1989), 182–183.
14. Semper, "Style in the Technical and tectonic Arts," 183.
15. Semper, "Style in the Technical and tectonic Arts," 183.
16. Semper, "Style in the Technical and tectonic Arts," 187.
17. Gottfried Semper, "Science, Industry, and Art: Proposals for the Development of a Material Taste in Art at the Closing of the London Industrial Exhibition," in *The Four Elements of Architecture and Other Writings*, translated by Harry Francis Mallgrave and Wolfgang Herrmann (Cambridge, England: Cambridge University Press, 1989), 137.
18. Gottfried Semper, "The Textile Art: Considered in Itself and in Relation to Architecture," in *The Four Elements of Architecture and Other Writings*, translated by Harry Francis Mallgrave and Wolfgang Herrmann (Cambridge, England: Cambridge University Press, 1989), 257. The quote appears in a note on this page.
19. Harry Francis Mallgrave, *Gottfried Semper: Architect of the Nineteenth Century* (Yale University Press: New Haven & London: 1996), 220.
20. Sullivan, "The Tall Office Building Artistically Considered," 403.
21. Menocal, *Architecture as Nature*, 43. "He [Adler] was one of the best architects of tall commercial buildings of his day. Yet, feeling that his own artistic sensitivity was insufficient to achieve the quality he wanted for his commissions, he hired Louis Sullivan in 1879 to design façades and ornamentation. Sullivan fulfilled Adler's expectations so well that he was made a full partner when the firm was reorganized as Adler and Sullivan in 1883. (Sullivan's date of 1881 in *The Autobiography of an Idea* is incorrect.) Until the end of the association in 1895, Sullivan's main contribution to the firm was the design of ornamentation and façades."
22. Sullivan, "The Tall Office Building Artistically Considered," 404.
23. Sullivan, "The Tall Office Building Artistically Considered," 403.
24. Sullivan, "The Tall Office Building Artistically Considered," 403.
25. Sullivan, "The Tall Office Building Artistically Considered," 407.