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# Dankmar Adler's Response to Louis Sullivan's "The Tall Office Building Artistically Considered": Architecture and the "Four Causes"

**In critiquing Louis Sullivan's "The Tall Building Artistically Considered," his former partner Dankmar Adler pointed out that "form follows function" was an incomplete description of how architectural form evolves from the complex web of functions, materials, and techniques available to the designer and builder. In comments to the American Institute of Architects in late 1896, Adler set an alternative agenda, noting that environment, which Adler took to include the technical and sociocultural milieu of a project, plays an important role in the dialogues, negotiations, and compromises that ultimately inform building design.**

Louis Henry Sullivan's 1896 essay "The Tall Building Artistically Considered," published in *Lippincott's* and later in *Inland Architect*, was the clearest statement of the utilitarian spirit that permeated Chicago commercial architecture during the era. Its famous aphorism "form follows function" summarized Chicago's almost Darwinian focus on maximizing office rental space while minimizing construction costs.[1] "The Tall Building Artistically Considered" went beyond this simple formula, however, suggesting that part of the skyscraper's function in its broadest sense included an emotional appeal to the senses, and a moral duty to honestly express the forces to which its designer had been compelled to respond. Sullivan felt that the result would be a uniquely American style, embodying the ethos and the values of a country dedicated to entrepreneurialism and honest dealings. Sullivan's former business partner, Dankmar Adler, admired Sullivan's essay, but in a response that subtly echoed their different backgrounds and outlooks, he warned that the simplicity of Sullivan's aphorism masked a far more complex set of forces acting on and influencing architectural form. In "amending" Sullivan, Adler touched on an ancient discourse regarding causes in the natural and architectural worlds. His response constructs a reconsideration of Sullivan's widely quoted essay in light of Aristotelian categories of causation; a reconsideration that places built work into economic, material, and environmental climates without which performance or programmatic explanations are not adequate.

Dankmar Adler had hired a young, impetuous Sullivan in 1879 as his office foreman. Adler was trained as an engineer, and he recognized that Sullivan's considerable artistic abilities and temperament would be an ideal match for his more technically minded background. The firm of Adler and Sullivan continued Adler's success with theater design, rebuilding the McVickers Theater and designing the Auditorium Building, the largest and tallest building in the Western United States. But they also built commercial loft buildings in eclectic, experimental styles, searching for architecturally valid methods of responding to their clients' straightforward and profit-minded requirements.

Large commercial commissions such as the Wainwright in St. Louis and the Guaranty in Buffalo followed, and these projects offered Sullivan broad opportunities to experiment with the compositional possibilities of the steel frame.[2] The need to jacket steel construction with masonry or terra cotta fireproofing allowed considerable latitude in proportioning and ornamenting the elevations. Sullivan's compositions, while inspired by the tenuous proportions of steel and by the vertical

1. Louis Henry Sullivan, 1890. Sullivania Collection, Ryerson and Burnham Archives, The Art Institute of Chicago. Series 3, BoxFF 6.2. (Photo courtesy of the Art Institute of Chicago.)




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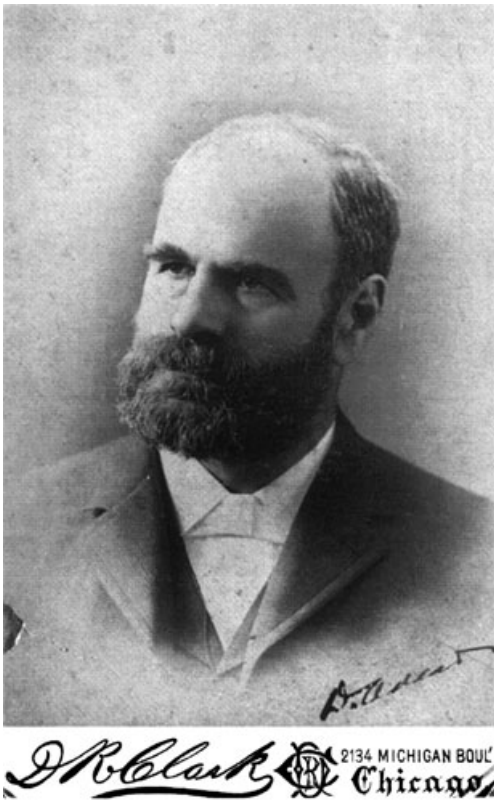


2. Dankmar Adler, ca. 1890. Archival Image Collection, Ryerson and Burnham Archives, The Art Institute of Chicago. Series 2, BoxFF 1.12. (Photo courtesy of the Art Institute of Chicago.)

proportions of skyscrapers in general, were highly personal, with minutely detailed ornamental panels of terra cotta, cast bronze, or iron.[3] Set against more academic approaches to skyscraper facades that attempted to mitigate their height with wallpapers of classical referents, Sullivan's designs offered a more insightful approach, one that relied on natural precedent at a metaphorical level in their botanical ornament, and an analogical one in their underlying insistence on Sullivan's sense of suitability for purpose.

Despite their enormous successes together, Adler and Sullivan split in 1895, citing that year's economic depression as a key factor. Adler accepted a position as consultant but soon went back into practice with his son. His later career was cut short by an early death, at age 56, in 1900. Sullivan had continued the practice, engaging Adler as a consultant for the mechanical design of the heralded Schlesinger and Mayer Store (1899; later the Carson, Pirie, Scott Store), developing a dramatic elevation for one of three loft buildings on Michigan Avenue by Holabird and Roche, and designing a single skyscraper in New York, the Bayard Building (1899).[4] Without Adler's business sense and practical guidance, however, Sullivan was lost; the firm disintegrated in the early 1900s and Sullivan began a descent into alcoholism, divorce, and poverty, dying in a transient hotel in 1924.

After their split, both men wrote extensively. Adler held a regular technical correspondent's position with *Inland Architect* until his death, whereas Sullivan tended toward the metaphysical. His writing and public talks were notoriously long-winded, florid in their language, and often baffling in their conflation of architecture with literary themes. Buried among these tendencies, however, was a developing understanding of the links between architectural function, building technique, and aesthetic expression. While far more poetic than his former partner's pragmatic essays, ''The Tall Building Artistically Considered'' was, by Sullivan's standards, a focused, restrained piece of writing, perhaps showing the efforts of *Lippincott's* editors to distill Sullivan's florid prose into a concise argument.

## ''The Tall Office Building Artistically Considered''

Sullivan's essay was presented in three parts: first, a statement of the office building's ''conditions . . . in the plainest manner'' along with a description of a standard massing solution and a suggestion for its broad architectural treatment; second, a very brief investigation into the expressive essence of the result; and, finally, a philosophical argument for the combination of these toward an integration of ''instinct and sensibility,'' logic and emotion.[5]

Sullivan outlined the ''conditions'' of the tall office building at three scales. At its broadest, the general need to multiply ground area in congested cities and the ability to inhabit these vertically multiplied areas safely by means of the ''perfection of the high-speed elevator'' and the ''safe, rigid, economical'' use of steel provided the basic demand, or the overall function of the office building.[6] Skyscrapers were speculative developments, machines for multiplying the ground rent of a given site, and their fiscal performance underlay the programmatic function that Sullivan pursued. Even at this stage, however, Sullivan also posed this demand in terms of sensation: ''How shall we impart to this sterile pile, this crude, harsh, brutal agglomeration,'' he asked, ''the graciousness of those higher forms of sensibility and culture that rest on the lower and fiercer passions?''[7]

He suggested that the solution must be contained within the essence of the problem itself. Thus, Sullivan posed a mid-level of functional needs: the ''practical conditions'' that stemmed from the general problem. Such conditions, Sullivan felt, had to do with the vertical massing of a skyscraper and the stratification of functions necessary to its full rental and overall performance. He thus proposed a more finely grained statement of functions and their logical deployment and expression. These included a basement to be filled with mechanical plant, a ground floor for retail or banking with ''large area, ample spacing, ample light, and great freedom of access,'' a second floor or mezzanine with retail or banking functions subsidiary to those on ground level, an ''indefinite number of stories of offices . . . one tier just like another tier'' that formed the essential rent-producing fabric of the skyscraper, and, finally, an attic story with ''tanks, pipes, valves, sheaves, and mechanical et cetera.''[8] At a further level of detail, Sullivan noted specifically the functional demands of the office itself, a ''room of comfortable area and


3. Jewelers' Building, Chicago, IL. Adler and Sullivan, 1882. View from southeast. (Photo by author.)

height'' that would define the building's structural spacing and the size of its windows.[9]

What form would this formula suggest? Sullivan concluded this first part of his essay by sketching a generic outline for an office skyscraper derived from ''natural instinct'' that represented a ''spontaneous and sensible'' formula:

> Beginning with the first story, we give this a main entrance that attracts the eye to its location, and the remainder of the story, we treat in a more or less liberal, expansive, sumptuous way—a way based exactly on the practical necessities, but expressed with a sentiment of largeness and freedom. The second story we treat in a similar way, but usually with milder pretensions. Above this, throughout the indefinite number of typical office tiers, we take our cue from the individual cell, which requires a window with its separating pier, its sill and lintel, and we, without more ado, make them look all alike because they are all alike. This brings us to the attic, which, having no division into office-cells, and no special requirement for lighting, gives us the power to show by means of its broad expanse of wall, and its dominating weight and character, that which is the fact—namely, that the series of office-tiers has come definitely to an end.[10]

This formula could have applied to dozens of office towers in Chicago or elsewhere. Even in this generic example, Sullivan had to admit the incomplete definition of form provided by the various functions. There was room for the designer's whims in the ''more or less liberal'' first story, the ''milder'' second story, and the surprisingly indeterminate attic story. The main shaft of the skyscraper, however, the offices themselves, were for Sullivan the key aesthetic problem. His suggestion that they be treated according to their nature as repetitive units was set against more

4. Wainwright Building, St. Louis, MO. Adler and Sullivan, 1890–1892. View from southeast. Historic American Buildings Survey. July 31, 1940. HABS MO, 96-SALU, 49-1. (Photo courtesy of Lester Jones.)

conventional attempts to mitigate, rather than enhance, these building's sheer vertical dimensions with arbitrary horizontal divisions.[11]

The designer, however, still held sway at a certain level of articulation. In the second part of his essay, Sullivan elaborated on where the ''imperative voice of emotion'' might enter in, demanding of skyscrapers that their language express their inherent verticality, ''in every inch a proud and soaring thing.'' While this claim seems counterintuitive to Sullivan's more pragmatic aphorism, it provides an important emotional context for ''form follows function.'' Sullivan was not making a simply pragmatic argument. He felt, rather, that expression of underlying causes was a technique for connecting daily experience to the spirit of the era. This communicative aspect, for him, was as much a ''function'' as light or height.[12]

Sullivan's conclusion began by more specifically proposing the tripartite functional diagram he had verbally sketched in the beginning of his essay, a division into a retail base, repetitive office shaft, and crowning mechanical attic. ''All things in nature have a shape,'' Sullivan noted as his essay built to a climax, ''that is to say, a form . . . that tells us what they are.''[13] This last phrase is crucial. Sullivan's notion of function's influence on form had to do not only with mathematical or spatial problem solving. It was tied as well to the subjective understanding of these solutions, an expression or, in Stanford Anderson's terms, a ''story.''[14] Birth and growth were processes of ''the essence of things . . . taking shape in the matter of things,'' and this drama of becoming was an alluring analogy to the realizations that occurred at drawing boards and construction sites.[15] Life and form, idea and matter, thus fulfilled one another in a union that, for Sullivan, was as metaphysical as it was causal:

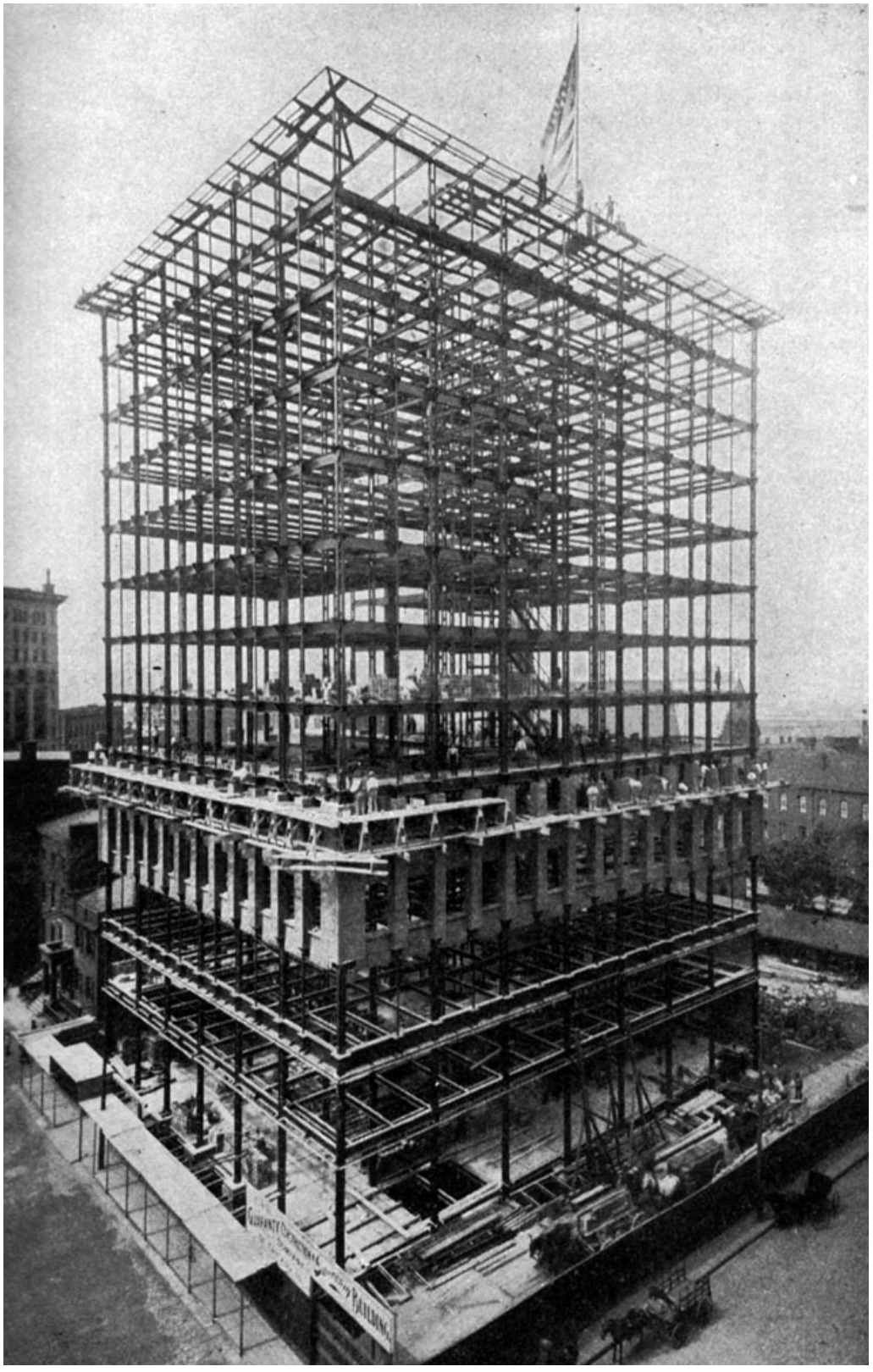
> Whether it be the sweeping eagle in his flight or the open apple-blossom, the toiling work-horse, the blithe swan, the branching oak, the

5. Guaranty Building, Buffalo, NY. Adler and Sullivan, 1894–1895. East elevation from northeast. Historic American Buildings Survey. May 1965. HABS NY, 15-BUF, 6-2. (Photo courtesy of Jack E. Boucher.)

winding stream at its base, the drifting clouds, over all the coursing sun, form ever follows function, and this is the law. Where function does not change form does not change.[16]

## "It May Be Well To Amend . . ."

Adler's response—neither quite an endorsement nor a rebuttal—came in comments to a paper presented by Ohio architect Joseph Warren Yost at the annual convention of the American Institute of Architects in October, 1896.[17] Yost's paper, titled "Influence of Steel Construction and of Plate Glass Upon the Development of Modern Style," was an exploration of the esthetic and, indeed, conceptual problems offered by these two new materials.[18] Yost noted several aspects of skyscraper design, including illumination, lighter weight, and height, that suggested a reconsideration of the skyscraper façade, reducing it to discrete elements—continuous "posts" or columns, structural lintels, spandrel panels, and the windows themselves—each of which ought to be treated as a screen or "covering," and that should not "pretend to be a wall."[19]This re-conception of the skyscraper façade from its elements, rather than its overall composition, was borrowed in part from the French restorer and theorist Eugene Emmanuel Viollet-le-Duc, in particular his explanations of antique form based on material and constructive, rather than programmatic, principles.[20] It also reflected Gottfried Semper's elemental approach, which posited that style arose from careful attention to "aim and function . . . material used [and] process employed," and drew tectonic distinctions between primeval types of construction.[21] Semper likewise advocated an understanding of construction as a textile act—a clear precedent for the woven grids of piers and spandrels that flourished on Chicago skyscraper elevations in the 1890s. Yost likewise adopted antiquity for his precedents, noting that there was a developing interest in adopting not merely the forms of authoritatively old buildings, but also their conceptual methods, in particular the reliance on construction and material properties to inspire and, literally, to inform architectural elements. "The materials of which buildings are erected," he noted, "always affect the designs to a greater or less [sic] extent. All historic styles of architecture possess certain peculiarities of form and detail induced by the character of the material . . . Any style will have a definable relation to the materials available when it is undergoing formation."[22]



6. Guaranty Building, Buffalo, NY. Adler and Sullivan, 1894–1895. Construction view showing relationship of steel frame to masonry and terra cotta exterior. From William Birkmire, *Planning and Construction of High Office Buildings* (New York: John Wiley & Sons, 1900), p. 107.

Adler's contribution to the debate was one of several commissioned responses to Yost's paper, and he took Yost's theme—the influence of new materials on design—as an opportunity to respond to his former partner's already well-known essay.[23] Adler began by crediting Sullivan for distilling into a ''three word aphorism the entire law of architectural design and composition.''[24] But he quickly moved on, noting that the simplicity of Sullivan's statement failed to do justice to the compositional range of actual buildings that could be seen on any major Chicago avenue. From Sullivan's statement, Adler suggested, '' . . . it might be possible to infer that it is only necessary to divide into a few classes the functions to be served by architectural structures, and to determine the form best adapted to each, and thus develop an infallibly correct system of architectural design.''[25] Such an approach, Adler thought, would lead to ''an architecture somewhat more scientific and vastly more practical,'' but ''trite and . . . devoid of the interest imparted by the creative impulse.''[26]

But where would this creative impulse find room for expression within such onerous economic and performance requirements? The answer lay in what Adler broadly termed ''environment.'' While Sullivan attributed ''what it looks like'' to a determinant relationship with ''what it does,'' Adler recognized that form had to account for not only function, but also how that function might be mediated by its surroundings.[27] Adler pinpointed this as an important missing element in Sullivan's remarks. As ''an ever changing environment has produced an infinite number of species,'' he noted, so should the vagaries of a building's environment lead to a plethora of architectural species.[28] The adaptation of architectural function to environment thus opened up the possibilities of multiple forms dependent upon the designer's role in balancing a building's functional requirements with the physical, economic, and material surroundings in which it found itself. In these negotiations, the applied


7. Gage Group, Chicago, IL. Holabird and Roche/Louis Sullivan. 1899. East fronts, facing Michigan Ave. Historic American Buildings Survey. HABS ILL, 16-CHIG, 66-1. (Photographer unknown.)

intelligence of the designer, and not any singular functional vector, clearly played the determining formal role. Adler believed this to be the unspoken crux of Sullivan's thought, and suggested that the tidy aphorism be expanded:

> [I]f 'form follows function,' it does not follow in a straight line, nor in accordance with a simple mathematical formula, but along the lines of curves whose elements are always changing and never alike; and if the lines of development and growth of the vegetable and animal organisms are infinitely differentiated, the process of untrammeled human thought and human emotions are even more subtle in the differences and shadings of their manifestations . . . before accepting Mr. Sullivan's statement of the underlying law upon which all good architectural design and all true architectural style is founded, it may be well to amend it and say: ''Function and environment determine form,'' using the words environment and form in their broadest sense.[29]

This argument makes sense in *literally* environmental terms—an igloo's form is distinct from that of a tropical hut for good reasons related to temperature, ventilation, and insulation, for instance—but Adler went further. The ''broadest sense'' of the term environment included alongside climate the range of available materials and techniques in the *economic* and *technical* ''environments'' that surrounded and influenced any architectural project. The ready availability of steel and plate glass in the 1890s in particular created a profoundly different technical milieu than that of a decade earlier, and building forms necessarily changed in response to this, rather than any changes in program. In other words, Adler used Yost's emphasis on *construction*—materials, techniques, and methods—to offer an additional dimension to Sullivan's emphasis on *function*. Adler continued by parsing Greek, Roman, and Gothic architecture into more specific relationships than Yost's more general view had yielded, again borrowing heavily from Viollet-le-Duc: Greek architecture could be partially explained by the limitations of stone and post-and-lintel construction and by a system of ornament and detail that arose out of its considerations. Roman vault construction offered a different set of forms to compose and decorate, and Byzantine, Romanesque, and Gothic similarly could be explained as systems of construction based on materials and methods deployed to meet functional needs, while proportions and forms could then be modified and decorated according to taste. ''Each historic style,'' Adler concluded, ''was called into being in obedience to new developments of function *or environment* [emphasis added] . . . therefore we are justified in assuming that the new conditions [of steel and plate glass] will exert a marked influence on architectural style in our day and in the future.''[30]

Like Yost, Adler advocated attention to architectural history to ''ascertain the creative principles and laws which underlie [these] achievement[s].'' Such a view would, Adler felt,

8. Schlesinger and Mayer (later Carson, Pirie, Scott) Store, Chicago, IL. Louis Sullivan, 1904. View from southwest. (Photo courtesy by author.)

reconcile Sullivan's attention to functional causes with Yost's interest in what might be termed the ''material causes'' of architecture; namely, the influences of construction materials such as steel and glass and their fabrication and assembly on the final form of a building. Adler went on to show how Sullivan's emphasis on function alone only incompletely described the way a building's design comes to be, and how functional causes must, necessarily, be woven together with material causes:

> [T]here is one impression stronger than all others. It is the consciousness of the zeal and earnestness of the all-pervading endeavor to utilize all the **means** at command that the **form** and expression of each structure might conform to its **function**...''[31] [emphasis added]

This, of course, aligns with Viollet-le-Duc's interpretation of Roman architecture, for example, where brick and concrete vaults were used for many different functions: baths, for example, but also basilicas, temples, etc. Likewise, Chicago architects put the multi-story steel frame to work for several different functions: offices, to be sure, but also factories, department stores, and warehouses. That many of these structures emerged with forms strikingly similar to one another might alone give us doubts about Sullivan's dictum, yet Adler's simple expansion shows how we might approach these structures with a slightly richer understanding of the complex of causes—functional and material in particular—that end up shaping buildings. In any case, Adler was able to open up Sullivan's linear relationship with complexities that now relied, in part, on subjective factors—''zeal . . . earnestness . . . endeavor''—to draw form out of competing causes and logics. To borrow from Matthew Crawford's terminology, design thus moved in Adler's account from being a ''constructive'' activity in which ''every element is fully within one's view, and subject to deliberate placement,'' and becomes

a ''stochastic'' one in which elements are ''variable, complex . . . and therefore not fully knowable.''[32]

## Conclusions—Causation and Sensation

While neither Adler nor Sullivan mentioned it explicitly, their two viewpoints neatly encompassed the ancient philosophical sub-discipline of causation, and their respective remarks, seen in this context, can be productively parsed to suggest a useful framework for understanding and explaining architectural causation. Sullivan's focus on ''function'' as a driving force within architectural design and Adler's insistence on environment both rely on arguments *from cause*, claiming, in other words, that the essence of any architectural work lies in the forces and logics behind their conception, instantiation, and continued operation. Sullivan's argument was largely compositional and related to visual expression, but it contained an undercurrent that the building's function is somehow exerting force on the designer, *pulling* decisions about form forward toward a goal. Adler's more nuanced suggestion was that form emerges from interplay between functional desiderata and an available palette of materials, techniques, and tools, something that is *pushed* by the designer from specific examples toward a goal that is not always clear.

This duality between functional goals and material availabilities recapitulates the balance between final and material causes first outlined in Aristotle's *Poetics* and the subject of much philosophical argument ever since. Aristotle actually posited four ''causes'' that, as Max Hocutt has pointed out, are better translated as ''becauses.''[33] A house comes into being, Aristotle suggested, *because* its owner desires certain functions, but also *because* a builder sets brick upon brick, *because* those bricks have properties that enable the desired functions if assembled correctly, and *because* certain patterns of brick walls, roofs, and rooms create a type of thing that we commonly call a ''house.'' These are commonly called, respectively, Final, Efficient, Material, and Formal causes.[34] The blurred distinction between an immediate ''because'' and a more speculative ''cause'' may confuse causation with ontology or, in Hocutt's words, Aristotle's logic with his metaphysics, but this may also present an opportunity if we are interested in the myriad reasons ''why'' an architectural form has come into being as it has instead of seeking an overarching teleological ''purpose'' for that form, a more ethereal goal for which Sullivan's essay (perhaps fruitlessly) seems to strive. Readers of Sullivan's essay have tended to mistake his metaphysics for his logic as well, an error that Sullivan made all too easy by casually conflating a set of strictly functional rationales (including the size, proportions, and lighting of office rooms and their successive stacking on a city site) with the larger ''problem'' of expression that involved the ''imperative voice of emotion.'' The latter, he seemed to imply throughout, relies on the diligent execution and expression of the former. Imitating, and thus *nature's* formal ''following'' of function, was an antecedent to something else, a truly final cause that aspired, in Sullivan's view, toward a national style and consciousness. Thus, while Sullivan championed the mathematical precision of functional desiderata in determining architectural form, he perhaps too casually expanded this logical formula into a metaphysical call for architecture that was as expressive as it was rational. Adler, on the other hand, hewed closer to more empirical arguments, leaving aside issues of teleology and expression.

Many commentators have noted that the four Aristotelian causes ''tend to melt into two,'' namely ''efficient'' and ''final'' causes, when translated into English.[35] This explains Sullivan's fusion of programmatic and teleological causes in his essay, but it also suggests that Adler's response posed a complementary argument for an integrated efficient causation in his remarks, one that combined the ''material'' and ''moving'' causes of Aristotle. That from which a building is made, Adler argued, and how it is assembled, play equally valid roles in influencing form. Just as a block full of cellular office spaces with lobbies, basements, and attics suggested formal conveniences or necessities at one scale, its construction of brick, stone, steel, or glass suggested equally valid formal or expressive possibilities or requirements at others. This recapitulates Yost's claim that ''any style will have a definable relation to the materials available when it is undergoing formation.'' The ''because'' of a building form, Adler explained, is not the linear process Sullivan suggested; rather, it is more akin to a pushing of formal ideas and possibilities with desirable functional outcomes through a filter of available materials and techniques. Variables in either element may lead to vastly different forms or ornamental possibilities. The designer's ''all-pervading endeavor to utilize all the *means* at command that the *form* and expression of each structure might conform to its *function*,'' [emphasis added] both expands and complicates Sullivan's tidy adage.[36] Moreover, it suggests the strong role of the ''means,'' the importance of the designer's subjective ''endeavor,'' and the understanding that this process itself provides no guarantees either of conformance or legibility without the designer's sensibility.

Adler suggested an approach to practice and history that, rather than categorizing architectural, engineering, or constructive activity into these four causes, recognized the productive interplay between them. It is, for instance, impossible to think of the multi-story nature of the tall office building (its function, or final causation) without understanding the necessarily parallel developments of iron and steel (material causation) or the techniques of riveting, prefabrication, and assembly that made these possible (efficient causation). And, of course, it makes little sense to see these three modes separate from the desire to conform to and to improve the tall office building as a type (formal causation), conceptually and aesthetically. Buildings have always been designed with function in mind, per Sullivan, and they have always been designed to

make use of an available palette of materials and techniques, per Yost and Adler. Similarly, they have been designed within traditions and toward certain niceties of composition and conception that we have come to recognize as what Reyner Banham called the ''operational lore'' of the profession.[37] What is not always recognized is that these vectors all inflect, contradict, adjust, and inform one another in processes that require assessment, experimentation, and judgment. The artifacts that emerge from this process cannot emerge as linear ''followers'' of functional problems, nor can they be precise manifestations of material or constructional properties, nor pure explications of one architectural ''type'' or style. Rather, they are the precipitates of complex, unkempt processes that are often contradictory and at best indifferent to one another. Functional solutions must be percolated through this sieve of available materials and technologies, adjusted or adorned to conform to what are often highly personal notions of aesthetics and style, and realized amidst the chaos and fiscal pressure of the construction site. That the results cannot be precisely parsed into knowable categories or neat explanations should not be surprising, and that Adler (whose career had been immersed in the practical balancing of these competing causes) should have touched on such a productive scaffold for understanding architecture as a rich, tangled network of relationships rather than the determined outcome of individual forces seems only too appropriate. ''The architect,'' he noted, ''is of the world as well as in it,'' and this, he felt, required designers of all sorts to understand the *resources* of that world as well as its *needs*, and to fully engage in the untidy negotiations among functional requirements, esthetic desires, and a limited but growing palette of materials and technologies.[38]

**Notes**

1. The earliest biography of Sullivan is Hugh Morrison, *Louis Sullivan: Prophet Of Modern Architecture* (New York: Norton, 1935), though more recent scholarship has expanded on this to connect Sullivan's career to aesthetic and cultural movements of the time. See, for example, Narcisco Menocal and Robert Twombly, *Louis Sullivan: The Poetry of Architecture* (New York: Norton, 2000) and Lauren Weingarden, *Louis H. Sullivan and a 19th-Century Poetics of Naturalized Architecture* (London: Ashgate, 2009). Sullivan's writings are available largely in two collections: Robert Twombly, ed., *Louis Sullivan, The Public Papers* (Chicago: University of Chicago Press, 1988), and Louis H. Sullivan, *Kindergarten Chats And Other Writings* (rep. Courthope Press, 2007). ''The Tall Office Building Artistically Considered'' is reprinted in the former; for original appearances see *Lipincott's*, March 1896, and *The Inland Architect and News Record*, vol. XXVII, no. 4 (May 1896): 32–34. Sullivan's place in the economic and cultural worlds of Chicago at the time are explored convincingly by Joanna Merwood-Salisbury in *Chicago 1890* (Chicago: University of Chicago Press, 2009), esp. Chapter 2, ''Louis Sullivan's Democratic Architecture and the Labor Movement.''
2. For Adler and Sullivan's buildings, see in particular James F. O'Gorman, *Three American Architects: Richardson, Sullivan, and Wright, 1865–1915* (Chicago: University of Chicago Press, 1992). The Guaranty, in particular, is covered in Joseph Siry, ''Adler and Sullivan's Guaranty Building in Buffalo,'' *The Journal of the Society of Architectural Historians* 55, no. 1 (March 1996): 6–37.
3. Sullivan's ornamental style is summarized by David van Zanten, *Sullivan's City: The Meaning of Ornament for Louis Sullivan* (New York: Norton, 2000).
4. Carson, Pirie, Scott is fully covered in Joseph Siry, *Carson, Pirie, Scott* (Chicago: University of Chicago Press, 1988).
5. Sullivan's essay originally appeared as Louis H. Sullivan, ''The Tall Office Building Artistically Considered,'' *Lippincott's Magazine* 57 (March 1896): 403–9. It was reprinted in *Inland Architect* 27 (May 1896): 32–34. More accessibly, it was reprinted in *Progressive Architecture* 38 (June 1957): 204–6. It was anthologized in Leland Roth, *America Builds* (New York: Harper & Row, 1983), pp. 340–46 and Robert Twombly, *Louis Sullivan: The Public Papers* (Chicago: University of Chicago Press, 1988), pp. 103–112. Because of the its greater availability, the notes below refer to the Twombly collection.
6. Louis H. Sullivan, ''The Tall Office Building Artistically Considered,'' in Robert Twombly, ed., *Louis Sullivan: The Public Papers* (Chicago: University of Chicago Press, 1988), p. 104.
7. Ibid., p. 105.
8. Ibid., p. 106.
9. Ibid., p. 106.
10. Ibid., p. 107.
11. It is notable, of course, that Sullivan's use of repetitive piers on the Wainwright and Guaranty Blocks, in particular, privileged this reading of the office cell as the fundamental unit over that of actual structure. Only every other large brick pier in these buildings' elevations conceals an actual column.
12. Stanford Anderson makes this point in his discussion of the ''functionalist'' mythology of modernism: ''No description of function, however thorough, will automatically translate into architectural form.'' Anderson instead argues that functionalism was a narrative, applied by critics as a straw man and by modernists as a shorthand for forms or details that ''told a story'' about programmatic or material aspects of a design and its process. Stanford Anderson, ''The Fiction of Function,'' *Assemblage* 2 (February 1987): 18–31.
13. L.H. Sullivan, ''The Tall Office Building Artistically Considered,'' p. 110.
14. S. Anderson, ''The Fiction of Function,'' Pier Luigi Nervi presented a straightforward formulation of this idea in his Charles Eliot Norton Lectures of 1961–1962: '' . . . the objective data of the problem, technology and statics (empirical or scientific), suggest the solutions and forms; the esthetic sensitivity of the designer, who understands their intrinsic beauty and validity, welcomes the suggestion and models it, emphasizes it, proportions it, in a personal manner which constitutes the artistic element in architecture.'' Pier Luigi Nervi, *Aesthetics and Technology in Building* (Cambridge, MA: Harvard University Press, 1965), p. 10.
15. L.H. Sullivan, ''The Tall Office Building Artistically Considered,'' p. 111.
16. Ibid.
17. Yost was a regional architect of some distinction, having worked on civic buildings in and around Columbus Ohio. He was best known for his expansion of the Ohio State Capitol in the 1880s and for his work, with other architects, on the Ohio Building at the Columbian Exposition. See Lewis Mumford, *Roots of Contemporary American Architecture* (New York: Grove, 1952), p. 437; and ''Ohio's World's Fair Building,'' *The Chicago Tribune* 25 (February 1892): 9.
18. J.W. Yost, ''Influence of Steel Construction and of Plate Glass upon the Development of the Modern Style,'' *The Inland Architect and News-Record*, vol. 28, no. 4 (November 1896): 33–37. Yost's paper was reprinted as ''The Development of Modern Style'' in L. Mumford, *Roots of Contemporary American Architecture*.
19. This sentiment was surprisingly widespread. In its coverage of the 1896 Fisher Building in Chicago by Burnham and Root, *Inland Architect* described its skin in similar language: ''The fronts are covered with cellular terra cotta on the outside, not in imitation of a wall, but following upward the steel supporting members, and closing in the transoms between the windows, leaving two-thirds of the exterior to be inclosed with glass.'' ''Technical Review, The Fisher Building, Chicago—A Building Without Walls,'' *The Inland Architect and News Record* [Special Supplement], vol. 27, no. 4 (May 1896). N.p.
20. Eugène Emmanuel Viollet-le-Duc, *Lectures on Architecture*, Benjamin Bucknall, trans. (rep. New York: Dover, 1987), vol. I, pp. 101–170.
21. Roula Mouroudellis Geraniotis, ''German Architectural Theory and Practice in Chicago, 1850–1900,'' *Winterthur Portfolio*, vol. 21, no. 4 (Winter 1986): 293–306. Semper was translated and interpreted for Chicago audiences by both Frederick Baumann and John Wellborn Root.
22. J.W. Yost, ''Influence of Steel Construction and of Plate Glass upon the Development of the Modern Style,'' p. 33.
23. Dankmar Adler, untitled response to J.W. Yost, ''Influence of Steel Construction and of Plate Glass upon the Development of the Modern Style,'' *The Inland Architect and News-Record*, vol. 28, no. 4 (November 1896): 36–37.
24. Ibid., p. 34. Like Yost's paper, Adler's reply is included in L. Mumford, *Roots of Contemporary American Architecture*, albeit with the misleading title ''Function and Environment.''

25. Ibid.
26. Sullivan, incidentally, thought this too, and labored in one of his later ''Kindergarten Chats'' to give credit to the ''creative process'' for preventing such a formula from falling into mere architectural syllogism.
27. The emphasis on final over material causes in Darwin's *Origin of Species* was taken up with great passion by Scottish biologist D'Arcy Wentworth Thompson in his 1913 book *On Growth and Form*.
28. D. Adler, ''Influence of Steel Construction and of Plate Glass upon the Development of the Modern Style,'' pp. 34–35.
29. D. Adler, ''Influence of Steel Construction and of Plate Glass upon the Development of the Modern Style,'' p. 35.
30. Ibid.
31. Ibid.
32. Matthew Crawford, *Shop Class as Soulcraft: An Inquiry into the Value of Work* (New York: Penguin, 2009). Interestingly, Crawford places building in a realm with mathematics, claiming that it involves well-known, easily understood elements and decisions, contrasting it with the more intuitive and sometimes unknowable nature of motorcycle repair, the subject of his inquiry. In fact, the qualities Crawford seeks in a mechanic—generally ''attentiveness'' rather than ''assertiveness''—are necessary for the synthesis and balancing of systems, components, and requirements that even the simplest built structure requires. Joanna Merwood makes the point that the nature of Sullivan's craft ''reinforced the divide between the architect and the mechanic,'' reinforcing the sense that his philosophy places him firmly in the ''constructive'' sense of Crawford's schema. Joanna Merwood-Salisbury, *Chicago 1890: The Skyscraper and the Modern City* (Chicago: University of Chicago Press, 2009). Chapter 2, ''Louis Sullivan's Democratic Architecture and the Labor Movement,'' pp. 38–54. Adler, in contrast, seems to have proffered exactly such a ''stochastic'' response.
33. Max Hocutt, ''Aristotle's Four Becauses,'' *Philosophy*, vol. 49, no. 190 (October 1974): 385–99.
34. See W.D. Ross, *Aristotle* (rep., New York: Barnes & Noble, 1956), esp. pp. 71–75 for a cogent discussion of Aristotle's writings on causation. Translated selections from Aristotle's writings on causation are conveniently collected in Aristotle, *Metaphysics*, Book V, Chapter 2 (pp. 12–13 in Walter J. Black, ed., *Aristotle: On Man in the Universe* [New York: Classics Club, 1943]), John Henry McMahon, trans. A highly readable primer on Aristotelean causation by S. Marc Cohen can be found at: http://faculty.washington.edu/smcohen/320/4causes.htm, accessed July 21, 2010. The description following borrows from Dr. Cohen's explanation.
35. ''In general, however, one can say that the efficient, final, formal and material causes tend to melt into two, that Aristotle inclines to reduce the four causes to two, namely, the formal cause and the material cause (though in our modern use of the term 'cause' we naturally think first of all of efficient causality, and then perhaps of final causes.'' Frederick Coppleston, S.J., *A History of Philosophy*: *Volume I, Greece and Rome* (rep., New York: Doubleday, 1993). Chapter XXIX, ''The Metaphysics of Aristotle,'' pp. 287–319. See, too, W.D. Ross, *Aristotle* (rep., New York: Barnes & Noble, 1956), pp. 71–75.
36. D. Adler, ''Influence of Steel Construction and of Plate Glass upon the Development of the Modern Style,'' p. 35.
37. Reyner Banham, ''Stocktaking,'' *Architectural Review* (February 1960): 93–100.
38. D. Adler, ''Influence of Steel Construction and of Plate Glass upon the Development of the Modern Style,'' p. 35.