The Material Imagination:
Architecture and the Craft of Making

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When men are ignorant of the natural causes producing things, and cannot even explain them by analogy with similar things, they attribute their own nature to them. The vulgar, for example, say the magnet loves the iron.

        —Giambattista Vico, New Science
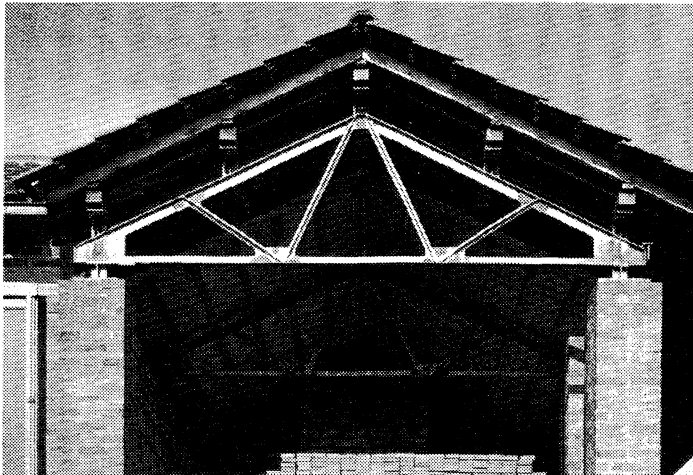

Fig. 1. Rodenkirchen, Köln, Germany.

TECHNÊ AND POIÊSIS

Throughout its history, architecture has been defined as a balance of science and art – of construction and technology, on the one hand, and formal ideas and social and environmental factors, on the other. This view of architecture, although somewhat over simplified, continues to shape the views of both academics and professionals. The balance between techné (arts and crafts) and poiêsis (bringing-forth), however ideal, is not easily achieved or accommodated. More often than not, the means of technology and materials are pitted against the ends of aesthetics and form. Although, by definition, architecture encompasses firmness, commodity, and delight, achieving one of these goals is often accomplished at the expense of the others.

Within the framework of this dilemma lies another: There has been an historical tendency to place architecture within the contexts of both the arts and crafts tradition as well as aligning it with engineering and the sciences. There is almost a mythic/poetic view of the architect/artist who, when building was by-and-large a product of necessity, had a holistic command of the building process in its entirety. Certainly this view underlies the various accounts of the primitive hut with appropriate emphasis placed upon either aesthetic or technical criteria. Somewhere along the line, we are informed, the architect/designer became disengaged from the craftsman/ producer. Building and architecture, once integral, were no longer one. According to this exegesis, architecture has been trying ever since to reconcile design with the means of production, art with craft.

In "Academicism: Modernism" Anthony Vidler exposes the anti-Academic discourse of modernism that encouraged the formation of a myth around the architectural production of the nineteenth century and specifically around the institution of the Beaux-Arts.[2] This myth, he says, has tended to obscure all subsequent attempts to analyze not only the conditions of that production but also those of the Modern Movement itself. Thus the work of the arts and craft movement is understood more readily in terms of social engagement than according to any aesthetic criteria stemming from the problem of building.

Vidler traces this social criteria to strains of utopian socialism – technological socialism from Saint-Simon and social utopia from Fourier. Thus the Gothic revival is more studied for its evidently proto-modern ideology, he asserts, than for its revived stylistic language. Likewise, the work of the arts and crafts movement is understood more readily in terms of social engagement than according to any aesthetic criteria, especially because craft is not placed in the same intellectual category as the fine arts.

Rayner Banham critically linked technological innovation with modern ideology in *Theory and Design in the First Machine Age.* Just like his modern mentors, he sought to portray the utopian outlook of the First Machine Age against the gritty and brutish backdrop of 19th century industrial capitalism:

"The machinery of the preceding Victorian Industrial age of 'cast iron, soot, and rust' had been ponderous, simple-minded, tended by a mass-proletariat in parts of the world that were remote from centers of enlightenment and culture. The machines of the First Machine Age of the early 20th century were light, subtle, clean and could be handled by thinking men [sic] in their own homes out in the new electric suburbs."[3]

Banham also sought to establish historical continuity with earlier theorists who viewed architecture both as an art and a process of making tethered to a craft tradition. He traces the *rapprochement* between creative designers and industry in the twentieth century to the formation of the Duetscher Werkbund and its founder Herman Muthesius.[4]

The German Werkbund emerged, in part, as a result of Muthesius's experience in England from 1886 to 1903 from which he gained an appreciation of the English Arts and Crafts tradition. But the German establishment regarded Muthesius with suspicion because he was Prussian and was intolerant of the "Bohemian individualism and aestheticism" of the German craftsmen and designers.[5]

The resistance of German artisans toward Muthesius's "foreign" ideas was already evident during the Weimar Republic and abetted the rise of fascism during the 1920's. Heidegger's Black Forest farmhouse, with its pitched roof and utilitarian accommodations, represents a paean to German vernacular building traditions and aesthetic honesty. As such, it became a symbol of deeply rooted notions of German nationalist identity and xenophobia. However, even Heidegger acknowledges that this "in no way means that we should or could go back to building such houses; rather, it illustrates by a dwelling that *has been* how *it* was able to build."[6]
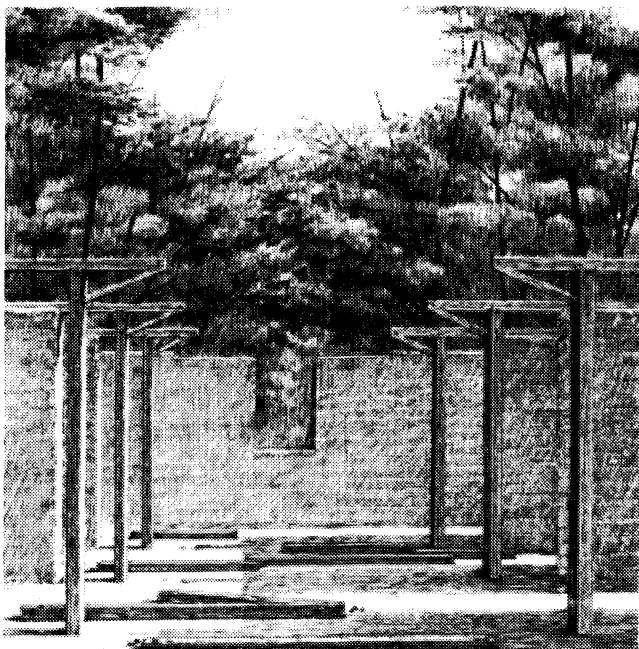
UNIVERSALIZATION VS. TRADITION

In his essay "Vernacular Architecture and the Economics of Dwelling," Daniel Willis writes that vernacular architecture is but one instance of the broader field of vernacular production. Although these production practices vary among societies, they have one thing in common: They are always "premodern." This distinction, Willis clarifies, is based upon an ideological, not chronological, distinction of "modernity."[7] Accordingly, vernacular architecture must then combine both limited and relatively inefficient production practices with the will to imbue its creations with an "aura" of significance. From a modern perspective, such practices are literally backwards because they do not seek to progress beyond their moderate levels of efficiency. The economies in which such architecture flourishes also operate in an inverted manner: instead of being dedicated to growth, they strive to maintain the status quo.

Kenneth Frampton's writings on regionalism and the tectonic extend Banham's premise that building is inherently a phenomenon of technology and that aesthetics in architecture is fundamentally a product of materials, detail, and assembly. In his essay "Prospects for a Critical Regionalism," Frampton cites the philosopher Paul Ricouer's struggle with the paradox of universalization. "In order to take part in modern civilization," he writes, "it is necessary at the same time to take part in scientific, technical, and political rationality, something which very often requires the pure and simple abandonment of a whole cultural past."[8] Ricouer's thesis is that a hybrid "world culture" will only come into being through a cross-fertilization of rooted culture on the one hand and universal culture on the other. In his essay "Universalization and Rooted Cultures" of 1961, Ricouer implied that everything will depend in the last analysis on the capacity of regional culture to recreate a rooted tradition while appropriating foreign influences at the level of both culture and civilization.[9]

Fig. 2. Pre-industrial building technology.
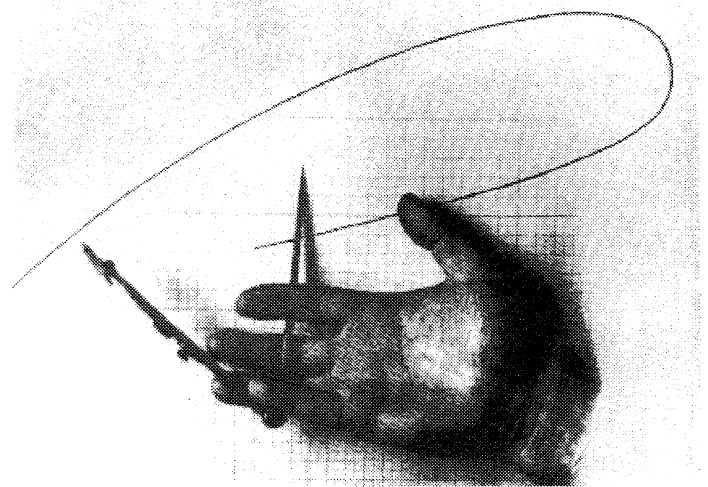
Fig. 3. The Constructor *(1924). El Lissitsky.*

Giuseppi Zambonini projects Ricouer's argument about hybrid culture and the roles of the artist/craftsman and technology into his own theory of making. "Every man-made form – and in particular, every architectural form," he writes, "does not exist solely as static consequence to an otherwise irrelevant act of production, but conversely, that the nature of form is inlaid in the process of making."[10] Zambonini contends that issues of quality are governed by the degree to which materials and methods typical to the host society are integrated together. "Through their employment," he says," the maker intends to contribute to the traditions and common meanings of the collectivity in which the production activity is nested, without renouncing technological advance or personal expression."[11] It is in this context that a distinction can be drawn between Frampton's and Zambonini's views of the artist as "maker."

Zambonini writes that any activity of production involves the transformation of matter for a purpose clearly defined somewhere between society and the individual. The maker and the object to be created are tied to together by an intimate relationship that does not disappear at the conclusion of the production process. Although this relationship can be described in different ways, in each case it is inseparably connected to the nature of the production process itself.[12] For him, the "maker" can either be a craftsman intimately involved with materials through the production of artifacts, or a designer who at least understands through experience the characteristics and tectonic limitations of materials.

Frampton defines Critical Regionalism as a "dialectical expression that self-consciously seeks to deconstruct universal modernism in terms of values and images which are locally cultivated, while at the same time adulterating these autochthonous elements with paradigms drawn form alien sources."[13] His implied view of the artisan is decidedly more intellectual and, in a sense, utopian. For him, the artisan is a product of both local and regional traditions and universal culture (i.e.: modernism). Thus, the modern artisan must walk a fine line between assimilating indigenous forms and methods of making, whatever they may be, and outright eclecticism. However, "any attempt to circumvent the dialectics of this creative process through the eclectic procedures of historicism," he warns, "can only result in consumerist iconography masquerading as culture."[14]

THE AESTHETICS OF CRAFT

Like Banham, Martin Pawley eschews traditional arts and crafts-based notions for a more progressive version of inexorable technological advancement. "The Second Machine Age," he laments, "is an age without ideology."[15] It is not so much that the Second Machine Age failed to produce a sequel to the Arts and Crafts movement, Pawley writes, as it has failed to produce any unifying theories at all. Earlier theoretical treatises contained "urgent texts and clear plans urging principle and practice." In an academic sense, they were "suppositions explaining something, based on principles independent of the phenomenon being explained."[16]

Pawley contends that architectural theory has been incrementally superceded by architectural imagery. The dissemination of readily attainable building images through architectural publications has merely substituted visual culture for ideology.[17] The conquest of theory by imagery, he cautions, is not a superficial phenomenon. When building elements are no longer dependent on culture, context, or climate, it reflects disturbing changes in the structure and task of the architectural profession.

Frampton points out that for Heidegger the rootlessness of the modern world begins with the translations of the Greek experience into the edicts of the Roman imperium and culminates with the productionist philosophy of the machine age. Like Eduard Husserl, Heidegger turns to the phenomenological presence of things in themselves in which, he argues, form already exists.[18] A brick, for example, cannot be anything but what it is: formed and fired clay. Its material properties of malleability and extrusion give it form.

In Zambonini's view, the materialization of an idea has a moral component – a quality that goes beyond material integrity and a business ethic – sustained by personal choice, and ultimately comes to bear on society as whole. In traditional artistry, where the artisan is singularly responsible for the entire production process, the artist or craftsman is first concerned with the embodiment of an idea through a unique materiality. Here the process requires the definition of an economical and efficient path of fabrication. The maker faces two dilemmas or burdens that are conditioned by morality:

> "The first burden concerns the identification of materials and tools used in the process of transformation. Its moral component is that the most significant properties of material can only be discovered through a methodical investigation measured in years of pursuit.... The second burden has to do with the relationship of the artisan and the history of their trade.... The object produced epitomizes the artisan's role in society."[19]

Because it inevitably carries meaning, the object contains all of the advancements and contradictions manifested in the society of which it is a product. It also speaks to the relationships among the members of that society and, in turn, the relationship of those individuals to the environment they occupy.

Zambonini's argument for making is circumscribed, once again, by Ricouer's paradox of universalization and preservation of tradition. "Here the moral responsibility of the artisan is two-fold: it deals simultaneously with preservation and innovation. It is within the critical interpretation of these two opposites that the range and quality of discussion applicable to the process of making occurs."[20]

When Le Corbusier extolled the virtues of the engineer's art in *Towards a New Architecture*, Willis contends that he was praising an "engineering vernacular."[21] The ocean liners, airplanes, and automobiles Le Corbusier then photographed were still partially experimental. Their production and operation had not yet become certain. The engineering behind them was still of a practice, as opposed to a technique. In a phenomenological sense, the engineer's aesthetic is simply a manifestation of the form already inherent in materials and the means of production. According to Willis, "there

are no ambiguous rules regarding what is true to a material."[22] There is, one might argue, an optimal way to assemble an automobile with all the parts in the proper order so that it will function efficiently. Likewise, buildings have their own optimal orders based on material properties and climate. The roof must shed rain; walls must either be pervious or impervious to sun and weather; and, wood, steel and concrete have intrinsic structural properties that must not be exceeded.

Le Corbusier's pairings of Greek temples with automobiles signified his desire to preserve those aspects of the past that, in his view, were enduring while at the same time embracing the innovative uncertainty of the future. Both the temple and the automobile are products of technological refinement; both are emblematic of their own eras.

Much like Heidegger's farmhouse, Rudofsky's images and descriptions of what he calls "nonpedigreed architecture" carry the utopian promise of human beings living in harmony with each other and the land. Karsten Harries observes that this architecture is neither burdened by technology, nor what we think of as "Architecture." "This architecture belongs to a specific region, as do its rocks, caves, trees, and animals."[23]
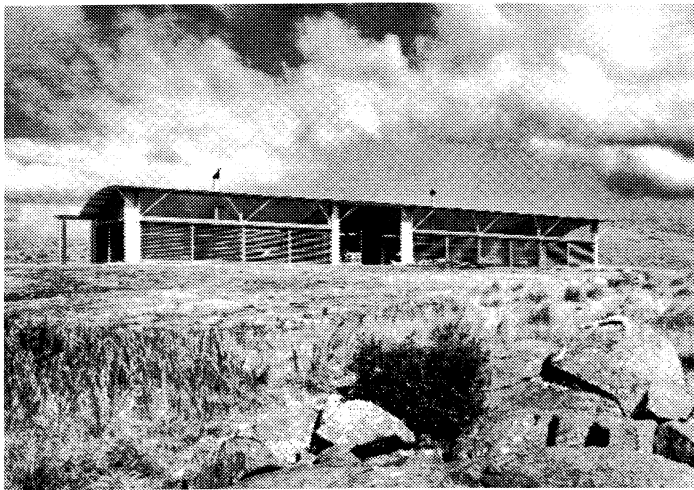

Fig. 4. Moruya House. Australia. Glenn Murcutt.

Glenn Murcutt's interest to produce "an architecture that continually acknowledges the physical and climatic character of its site" is not an unrequited desire for an Edenic paradise, but a search for environmental harmony. His choices of specific materials and forms is conditioned by an innate sense of place and a moral consciousness of the ecological consequences of unrestrained technology.[24] Murcott is critical of fellow Australians who have difficulty with the *raison d'être* of his buildings and tend to focus on their image only. They see references to a supposedly authentically "Australian" character of forms and materials that Murcott characterizes as "a romantic response of a people who live in the most suburbanized country in the world but who cling to mythic images of the landscapes that have become so distant from their lives."[25]

According to Harries, part of both pedigreed architecture and the economic imperative to produce the largest results at the least cost is an antagonistic relationship to the environment, which treats nature as no more than a source of materials to be exploited. "'Pedigreed' architecture and engineering are both made to appear as products of a fall into sin that, like the first fall, means inevitably also the fall out of a natural realm."[26] Furthermore, in the never-ending search for economic expedience and technical efficiency, the technologist cannot afford to hold allegiance to any particular material or method. Thus, "in a technological society, all materiality is destined to 'melt into air.'"[27]

In "The Valor of Iron," Willis contends that we are constantly lead to the conclusion that one material is as good as any other from an aesthetic point of view, provided that we are sophisticated enough to use it properly. His observations hinge on *technique* in terms of the formal limitations of a material or fabrication process to determine the relative merits of substances. "Traditional methods of fabricating wrought iron railings," he hypothesizes, "could be dismissed once a casting technique is devised that produces a cast iron railing with enough formal diversity to convincingly simulate wrought iron."[28] Of course, purists (a la Ruskin) would object on moral principle claiming that such a procedure would result in a "dishonest" material.[29] Compared to the "directness and simplicity" of the wrought iron method, casting is a fairly dull procedure. It imposes a distance between the craftsperson and the substance; the immediacy of contact between the smith and the iron is lost.

The intimate relationship described by Willis between artisan and artifact is rarely experienced in today's era of specialization and industrial production. The exigencies of scheduling, economics, and manufacturing technology have permanently transformed historical notions of craft. But this phenomenon is not unique to our own era. As Andrew Martindale points out in *The Rise of the Artist*, as early as the second half of the thirteenth century there already existed a division between the office and the shop floor:

> "It was the custom to have a principal master who gave only oral orders, was very rarely on the job or never used his hands, although he received a much larger salary than the others.... This is part of a tendency on the part of architects within the bounds of their own competence to emphasize the 'scientific' or 'intellectual' aspects of their occupation at the expense of the 'art' in its medieval sense of craft."[30]

This distance between artisan and object is reflected today in architectural practice where the role of the architect is relegated to planning, designing, and specifying. When an architect professes to build, they are speaking metaphorically since the actual construction of buildings and places is in the domain of other specialists. Similarly, an individual practitioner may be credited with the design of a building, whereas design is typically the collaborative effort of a team.

For Frampton, the notion of mediating instrumental reason through an appeal to tradition, as an evolving matrix from within which the lifeworld is realized both materially and conceptually, must be viewed circumspectly since an a priori value is attached to the

fragmentary – in this case the artifact and the means of production. Architecture, in the sense of a technoscience, has no hope of being universally applied:

"One only has to look at the spontaneous megapolitan prolif-eration [of built forms besieging the landscape] to recognize the incapacity of the building industry, let alone architecture, to respond in any effective way. Where technology, as the maximi-zation of industrial production and consumption, merely serves to exacerbate the magnitude of this proliferation, architecture as craft and as an act of place creation is excluded from the process."[31]

CONTINUITY, INTEGRATION, AND THE "MATERIAL IMAGINATION"

Alvaro Siza observed that "architects don't invent anything, they transform reality."[32] Unlike fine art, all such transformations have to be rooted in the opacity of the lifeworld and come to their matu-rity over an unspecified period of time. This implies a more essen-tial understanding of craftsmanship, which Zambonini defines as "knowledge of the entire process in view of its goal."[33] This holistic knowledge of the process of making requires historical continuity of a craft tradition and the ability to integrate each element of the creative and production process. *Continuity* refers to a unity in time – a set of relationships to be seen in the life of artifacts and their inception. *Integration* suggests another kind of unity among the makers themselves, expressed at once in their work.[34] It resists all notions of standardization and specialization.

Willis contends that the technologist would prefer the relationship of raw material and finished artifact to be of one pure, proportional projection.[35] The relationship of a stone carving, for example, would perfectly match the source in scale and detail. In these "perfect" translations from one material and process to another, the techno-logical conceit is that material processes can be made transparent, and all universes rendered immediately accessible. Not all materi-als, however, behave in fashion that allows such projections to be made easily. "The preconceived ideal product is always distorted by the partially opaque lens of the substance or process; the 'eye' of any material will always disrupt the projective focus."[36]

As a society becomes more technological, the imaginative opportu-nities opened within it will become increasingly formal. Once the process of making anything has been deemed irrelevant to the mean-ings attached to it issues of shape, style, and visual appearance must gain in importance. Echoing Pawley, Willis observes that one defining characteristic of modernity has been our cultural de-em-phasis on the material imagination. This tendency has been fur-ther exacerbated by the problem of "mechanical reproduction," as noted by Walter Banjamin, and by the invention of synthetic mate-rials pulled from the "womb of the earth." Willis quips, "there are no myths associated with the creation of plastic."[37]

Zambonini insists that integration of the representational process in drawing with the experience of material itself is among the most

difficult to communicate if one does not already believe that mate-rial – in its structural and aesthetic properties – precedes the trans-forming idea.[38] In recent years there has been a tendency to give drawing pre-eminence in the conceptual process, leaving to dis-tant executors all decisions concerning how best to build the work. This means that knowledge of all phases and all components of building becomes crucial if the designer is to properly observe and interpret these material properties.

Whereas Pawley is searching for an overarching techno-scientific ideology, Zambonini asserts that direct material experience identi-fies the difference between a process oriented fundamentally to material as opposed to ideas. Zambonini's argument follows a tra-jectory similar to Heidegger's where he is focusing attention "on an object's capacity to carry meaning embodied in its physical quali-ties, in its materiality."[39]

"At the end of the millennium," Willis says, "we find ourselves, members of a society whose hands are asleep."[40] Traditional arti-facts will be increasingly difficult to produce as our society con-verts imaginative work to efficient labor. The ambiguous duality that is the nature of all materials, he writes, is, of course, a mirror of our own double nature – between our desires for freedom and rootedness. However, he cautions, we must not interpret "the sub-stantial dreams of the material imagination as reductive rules."[41]
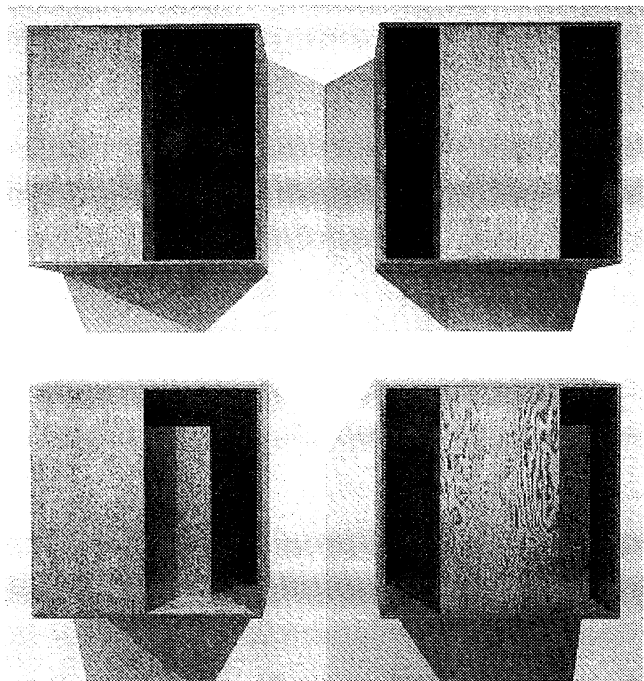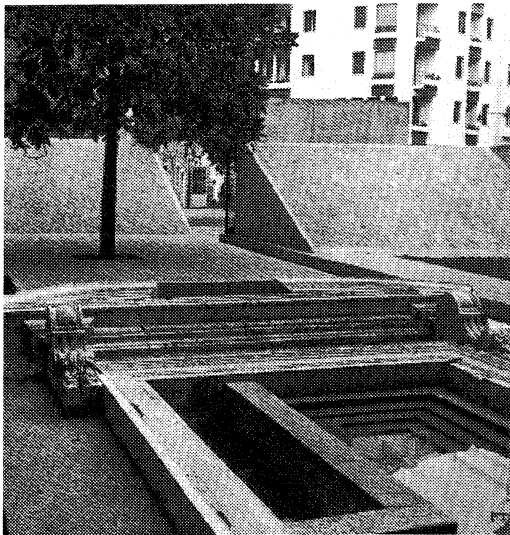

Fig. 5. Untitled. *1987. Donald Judd*

We must look not only at the quality of the material used and at the craft employed, but also at the quality of the intention in selecting and working with the material. In the artistic work of Donald Judd, for instance, Zambonini points out that the quality is not in the material, which is plywood, and not in the production methods,
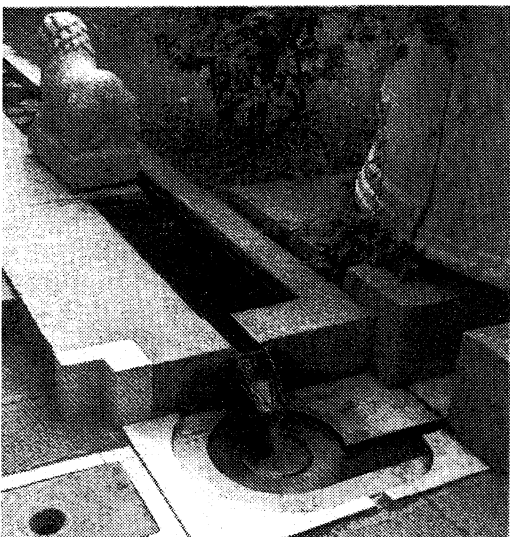
though the methods of cutting the plywood have been perfected to an exacting standard. "The quality," he says, "is projected by the sensual and perceptual sensations produced by the finished work."[42]

Vitorio Gregotti maintains that detailing should never be regarded as an insignificant technical means by which the work happens to be realized. According to Frampton:

"The full tectonic potential of any building stems from its capacity to articulate both the poetic and cognitive aspects of its substance. This double articulation presupposes that one has to mediate between technology as a productive procedure and craft technique as an anachronistic but renewable capacity to reconcile different productive modes and levels of intentionality. Thus the tectonic stands in opposition to the current tendency to deprecate detailing in favor of the overall image."[43]

Fig. 6. IUAV Courtyard Details. Vicenza. Italy. Carlo Scarpa

In Scarpa's buildings, for example, we begin to understand that one must accept a method of representation based on the complex play of smaller-scale relationships held together by a tectonic text. As Zambonini observes: "It is [through] the art of joinery, the method of producing convincing details, [where the architect can achieve] optimal results, since it is in the conception of those details that we fully express the meeting of our history, in our visual culture, of all the meaningful events that we have witnessed."[44]

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In Italo Calvino's *Invisible Cities*, Marco Polo describes a bridge stone by stone. Impatient with his detailed account, Kublai Khan asks "But which is the stone that supports the bridge?" Marco explains that neither one stone nor another supports the bridge. When the Khan presses him for more information about the arch, Marco answers: "Without the stones there is no arch."[45]

ENDNOTES

[1]Daniel Willis, "The Valor of Iron: An Introduction to the Material Imagination," *The Emerald City and Other Essays on the Architectural Imagination* (New York: Princeton Architectural Press, 1999), p. 30.

[2]Anthony Vidler, "Academecism: Modernism," *Oppositions*, vol. 8 (Cambridge, Massachusetts: The MIT Press, Spring, 1977), p. 1.

[3]Reyner Banham, *Theory and Design in the First Machine Age*, second edition (Cambridge, Massachusetts: The MIT Press, 1981), p. 11.

[4]"The heart-theme of the practical body of thought in Germany in 1907 was the relationship of architecture, as an art of design, to mechanical production at all its phases, from the factory work-hall to the advertising of the finished product. This relationship was scrutinized most closely at two critical points: the aesthetics of engineering construction, and the aesthetics of product design." [Banham, p. 68.]

[5]"[Muthesisus] was a Prussian civil servant who regarded himself as an instrument in the furtherance of German economic policy, he naturally stood for order and discipline, and not for the Bohemian individualism and aestheticism of the loosely organized German *kunstgewerbe* craftsmen and designers. Furthermore, he seems to have been regarded as the importer of a foreign style to be imposed on German Arts and Crafts." [Banham, p. 69.]

[6]Martin Heidegger, "Building Dwelling Thinking," *Basic Writings*. David Farrell Krell, ed. (New York: Harper & Row, 1977), p. 338.

[7]Daniel Willis, "Vernacular Architecture and the Economics of Dwelling," *The Emerald City and Other Essays on the Architectural Imagination* (New York: Princeton Architectural Press, 1999), p. 120..

[8]Kenneth Frampton, "Prospects for a Critical Regionalism." *Perspecta: The Yale Architectural Journal*. vol. 20 (Cambridge Massachusetts: The MIT Press, 1983), p. 148.

[9]Paul Ricouer, "Universal Civilization and National Cultures," *History and Truth* (Evanston, Illinois: Northwestern University Press, 1961), pp. 276, 283.

[10]Giuseppi Zambonini, "Notes for a Theory of Making in a Time of Necessity," *Perspecta: The Yale Architectural Journal*, vol. 24 (Cambridge Massachusetts: The MIT Press, 1988), p. 3.

[11]*Ibid.*, p. 3.

[12]*Ibid.*, p. 3.

[13]Frampton, p. 149.

[14]*Ibid.*, p. 149.

[15]Martin Pawley, *Theory and Design in the Second Machine Age* (Cambridge, Massachusetts: Basil Blackwell, 1990), p. 3.

[16]*Ibid.*, p. 3.

[17]"With the stripping away of the real historical context of plan, structure, and ideology, all architecture has been reduced to imagery, and all imagery is available to be used in any combination. Today all features ever included in any building, from the stone reliefs of the temples of Abu Simbel to the perforated steel sunscreens of the Hongkong and Shanghai Bank, can be mixed and matched and applied to any other building under the guise of 'historical references.'" [Pawley, 4]

[18]"That which gives things their constancy and pith but is also at the same time the source of their particular mode of sensuous pressure -- colored, resonant, hard, massive – is the matter in things. In this analysis of the thing as matter, form is already co-posited. What is constant in a thing, its consistency, lies in the fact that matter stands together with a form. The thing is formed matter." Martin Heidegger, "The Origin of the Work of Art," Basic Writings, David Farrell Krell, ed. (New York: Harper & Row, 1977), p. 338.

[19]Zambonini, p. 4.

[20]Zambonini, p. 5.

[21]Willis, "Vernacular Architecture," p. 123.

[22]Ibid., "The Valor of Iron," p. 43.

[23]Karsten Harries, "Context, Confrontation, Folly," Perspecta: The Yale Architectural Journal. vol. 27, Roberto H. de Alba and Alan W. Organschi, eds. (New York: Rizzoli International Publications, 1992), p. 7.

[24]"It is no longer enough to use a material because we like the way it looks or because it's cheaper. It's absolutely crucial to come to terms with the fact that our paints and coatings may poison our water or air; that our choices of exotic and inaccessible materials may cause destruction of a landscape in another part of the world...." Glenn Murcott, "The Mining Museum of Broken Hill," Perspecta: The Yale Architectural Journal. vol. 27, Roberto H. de Alba and Alan W. Organschi, eds. (New York: Rizzoli International Publications, 1992), pp. 173–174.

[25]Ibid., p. 174.

[26]Harries, p. 10.

[27]Willis, "Valor of Iron," p. 41.

[28]Ibid., p. 25.

[29]"Wrought ironwork is 'direct,' 'primitive,' and 'simple.' It requires a high degree of skill and runs an appreciable risk of error. The limitations imposed by the size of the smith's forge, the variety of anvils and dies at his disposal, as well as by the limits of his own size and strength leave their characteristic trace on the shape of any wrought iron work." [Willis, "Valor of Iron," p. 25.]

[30]Andrew Martindale, The Rise of the Artist in the Middle Ages and Early Renaissance (New York: McGraw-Hill, 1972), p. 84

[31]Kenneth Frampton, Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture, John Cava, ed. (Cambridge, Massachusetts: The MIT Press), p. 24.

[32]Ibid., p. 25.

[33]Zabonini, p. 16.

[34]"Integration is fundamentally opposed to the perceived necessity for standardization and specialization – two forces that have tremendous impact in today's economies....A more integrated method of production depends on the coming together of trades and artisans, each capable of applying different skills, while nonetheless maintaining an understanding of the whole to which the work aspires." [Zambonini, p. 16.]

[35]Willis, "Valor of Iron," p. 41.

[36]Ibid., p. 41.

[37]Ibid., p. 42.

[38]Zambonini, p. 16.

[39]Ibid., p. 17.

[40]Willis, "Valor of Iron," p. 45.

[41]Ibid., p. 43.

[42]Zambonini, p. 24.

[43]Frampton, Tectonic Form. p. 26.

[44]Zambonini, p. 22.

[45]Italo Calvino, Invisible Cities. translation by William Weaver (New York: Harcourt Brace Jovanivish, 1974), p. 82.