GENERAL ARTICLE

Formulating Abstraction: Conceptual Art and the Architectural Object

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ABSTRACT

Digital techniques, primarily software appropriated from the entertainment and industrial design sectors, have destabilized the essential status of the architectural image-object formulated in classical philosophical thought. Western European art experienced a similar crisis when conceptual art movements of the 1960s challenged Clement Greenberg's notion of medium specificity. The author examines work by conceptual artists whose theories posit alternative views of spatial and social relations based on open-ended systems and indeterminacy. An examination of the relationship between materiality and abstraction as exemplified in new media's reformulation of architectural design processes indicates how a more inclusive and mutable profession has been realized.

Imagination pouvoir

—Graffito, Paris 1968 [1]

Recent advances in digital technology and communication have necessitated a critical appraisal of new methods of image construction as they relate to architectural production. Concurrently, the popularization of the Internet and wireless technologies has pressed architects to recognize less material forms of public interaction, which is historically considered the province of architecture. As a result, the discipline is facing an ontological crisis, which compels a review and critique of its origins.

A period of questioning and criticism occurred in Western art during the late 1960s; by examining this past, it is possible to gain an understanding of the challenges that architectural imaging currently faces vis-à-vis digital media. The forces that contributed to the dematerialization of the art "object" are in many ways similar to those at work in the dematerialization of the architectural "object," giving rise to increasing attention to process and

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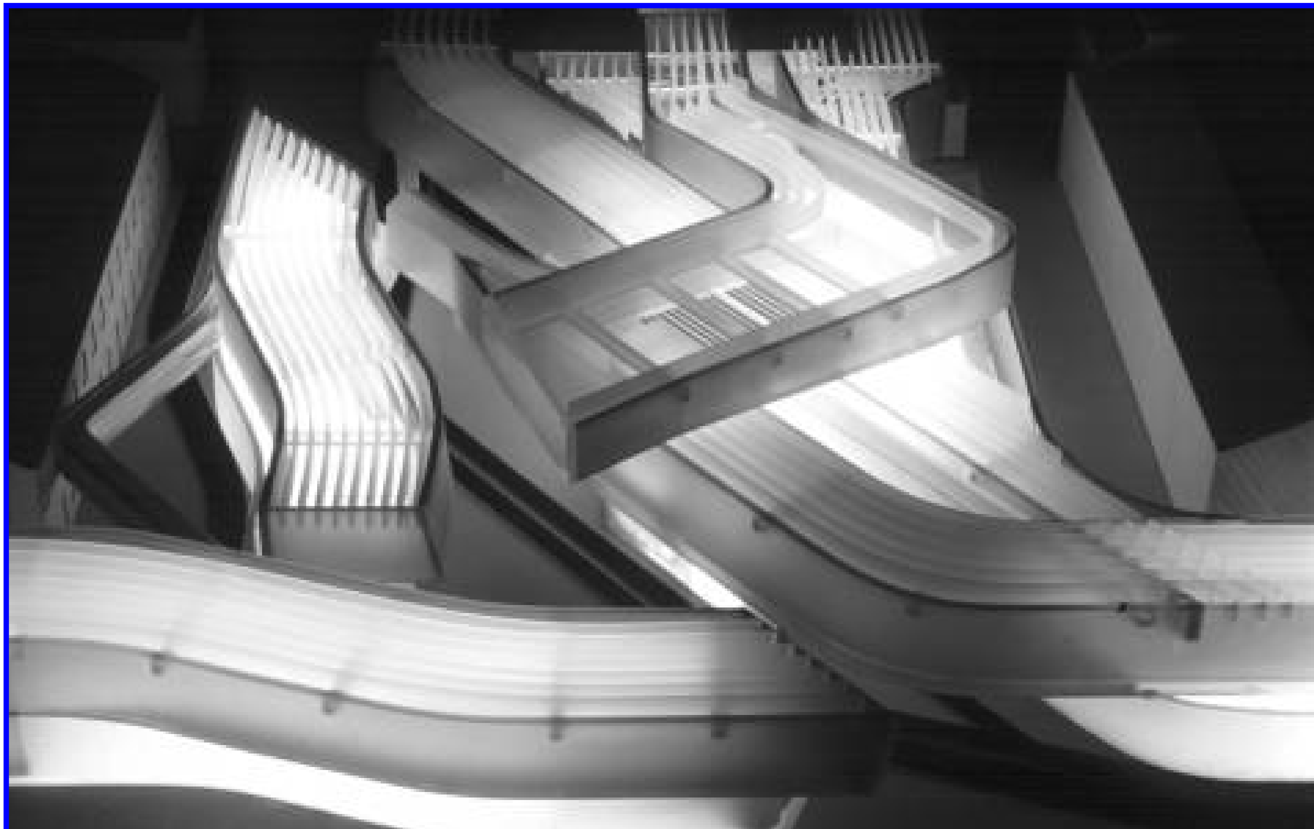

Fig. 1. Zaha Hadid Architects, *The Contemporary Art and Architecture Centre for Rome*, 1999–present. (© Zaha Hadid Architects) A digital rendering of the museum complex describes urban flows, as well as the design concept of "irrigating" a large urban field with linear display surfaces.

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Fig. 2. Herzog & de Meuron Architects, Ricola-Europe SA Production & Storage Building, Mulhouse-Brunstatt, France (1993). (Photo © Margherita Spiluttini) The structure is designed to drain rainwater onto a vertical wall surface. When sunlight interacts with environmental conditions, it creates a constantly changing surface reflection, which challenges the building's materiality.

context. This philosophical shift could be said to have originated when art critic Clement Greenberg's argument for medium specificity ultimately exhausted itself.

Any reconsideration of the architectural image-object has serious consequences, because the image instantiates not only a process of information exchange but also a mode of thinking. The term *image* will be used here to describe architectural drawings, whether analogue or digital; photographs; renderings; animations; or new media. While in the past visionary architects, most notably Giovanni Battista Piranesi (in 1745), Etienne-Louis Boulee (1784) and Antonio Sant'Elia (1914), experimented for various reasons with redefining architectural drawings as products or media, it is worthwhile to reinvestigate art's response to technology's challenge of immateriality, which invites comparison to current architectural discourse.

During the early 20th century the normative vision of the fine arts was called into question as a result of numerous factors, most especially technological advances in methods of representation, first in photography and later in Dadaist film. Both film (through movement) and conceptual art (through "non-art," where the idea is the most important aspect of the work, and "anti-form," a plastic quality that emerges through process, for example, a set of instructions) necessitated a shift in conceptions of what precisely constituted a work of art [2]. Questions were posed by critics and artists alike, all of which threatened to destabilize the art world: Is a work an eternal immutable object? A commodity? A process?

Three closely related conceptual art movements have much relevance to today's crisis in the status of the architectural image: Arte Povera, process art and art-and-technology. Conceptual artists who participated in the discourse of the late 1960s concluded that what was most intrinsic to art was not its object-status, but, first, the inherent cognitive concept and second, the open-ended exploratory process of expressing the concept [3]. These notions later filtered into architecture via architects and designers whose social networks extended into conceptual and process-art circles. Some of these architects, such as Rem Koolhaas and Zaha Hadid at the Architectural Association and Daniel Libeskind, director of Cranbrook Academy, introduced into studio pedagogy new design methods that were later reflected in their built works (Fig. 1).

In addition, conceptual artists also saw art as expressive of a larger social and biological system. Conceptual artists determined that there were no clear boundaries between the artist, the art expression and the audience. Such theorizing was not unique to art but manifest throughout science, music, performance and linguistics. By transposing the 1960–1970s art debate onto architecture, Swiss architects Jacques Herzog and Pierre de Meuron, among others, allowed new possibilities to emerge in their designs: Architectural expression could be said to operate on multiple registers, only one of which is material; it is defined by a process and is part of a larger cultural and biological system [4].

Essentialism or Anti-Essentialism

Early 20th-century codes of normalcy or appropriateness in art have been said to originate with the art critic and historian Joshua Reynolds. In his *Discourses on Art* (1771), he attempted to formalize art's universal principles of pan-historical greatness [5]. Reynolds also originated the concept that paintings are experienced "all at once" because they occupy a defined space and are perceived in one moment of time. The other notions received from Reynolds were firstly, that certain mediums do certain things in certain ways (medium specificity); secondly, art genres should not exceed their boundaries—for example, in the transference from one medium into another; and lastly, the importation of one medium into another violates conven-

tions [6]. One can understand these principles as expressions representing the permanence or stability of an existing aristocratic hegemony. Additionally, they supported the view that architectural expressions, whether images or buildings, exist in fixed, static, timeless modes.

Reynolds's treatise was a refinement on the dramatist and art critic Gotthold Ephraim Lessing's earlier work, *Laocoon* (1766). Lessing contrasted painting's singular moment of perception with the temporality of poetry. He concluded that poetry was best represented consecutively, that is to say, sequentially, because it was experienced over time [7]. Both Reynolds and Lessing promoted rigid, inviolable media boundaries and were unable to entertain the possibility that media might be combined.

Although Reynolds and Lessing were certainly influential, the leading figure of 20th-century art criticism, Clement Greenberg, was ultimately responsible for many accepted conventions about aesthetics. "Purity in art consists in the acceptance of the limitations of the medium of the specific art . . . an art which is nothing else except sensuous" [8]. His *Towards a Newer Laocoon,* written in 1940, developed arguments by Reynolds and Kant to justify criticism of art. His two main ideas were that art (as he defined it) is a nonconceptual, subjective, universal and irreducible pleasure, and that aesthetic judgment is disinterested and detached.

Speaking as an unrestrained positivist, Greenberg perpetuated the limiting concept of medium specificity. His writings appealed for an explicit and rational structuralism of the arts. In Greenberg's view, the medium of art, its materiality, was paramount, because it was the ultimate grounding for the work of art. Even more importantly, only abstract art was considered a pure expression of its medium, because Greenberg reductively concluded that flatness and opticality were the only two irreducible aesthetic experiences in painting. In addition, abstract art, to maintain its purity, also required absolute integrity, which is to say, no intermixing of other media [9].

Fig. 3. Bruce Nauman, *Live/Taped Video Corridor,* wallboard, video camera, videotape player and two video monitors, dimensions vary with installation, 1969–1970. (© 2007 Bruce Nauman/Artists Rights Society [ARS], New York) The interactive relationship between physical installation, the viewer/participant and the video camera dissolves the formal divisions between art object and art experience. Gordon Matta-Clarke's *Splitting: Four Corners* appears at left.

While Greenberg directed his criticism to paintings and sculpture, his theories were not unfamiliar to architecture. A reexamination of architecture's genealogy shows that the discipline inherited Classicist notions of integrity and medium specificity. Classicism (including, broadly speaking, Greek, Hellenistic and Roman styles, as well as those of the 17th, 18th and 19th centuries, where these contain some allusion to the antique orders [10]) established a prescriptive system composed of rules determining the acceptability of a design's formal or functional aspects on the basis of nonviolation of certain constraints. (Formal architectural systems similar to classicism—for example, typologies and most building regulations—are likewise prescriptive systems.) Ancient Greek aesthetics attempted to purify the form, and its constraints were maintained in subse-

quent architectural treatises from Andrea Palladio to Marc-Antoine Laugier, and even in Robert Venturi's postmodernism; all consistently referred back to classicism as their true origins. Thus occurred repeated resurgences of classical coding after the Middle Ages, from the Renaissance through the 18th century and continuing with the various revival styles of the 19th century. Architectural pedagogy, as well as practice, consisted of a historical referencing, a recombination of preexisting elements and an uncritical acceptance of tradition.

When World War I resulted in a social and cultural break with aristocratic aesthetic privilege, the efforts of the avant-garde, primarily the de Stijl movement and other early modernists, provided the means for early-20th-century architects to break with history. In an attempt at self-criticism best represented by Le Corbusier and the International Style, modern architects established their own version of formal purification. However, while it is commonly acknowledged that Le Corbusier's modernist version of functionality, purity and the machine aesthetic effectively replaced the Vitruvian coding of *utilitas, firmitas, venusta* (useful economy, structural integrity and aesthetic pleasure) [11], even Le Corbusier did not actually make a clear historical break but studied classical proportions to justify the forms of racecars and his own system of regulating lines [12].

Moreover, by mid-century, with few exceptions, architectural discourse lagged behind the internal art debate because of the demands of a post–World War II building expansion. The architectural discipline had to contend with a severe housing shortage and new construction methods. While isolated moments of critique and experimentation existed, such as among the Situationists or in innovative proposals for a new Australian national government center at Canberra, the majority of architects were preoccupied with the demands of a rapidly expanding economy. As a result, most architects were engaged with topics related to functionality and standardization [13], leaving little time to reflect on the filmic implications of projects such as Friedrich Keisler's visionary "Endless House" [14].

Conceptual Art and Architecture

In 1969 philosopher and social critic Michel Foucault, in *The Archaeology of Knowledge,* ventured that the crisis of classical thought was produced by a loss of ground. Within the field of art, this loss was accompanied by the loss of an art-product produced on the basis of a desire to represent. It has been suggested that this loss was actually initiated much earlier in the century by artists' adoption of a new technology, photography, which destabilized traditional art practices such as portrait or landscape painting. The Surrealist André Breton believed that it was photography's indexical character that compelled a reexamination of art's ontological origins and purpose as well as of the grounding of the discipline itself.

Breton argued that artists in the classical tradition *represented* a preexisting condition, whether or not through the aid of Cartesian perspective, the camera obscura or other optical devices. Avant-garde artists of the early 1900s, on the other hand, were making attempts to *present* an original concept or idea previously unknown. Influenced by Freud's psychological research, Cubism, Surrealism and Dadaism expressed previously unseen subjective worlds. They "sought to explore the unconscious as a site of meaning and to challenge rationalist distinctions between self and other, inside and outside, conscious and unconscious" [15]. In a sense this was a liberation of art from the constraints of representation, freeing it to do what only art can expressly do.

With this in mind, the end of the classical age, which Nietzsche pronounced an end without return, was in actuality the exhaustion of the early rationalist modernist project. By the 1960s, moreover, art was responding to an even more complex set of factors. In addition to the critique of rationalism, it was also opening up to interdisciplinary ventures. In the wider social milieu, student riots, new divorce laws, a mixing of high and low culture and the influence of advertising and mass media marked the disappearance of any kind of absolute referent that might frame a system of essentialized knowledge [16].

While many avant-garde movements in the late 1960s and 1970s attempted to articulate this disappearance of ground, conceptual art had particular bearing upon the architectural image [17]. The broader rubric of conceptual art applies to "work in which the idea is paramount and/or the material form is secondary, lightweight, ephemeral, cheap, unpretentious and/or dematerialized" [18]. These art movements were directly related to the transformation of the architectural image by two major contemporaneous trends: first, new theories of representation and second, new technologically derived mediums. Both resulted in an unprecedented dematerialization of the art object.

This ontological crisis of representation is crucial to understanding one of the forms of resistance in architecture toward new forms of media expression. Traditionally, architects represented an idea in a drawing, and the drawing was then represented in a building. Although the drawing had documentary status, it needed to be further translated into another medium: material form. If in actuality architects only construct ideas and the design evolves dynamically as a process, then all expressions, in whatever media, are a record of the process. Architectural expressions then participate in a larger design continuum with conceptual or cognitive activity at one end and materiality at the other, with many variants or media in between. Rigid distinctions between media are not only unnecessary but patently misleading.

In one of their few areas of agreement with Greenberg, conceptual artists also apprehended the increasing colonization of art by consumer capitalism. In *Towards a Newer Laocoon,* Greenberg's critique of capitalism was grounded in a fear of mass

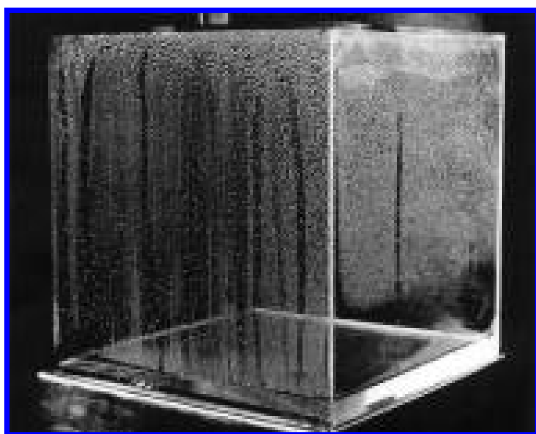

Fig. 4. Hans Haacke, *Condensation Cube*, clear acrylic, water, light, air currents, temperature, climate in exhibition situation, 30 × 30 × 30 cm, 1963. (© 2007 Artists Rights Society [ARS], New York/VG Bild-Kunst, Bonn) Haacke was concerned with production of systems and the operational structure of organizations, in which transfer of information, energy and/or material occurs. Here he demonstrates the dependency of a relatively closed system on its environmental context: Changes in temperature and humidity lead to condensation and evaporation within the cube.

culture and of a loss of an essentialist aesthetic [19]. Furthermore Greenberg was convinced that only abstract art, because of its pure medium specificity, could successfully carry the burden of defeating capitalism. Ironically, however, he was unable to recognize how artists themselves had been converted into a form of cultural capital by the economic processes of art production and consumption [20].

While abstract expressionists and minimalists were still producing discrete form-objects distributed through a traditional gallery system, conceptual artists saw a decreasing range of expression in adherence to the preordained medium-specificity protocol. Thus, their efforts were directed toward a deterritorialization of art from its commercial context in such a way that new possibilities could emerge. In this substantial respect, conceptual art differed from the avant-garde project. As Edward Shanken explains,

> Resisting the arch formalism that had become institutionalized by the 1960s, conceptual art . . . sought to analyze the ideas underlying the creation and reception of art, rather than to elaborate another stylistic convention in the historical succession of modernist avant-garde movements [21].

The dissemination of anti-rationalist writings by John Dewey, an early advocate of knowledge acquisition through experimentation, as well those of Roland Barthes and Umberto Eco, validated new approaches to the art process. These writers endorsed exploration, complexity and diversity. This open-ended approach, while not denying history, allowed it to be renegotiated [22].

The redefinition of creative processes was also extended to unorthodox materials. In Turin, Italy, Arte Povera challenged the assumption that only marble or bronze were suitable materials for sculpture. Trash or refuse, industrial materials, even people, as well as immaterial processes such as moisture, sound or energy, could all be art. Concurrently, art-and-technology also questioned the idea that only tangible media are inherent to artistic expression. Instead, conceptual artists believed that art expressions could be written, gestured, spoken, acted, filmed, industrially produced or conceptualized. The work of art might exist as a momentary, time-based action, such as performance, as in Arte Povera artist Michelangelo Pistoletto's *Ball of Newspapers (Minus Objects)* (1966–1968). In the work as event and performance, an immense papier-mâché ball was rolled through the streets of Turin and filmed. Later, the ball, as sculpture, was enclosed in a metal cage and retitled *Mappamondo* (Globe). This version later appeared in an exhibition in Amalfi. Pistoletto was ultimately questioning the nature of the event: Is it documentary (newspapers) or actuality (performance)? [23] The investigative and participatory process was foremost, however. In another example, Emilio Prini, who produced some of the most dematerialized work associated with Arte Povera, was concerned with notions of time and space and sought to reconnect aesthetic experience with a durational experience of actual lived time. This echoed explorations of the concept of duration by the philosopher Henri Bergson. In Prini's work *L'USA usa* (The USA Uses) (1969), a tape recorder unceasingly recorded the sound of its own mechanisms until it broke down. In *Asta Curbata* (Bent Pole) (1967), the viewer's perception was guided away from the work of art to an awareness of the basic dimensions of space and thus of experience itself [24].

These installations did not remain as singular or isolated moments within the art world but formed a trajectory into contemporary architecture. Jacques Herzog and Pierre de Meuron, Peter Zumthor, Elizabeth Diller and Richard Scofidio have all made claims to the philosophies of conceptual art. Pritzker Award winners Herzog and de Meuron frequently collaborate with artists as part of their design method. The architects have explained that each project begins with a particular form of non-directed

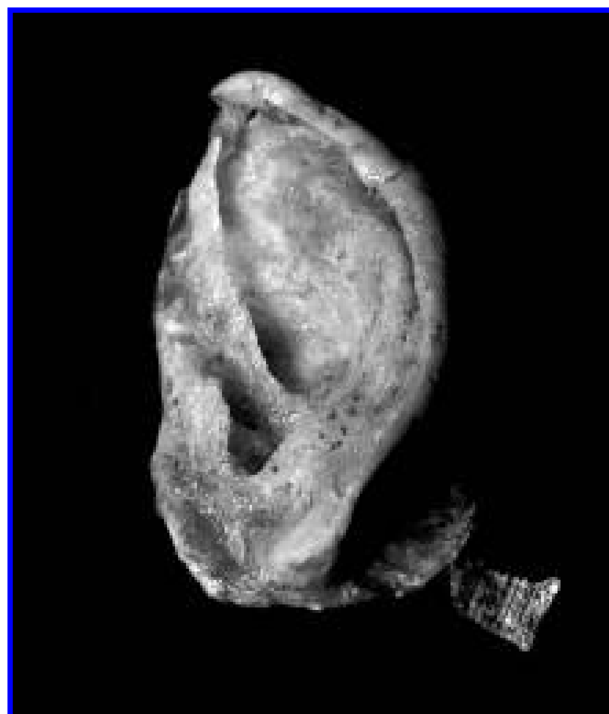

Fig. 5. Tissue Culture & Art (Oron Catts & Ionat Zurr) in collaboration with Stelarc, (top) *Extra Ear—1/4 Scale*, 2003: small ear in hand (bottom) *Extra Ear—1/4 Scale*, close up, semi-living sculptures of biodegradable polymer and human chondrocyte cells, 3cm × 1.5cm × 1.5cm, 2008. (© Oron Catts and Ionat Zurr) Art is continually open to redefinition; TC&A have extended their investigations into living systems.

questioning; the inclusion of an artist reflects their refusal to presume in advance what a future building *ought* to look like (Fig. 2). Swiss artist Remy Zaugg states, "If we know what art or architecture are, we, you and I, merely produce illustrations of what we already know about architecture or art" [25]. In another collaborative project with a biologist, Herzog designed a garden structure, the EDEN Pavilion, which reacted to the weathering process of lichen by transforming the concrete roof structure into a living, evolving generative canopy. Instead of memorializing a static moment in time, the architectural expression encompassed temporality, interacting with the environment whether in sun, fog or rain.

In closely analyzing conceptual art, it should be noted that many rigid disciplinary boundaries and categorizations were initiated by critics and academies, not the artists themselves, most of whom resisted all attempts at classification. It might otherwise be confusing that concurrently with Arte Povera, American artists Bruce Nauman, Walter de Maria and Michael Heizer were linked with what was termed process art. It differed from other conceptual art in that an artist would set a process in motion and await unpredictable results (Fig. 3). This exemplified a radical shift from artist as primogenitor to artist as one who sets up an autonomous and random process.

In Hans Haacke's Plexiglas cubes, or "weather boxes," water condensed and evaporated in response to the changing levels of light and temperature in the gallery (Fig. 4). "A sculpture that physically reacts to its environment and/or affects its surroundings is no longer to be regarded as an object," explained Haacke.

> The range of outside factors influencing it, as well as its own radius of action, reach beyond the space it materially occupies. It thus merges with the environment in a relationship that is better understood as a system of interdependent processes. These processes—transfers of energy, matter or information—evolve without the viewer's empathy. . . . A system is not imagined; it is real [26].

Systems thinking, as well as cybernetics, were at the same time making their way into other disciplines, including art, via art-and-technology, and architectural design theory. Within the architectural discipline, self-criticism occurred primarily through Horst Rittel and other second-generation theorists of the 1970s who critiqued scientific rationalism's prescriptive methods and forged interdisciplinary design research [27]. Advances in technology, psychology, computer sciences and especially "autonomous design" impinged on academic disciplines, creating a need for them to come to terms with the very same issues regarding media and methodology that we face today. The art critic Jack Burnham

> pushed the exploration of the relationship between art and technology to an unprecedented point. In 1970, he curated the exhibition *Software, Information Technologies: Its New Meaning for Art* . . . the show drew parallels between the ephemeral programs and protocols of computer software and the increasingly "dematerialized" forms of experimental art, which the critic interpreted, metaphorically, as functioning like information processing systems [28].

Most conceptual artists also incorporated an interest in perceptual psychology and the role of the viewer, in addition to the processes of making. Primacy was given to immediacy of the experience, traditionally associated with architectural affects. This emphasis was reflected in the increased scale of their projects, often exceeding traditional gallery or museum space and venturing into architectural modes of expression. In one example, the negative space of the exhibition hall is defined by the stacks of felt and the walls. In another, Joseph Beuys removed the exterior wall of a gallery that directly faced an alley and thereby engaged pedestrians as part of the installation. In conceptual moves borrowed largely from the Situationists, actions of passersby and coincidental meetings in time contributed to the work of art. These efforts suggest an element of interactivity and a merging of art, technology and architecture. Conceptual art was dedicated to the possibility of making art outside conventional media, outside normalcy.

By dismantling the inherited frame around defined art, that is to say, the frame of medium specificity, artists opened up the territory of art to include the immaterial conceptual realm as a way to renegotiate the art experience. The ultimate infiltration of Arte Povera, process art and art–and-technology into architectural modes of thinking and production was perversely caused by an extended economic recession during the late 1970s and 1980s [29]. We find the stance taken up by architects who were familiar with both process art and performance: In the United States, Diller Scofidio + Renfro utilized this approach with their Times Square installation *Soft Sell* (Color Plate A No. 2) and their performance of Duchamp's *Delay in Glass* (1986). At that time there was little new work and even less construction, so newly graduated, ambitious, yet unemployed architects began to trespass art's historical territory in search of new forms of architectural expression.

Perspectives

The furthest trajectory of this line of questioning led to the notion that the intrinsic experience of cultural production might be nonmaterial. It was further elaborated in two influential writings: Robert Smithson's *Tour of the Monuments of Passaic New Jersey* and Samuel Wagstaff Jr.'s interview, *Talking with Tony Smith,* which included Smith's night ride on the unfinished New Jersey Turnpike [30]. Both essays radically altered preconceived attitudes about the art experience.

> At first I didn't know what it was, but its effect was to liberate me from the many views I had about art. It seemed there was a reality there that had not any expression in art. The experience on the road was something mapped out but not socially recognized. I thought to myself, it ought to be clear that's the end of art. Most painting looks pretty pictorial after that. There is no way to frame it; you just have to experience it [31].

This view radically differed from previous social codifications of the art object, in that Smith was attempting to define the art expression as nonmaterial, that is to say, as an experience. A similar rupture was effected by conceptual artists who explored "networks of signification" by deploying language through the information arts. Their efforts led to a larger critique of traditional art norms through the analysis of the operative relations within semiotic systems [32]. Contingencies of meaning and material converged in the first digital art installations, as diverse as Nam June Paik's *Zen for TV*, Sonya Rapoport's *Goethe's Urplfanze* (which later evolved into *Shared Dynamics*) and some of the early interactive, digitally based art-and-technology works.

These approaches could then be similarly applied to architectural expression, making it possible to frame architectural production in a more conceptual way. Given that materiality was replaced exclusively by ephemeral experience, contextuality became foregrounded and instrumental in the perception of the work of architecture. Historically, classical/modern architecture viewed the singular built object as inseparable from the architectural experience. However, upon reexamination, this is always revealed to be an assumption. The definition of an architectural experience is in fact em-

bedded within a larger social and cultural system. One objective of critical theory has been to remove surface layers of materiality and expose the invisible forces operating on form, which describe an intricate network of social and economic relationships. This leads one to suggest that the intrinsic architectural experience might not be materially grounded—that it might actually be a set of relations or even a special kind of attention existing outside normative boundaries. This notion is not unique but was advanced by conceptualists who indicated that the most exciting "art" might be still be discovered in social energies not yet designated as art [33], or by John Cage in regard to musical composition and Eleanor Rosch in her psychology research [34]. Architecture, like art, is continually open to redefinition (Fig. 5). However, its acceptance can only be predicated on a reexamination of existing architectural design theories and the proposition of a new ground rather than a deconstruction per se.

It also seems evident that instead of constituting yet another reactionary avant-garde movement, the various threads of conceptual art were actually an attempt to deterritorialize art, to abstract it from a historically bound context in such a way that new interpretive connections could be formed. This process of deterritorialization further recoded the interpretive matrix of the original historical context as part of a socially reflexive process. First, while Arte Povera may not have specified exactly what art *is*, it certainly re-inscribed the boundaries of art production to encompass the conceptual or non-material. Second, process art revealed the narrative process of its own making, so that whatever form the art object may take, it also occupied a transition in time. Third, art-and-technology, using less material modes of expression, found a way to define art as a set of social relations, even if technologically supported.

A broader perceptual shift thus emerged from the 1960s art world, one that eventually found its way into architectural pedagogy and practice. By the mid-1990s, new theories of representation and technologically derived media supported a more diverse range of expression for architects, including installations and web sites, once again generated during a building recession. The gradual infiltration of these three art movements, Arte Povera, process art and art-and-technology, as part of the larger conceptual art movement, into architectural modes of thinking and production indirectly contributed to a transversal of media boundaries to include digital forms of expression and ultimately to an unprecedented dematerialization of the architectural image-object.

References and Notes

1. National Public Radio, interview with film director Bernardo Bertolucci, "Morning Edition," 6 February 2004.

2. Richard Flood and Francis Morris, *Zero to Infinity: Arte Povera 1962–1972*, exh. cat. (London: Tate Museum Modern Art, 2001) p. 21.

3. Sol LeWitt, "Paragraphs on Conceptual Art," in Lucy R. Lippard, ed., *Six Years: The Dematerialization of the Art Object from 1966 to 1972* (Los Angeles: University of California Press, 1973) p. 28.

4. Interview with Pierre de Meuron, Basel, Switzerland, 14 July 2001.

5. The principles of art's universal subjectivity were later codified in Immanuel Kant's "On the Ideal of Beauty," from *Critique of Judgement* (first published 1790), Werner S. Plucher, trans. (Indianapolis, IN: Hackett, 1987) and found their way into Greenberg's thinking.

6. Joshua Reynolds, *Discourses on Art*, Robert R. Wark, ed. (San Marino, CA: Huntington Library, 1959) pp. 145, 175, 182.

7. Gotthold Ephraim Lessing, *Laocoon: An Essay upon the Limits of Painting and Poetry*, Ellen Frothingham, trans. (New York: Noonday Press, 1957) pp. 91–92.

8. Clement Greenberg, "Towards a Newer Laocoon," *Partisan Review* **7**, No. 4 (July–August 1940) p. 305.

9. Shannon Jackson, Charles Altieri and Whitney Davis, Theory across the Arts, Rhetoric 240G, University of California at Berkeley, Fall 2003.

10. John Summerson, *The Classical Language of Architecture* (Cambridge, MA: MIT Press, 1966) pp. 7–8.

11. An exception was the Bauhaus under Walter Gropius's direction. His manifesto called for a unification of all the arts, including performance and theater, "in a cathedral of socialism."

12. Le Corbusier, *Towards a New Architecture*, Frederick Etchells, trans. (New York: Payson and Clark LTD, 1927) pp. 65–83.

13. While many architects, such Alison and Peter Smithson, and councils, such as the Congrès Internationaux d'Architecture Moderne (CIAM), were concerned with social and economic equality after the war, most of their efforts centered on the issue of mass or social housing as a result of a manufacturing drive spurred on by production during and after the war. For many architects, it was difficult to separate mass culture from the goal of standardization, which was believed to be the only practical economic strategy to accomplish social justice. Even these efforts were primarily confined to Europe, as the majority of American architects operated in the midst of a post–World War II building boom.

14. The questions that the Surrealists asked during 1920–1930s were revisited again during the 1960–1970s. Although architectural discourse was not especially engaged with topics related to doubling, media presentations or the origins of transmedia art, other artists were.

15. Whitney Chadwick, ed., *Mirror Images: Women, Surrealism and Representation* (Cambridge, MA: MIT Press, 1998) p. 5.

16. Flood and Morris [2] p. 24.

17. Peter Eisenman does not make distinctions between the art process and the architectural process (although he does distinguish their products). Peter Eisenman, "Conceptual Architecture: Towards a Definition," *A+U*, No. 2 (February 2001) p. 365.

18. Lippard [3] p. vii.

19. Greenberg [8] p. 301.

20. Through his writings, Greenberg promoted abstract expressionism via the gallery system, inadvertently or perhaps intentionally inflating the value of his own art collection.

21. Edward A. Shanken, "Art in the Information Age: Technology and Conceptual Art," *Leonardo* **35**, No. 2, 433–438 (2002) p. 433.

22. Flood and Morris [2] p. 16.

23. Zero to Infinity: Arte Povera 1962–1972, exhibition, Museum of Contemporary Art, Los Angeles, 10 March–11 August 2002.

24. Flood and Morris [2] p. 17.

25. Wilfried Wang, *Herzog & de Meuron* (Basel, Switzerland: Birkhauser Verlag, 1992) p. 191.

26. Germano Celant, *Arte Povera* (New York: Praeger, 1969) p. 179.

27. Jean-Pierre Protzen, Architecture Lecture: Design Theories and Methods, Arch 230, University of California at Berkeley, Spring 2003.

28. Shanken [21] p. 433.

29. See Ref. [4].

30. Tony Smith was educated and practiced as an architect.

31. Samuel Wagstaff, Jr., "Talking with Tony Smith," *ArtForum*, Vol. 4 (December 1966) p. 19.

32. Shanken [21] p. 433.

33. Lippard [3] p. xxii.

34. Eleanor Rosch, "If You Depict a Bird, Give It Space to Fly: Eastern Psychologies, the Arts, and Self-Knowledge," *SubStance: A Review of Theory and Literary Criticism* **30**, Nos. 1–2, 236–253 (2001).

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Over the last decade, “nano” has become *the* buzzword signifying everything from imagined atomic-scale robotic utopias to small electronics. For scientists the shift toward nano has also become ubiquitous; what used to be referred to as “molecular” has been reframed as “nano,” 27 journals devoted to nanotech/nanoscience are now published, and the National Science Foundation and other granting agencies have devoted a significant amount of funding toward nanotech/nanoscience. Among engineers, scientists and science-studies scholars, discussions of the potential of nanotech/nanoscience abound, including conferences that debate the pros and cons of a nano-hegemony and attempt to debunk some of the hype. Artists, however, have only begun to explore this emergent scientific field, leaving it wide open for creative interpretation. With this special section of *Leonardo* we hope to ignite artists’ interest in the exploration of nanotech/nanoscience and encourage scientists, scholars and educators to contemplate the implications of an art-nanotech/nanoscience connection.

Leonardo, in collaboration with the Exploratorium under the auspices of the Nanotech Informal Science Education Network, will publish a series of special sections periodically over the next 5 years exploring the intersections of nanotech/nanoscience and art. We are especially seeking submissions of artworks (visual, performance, sound, etc.) with artists’ statements explaining the relationship of the work to nanotech/nanoscience; essays from scientists, engineers and scholars exploring the connection between nanotech/nanoscience and art; and essays and visuals aiming at nanotech/nanoscience education that uses the arts as a pedagogical tool.

Interested artists and authors are invited to send proposals, queries and/or manuscripts to the Leonardo editorial office: Leonardo, 800 Chestnut St., San Francisco, CA 94133, U.S.A. E-mail: <isast@leonardo.info>. Editorial Guidelines for Authors can be found at <www.leonardo.info>.