
RETHINKING POST-VANGUARD CONCEPTUAL PRACTICES

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INTRODUCTION

This essay is part survey, part provocation; an inquiry in search of new programs, agendas and strategies for “critical” modes of production and practice, informed by a reconsideration of 20th c. material practice, in comparison with contemporary material logics, and conceptually driven practices. The intent is to initiate discussion and provocation towards an “expanded field” of tactics and strategies for (post-vanguard) *material-practices, production and engagement*.

We are witnessing a gradual shift in the perception of what constitutes architecture, from object-specific practices, celebrating the autonomy of form over landscape, to architecture as a field-driven, adaptive enterprise, with the agility to negotiate multiple agencies, technologies, and paradigms. Parallel to this, the rise of the Expanded, Provisional Practice defined primarily by small offices, combining advanced technologies with what Michael Speaks termed Post-Vanguard Design Intelligence, constitutes a model for combining a newly emerging pragmatism with a conceptually driven attitude towards architecture as a performative, adaptive framework for innovation. Offices which leverage both the *Conceptual, Strategic and Technological*, recall both the mid twentieth century practices of Jean Prouvé, the Eames Office, and others, and invoke

the radical-conceptual attitudes of the sixties, within a much more subdued shroud- an anti revolutionary, perhaps evolutionary position that re-negotiates the Performative, Ecological and perhaps Parametric tendencies toward a broad Conceptual enterprise.

Newly “refurbished” models of efficiency proposed by techno-parametric culture (*Kieran & Timberlake: Refabricating Architecture*), fail to capture the possibilities inherent in a re-thinking of conceptually driven architecture. Similarly, the strategic recasting of labor in architecture (*Deamer: Building in the Future*), focuses on a neo-pragmatist approach to architecture, lacking a conceptually driven foundation. In the same vein, the invocation of Ecological Practice (*Tilder: Design Ecologies*) perhaps comes closest to re-instituting a critical-conceptual framework for architecture.

Is it possible to entertain both a renewed sense of pragmatism in architecture, while at the same time advocating for a profound return to the conceptualist practices that informed late twentieth century work, without a return to the “Theoretical Vanguard” but rather through *Thinking in Action and through Material Practice*? The author is invested in a reconsideration of material practice combining a pragmatic leveraging of (parametric, computational) technologies, within the broader framework of conceptual practice. This discussion



Figure 1. Differentiated Terrain (Landscape) and Undifferentiated Terrain (Cloudscape).

is largely absent in contemporary (Digital Fabrication) culture, thus the interest in posing these questions within the broader umbrella of practice, towards a reconsideration of emerging modes of production.

FROM LAG-TIME SPACES TO UNDIFFERENTIATED TERRAINS

Is it possible to describe projects and practices as “Landscapes of Production” by comparing actual terrains with the (conceptual, computational) terrains operative today?

The intent is neither to suggest a unified or unitary theory regarding new modes of practice, nor to suggest that an all-encompassing auto-poiesis of architecture or design is possible or even desirable. Instead, what is proposed here is based more on aspects of situational, contingent and open system ideas, suggesting a model of (open-source) activity or engagement of the architect or designer in society, and of the *technical object* in relation to its maker. The current inquiry probes aspects of both avant-garde negative critique, and post-criticality, without establishing alliances with either, but rather provoking questions concerning what constitutes critical engagement and innovation today, transcending both the limitations of axiomatic systems or formalism, on the one hand, while probing the opportunities and limitations of *performative* practices rooted in material innovation.

The underlying motivation for this research is the desire to understand emerging material practices, as a means to question the uncritical production of both digital and computational systems on the one hand, and the physical artifacts made possible by these systems. In particular, this inquiry may be understood as a search for the implications of repetition, variation, and the move from the (singular, essential) object, to (associative, relational) systems, and from critical project to post-vanguard praxis or engagement, within the confines of an increasingly parametric, computational culture.

Ultimately, the implications of this research are intended to impact the current techno-determinist, self-referential closure of much of today's (parametric, computational, & “fab”) production, in the hopes of establishing new opportunities for a renewed praxis. The intent is not to indict computational culture, but rather to transform it, creating spaces for an expanded, *techno-humanist* model of (material/conceptual) engagement with 21st century technologies.

To begin, I will use the analogy of shifting terrains, from differentiated to mottled, observed during a recent flight from Chicago to Boston (Fig. 1). The left-hand image depicts a landscape with both natural and manmade systems, including meandering rivers, post-glacial pockets or depressions, subdivided fields bounded by the Jeffersonian grid, and residual or interstitial spaces. These various outlines form a composite field of operations, superimposed into pattern formations reminiscent of both Stan Allen's *Field Conditions* and Alex MacLean's aerial photographs. On the right, a mottled and relatively undifferentiated *cloudscape* hovers over the highly developed and differentiated city below.

The differentiated landscape may be seen as an illustration of the contested terrains of late-twentieth century design and art practices, while the increasingly undifferentiated, mottled cloudscape may be understood as indicative of contemporary, technologically over-determined practices, subsumed within the complete containment of global capitalism. If the *surface-structures* of (20th c.) terrains are based on superimposition, negation and displacement, the contemporary surface may be described as essentially featureless, subsuming the joint, and the space within, towards a state of undifferentiated mottling, transformed by technology and capital into an endless “*cloudscape*.” If the late-twentieth century terrains still contained striated “Lag-Time Spaces,” today's smooth, fluid terrains of global capital are represented by the smoothing of surfaces, where the relentless repetition and variation of the (parametric component) fails to serve as a means for differentiation. If the autonomy of architecture was represented by the uniqueness of the detail, the loss of autonomy is now subsumed and represented within the endless cloud of details, obscured by their own proliferation and ubiquity into the post-lag-time cloudscape of contemporary (parametric) production.¹

FROM OBJECT TO SYSTEM

Several frames of reference are necessary backdrops to any discussion on conceptual practices as they relate to art and architecture: *Dialectical Strategies* based on theories of negation or negative critique, and *Opportunistic Strategies, emerging from Provisional, “Post-Edge” or “Post-Vanguard” Practices*, forming the core of this survey.²

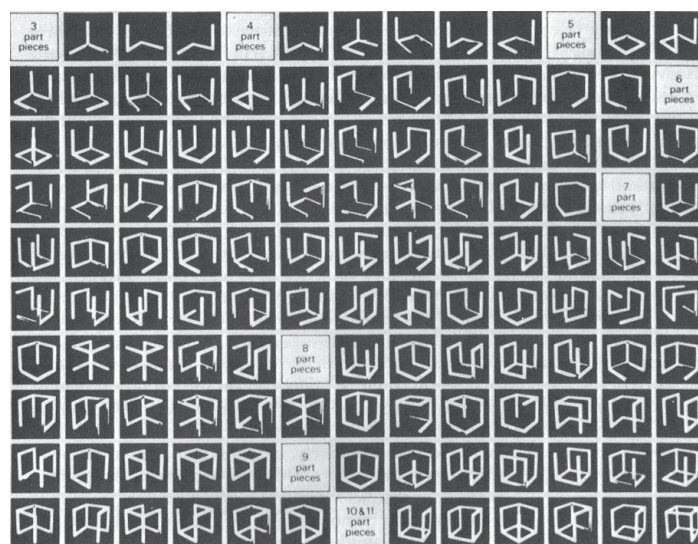


Figure 2. Sol Lewitt: 122 Incomplete Open Cubes.

The first consideration involves revisiting *Conceptual Art*, and by extension, conceptual strategies in architecture, acknowledging the roots of this movement within the context of the critical art theories and practices of the 1960's and 70's. In particular, attention must be paid to the relation of conceptual art to the wider framework of mini-

malist or “literal” art, and the strategies and tactics that arose from these movements. Two seminal essays stand out from this period, both of which would establish particular responses to the primary debates of the time between Painting and Sculpture (Clement Greenberg and Michael Fried) that have been exhaustively documented.

In particular, *Specific Objects*³ by Donald Judd, and *Paragraphs on Conceptual Art* by Sol Lewitt, introduced the shift from a (modernist) conception of art, to what we would now discern as a post-structuralist or postmodern understanding of the “*Expanded Field*” of art much discussed by Rosalind Krauss. These documents and positions form the backdrop to the present discussion, however they will be referred to only briefly as they are beyond the scope of the current work.

One of the hallmarks of conceptual art strategies during the height of the movement, was the shift from a reliance on the presence and materiality of the object, as a subject of contemplation, towards the production of the object as a singular or multiple instance of an axiomatic system, or idea. Conceptual art was Anti-Craft and Anti-Material. This is evident in the work and writings of Sol Lewitt, who advocated for the primacy of idea, axiom and system, above objecthood:

“In conceptual art the idea or concept is the most important aspect of the work. When an artist uses a conceptual form of art, it means that all of the planning and decisions are made beforehand and the execution is a perfunctory affair. The idea becomes a machine that makes the art.”⁴

An example of this is Lewitt's *122 Incomplete Open Cubes* (Fig. 2). Lewitt's serial structures were emblematic of ‘self-exhausting’ systems; embodying a finite set of operations, procedures or axioms. The conceptual operations from closed or exhaustive to “open systems” evident in art from the 1960's and 70's, was based on “systematic praxis guided by formalized code.” Instead of contemplation of the solitary object, the viewer negotiates the space between objects, and ultimately the “viewer's imagination is stimulated to

imagine this generative code, to imagine all the variations that can be generated by the code.”⁵

A related aspect of the changing nature of the (sculptural) object was the activation of the surrounding space, critically appropriating, questioning and expanding the space of the gallery. This changing status was introduced by Judd's essay, *Specific Objects*. A significant aspect of the Specific Object with respect to the current inquiry involves the re-direction of the (viewers) perception away from the object itself, towards an intensification of the “Real” space of the viewer.⁶ Together, the shift from Object to (Axiomatic) System, and the Activation of the (Expanded, Real) Space of the viewer, provided a means to critically engage modes of production, reception and engagement of the work of art utilizing conceptual practices in the context of the 1960's and 70's. A comparison can be made between these shifts from object to system in 20th century conceptual practices, and the present context.

Systems Thinking Today

A second consideration of conceptual practices focuses on the shift from (closed) axiomatic systems, to Open Systems, engaging external parameters and influences, from the perspective of performative, material-specific, site-specific and environmental parameters.

The shift from object to system, and from closed to open systems, has been observed in many levels of art and design, in both built work and speculative proposals, such as the early sculptural work of Mary Miss (*Field Rotations* and *Perimeters/Pavilions/Decoys*), Richard Serra (*Shift*) and the networked cities envisioned by Yona Friedman's *Irregular Structures* and *Villa Spatiale*.⁷ Within architecture theory and practice, the built work and theories of Peter Eisenman may be seen, retrospectively, as inheriting much of the Axiomatic thinking from the conceptual art practices of the 1960's, in particular the exhaustive finite series of transformations found in Lewitt's Cube variations.⁸

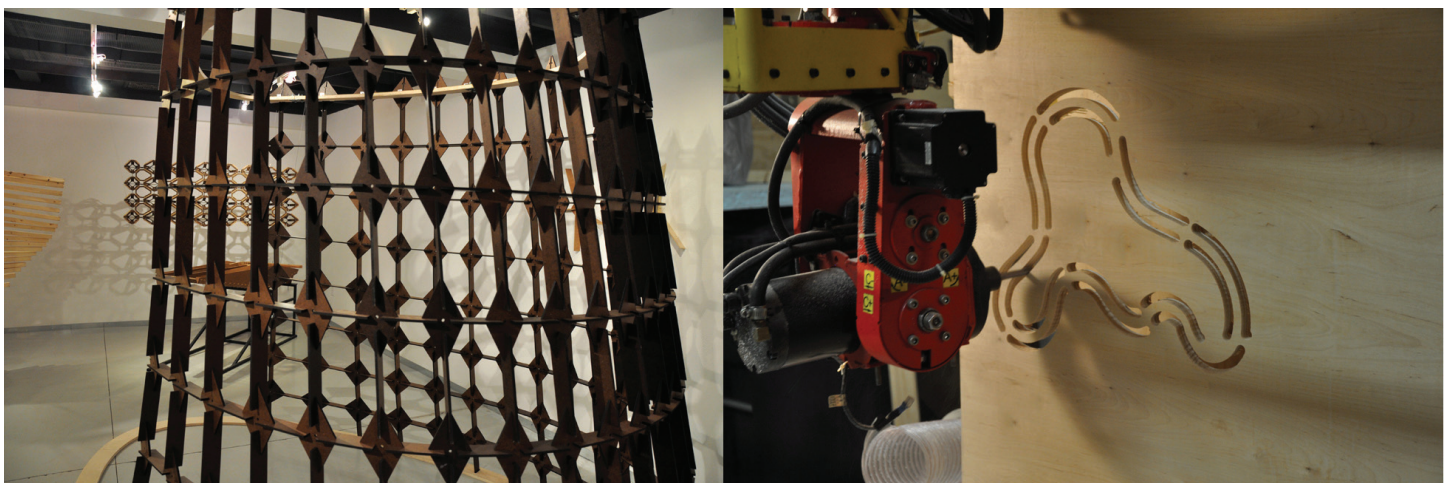


Figure 3. Customized Parametric Components: FABCRAFT Exhibit + Aalto Series milling experiments.

Within the context of parametric design and culture, we may witness a shift from the self-conscious use of repetition, variation, and transformation of the object or artifact, from a critical tool pointing the observer towards a (reflexive) notion of an all-encompassing system, operative in avant-garde practices such as Lewitt's, towards an (uncritical) proliferation of the paradigm of (customized, parametric) variation, now embedded within a (post-vanguard) context devoid of the original meta-project of resistance. The concept of an open-system is today associated with open-source, code sharing, collaborative fabrication frameworks, and mass customized assemblages. What has been lost, perhaps, in the technological advancement of system over object, is the notion of the "critical" artifact, the self-conscious detail, now subsumed within the new paradigm of computationally mediated performance. (See Fig. 3).

REFLEXIVE INNOVATION

The implications for a renewed investment in conceptual practices within the context of contemporary architectural productions are multiple and not without controversy. The intent of this brief foray investigating the potential of conceptual practices today in architecture is not to enter into the now historical debates between idea and object, nor to provide any definitive framework for what constitutes conceptual practice in architecture. The intent is quite simply, to open up new (projective) spaces of operation, new frameworks for production and engagement, within the current so-called "post-critical" or "post-vanguard" era dominated by the isomorphism of both global capitalism, and the homogenizing tendencies of digital (parametric) culture and production.

The "difficulty" in reconsidering conceptually driven work, stems from the current shift away from (the endgame) of criticality, or negative critique, as a now contested strategy of resistance, essentially dismantled by the enveloping fluidity of global capital. The search for new strategies of (critical) production and engagement follows a trail from the avant-garde practices of early modernism, based on strategies of resistance, to the neo-avant-garde of the 1970's through 1990's, during the height of Late Capitalism. The current period has been termed a transitional state from a "*First to a Second Modernity*," by the sociologist Ulrich Beck.⁹

Innovation, as advocated by Speaks, and promoters of "post-criticality," may not necessarily lead towards new strategies for overcoming the homogenization of architecture within global capitalism, without a mechanism for (self) reflection, transformation and action. The entrepreneurial form of innovation proposed by Speaks is adopted here with caution, as an initial tool for new agendas within the specificity of a technologically circumscribed, computational culture of "surface" architecture.

Several possibilities have been proposed for new strategies confronting the totalizing envelopment of capitalism within the post-avant-garde era. The most interesting, from the standpoint of conceptually based practices, is the term "Reflexive" Modernization,"

a combination of *Reflection* and *Reflex*, introduced by Beck and described by Varnelis as a post-avant-garde strategy:

"Reflexive practice implies both reflection and reflex. Reflection refers to an awareness of the perpetual need to reinvent oneself in contemporary society as one practices... The result would be an oeuvre in which new projects ceaselessly rework problems raised by earlier ones to form a body of work that coheres not through methodological consistency, but rather through methodological evolution."¹⁰

The application of a *reflexive* attitude towards thinking and making, inscribed by analog, craft based practices, modernist reductive practices, and ultimately by computational practices, may lead towards a rethinking of technology, asserting both the heideggerian notion of "questioning technology," and Dewey's notion of experimental thinking:

"What Dewey defines as technology is not what is commonly understood in today's philosophy of technology. Instead of meaning knowledge of how to make and use artifacts or the artifacts themselves, technology for Dewey is an art of experimental thinking. It is, in fact, intentional operations themselves carried out in the sciences, the arts of production, or social and political action. We mistakenly identify technology with one particular type of product- hardware- that may result from experimental thinking, but overlook the art that lies behind and provides the basis for creating other types of products."¹¹

While touched on here to provide context, the reader is urged to read the ongoing debates surrounding post-criticality, by R. E. Somol, Sarah Whiting, Michael Hays, Hal Foster and Michael Speaks, among others engaged in understanding and proposing what has been termed the "Post-Vanguard." In particular, the essays and responses in Praxis 5, under the heading of "architecture after capitalism," serve to underscore the difficulty in establishing a clear demarcation between critical theory and current (post-critical) strategies.¹² Rather than deflect the intent of this essay- to investigate the status of the *conceptual* as a strategy for production, the author will refer the reader to these texts.¹³

Within this broad backdrop, a singular framework stands out as an opportunity for investigation; the Relation between technological *Innovation* and *Conceptually* driven practices.

Michael Speaks has advocated for new strategies to confront the loss of (criticality) within global capitalism by suggesting that the "pursuit of innovation" is a hallmark of emerging practices. Drawing from the management philosophies of Peter Drucker, he defines innovation as exceeding the given parameters of a problem or problem solving, towards a re-framing of the given problem, creating new forms of knowledge and opportunities:

"While problem-solving works within a given paradigm to create new solutions to known problems, innovation risks working with the existent but unknown in order to discover opportunities for unpredictable design solutions."¹⁴

In and of itself this approach to innovation may devolve towards the creation of novelty for its own sake, or worse, complicity with the

homogenizing power structures and commodification of fluid, global capitalist systems. However, as a strategic framework for confronting current social, environmental and economic challenges, *innovation* may provide an (entrepreneurial) method for translating ideas and concepts into “thinking in action” uncovering new agendas for architecture and offering alternatives to negative strategies of “resistance.” The enabling shift underlying post-vanguard appropriation of innovation as a positive tool, Speaks tells us, is the “evaluation of knowledge based on its use-value rather than truth content.”¹⁵

TRANSDISCIPLINARITY + TOOLING

What are the relations between *Reflexive Material Practices*, and the evolution of the *Technical Object*? As Gilbert Simondon has shown, there is a tense reciprocity between the relative *abstract or concrete technicality of objects*, and the changing nature of the man-machine relationship in modern societies. According to Simondon, man becomes an organizer of “ensembles” of technologies, rather than a maker of (technical elements) in modern society. Simondon understood the “malaise” that ensues as society progresses from a technical to a post-technical era.¹⁶

The current era of renewed interest in material practices comes at a time when we are reconsidering the value of transferring tacit (craft) knowledge from the hand to the robot, creating a composite culture of technical expertise, embedded in both the (conceptual) practice, the (computational) procedure and the (robotic) tool. Reflexive practice today is therefore tied up in our emerging relationship with the use value of a new category of tooling- the “meta-tool” of code + robotics.¹⁷

The evolution of the tool from a specialized instrument, capable of a limited range of operations, requiring manual expertise, to the generalized robot or meta-tool, requires a new level of Transdisciplinarity, anticipated by 20th century pioneers in (reflexive) material practices, such as Jean Prouvé and the office of Charles & Ray Eames, who understood the changing relation between emerging materials, (post-war) economic shifts, and “composite” craft + advanced fabrication techniques.

“Transdisciplinary practices and research view the exchange of concepts and techniques between established disciplines in terms of translation and transference. Such an approach is distinct from more pervasive notions of *interdisciplinarity*, which endorse the crossing of disciplines as a means to establish shared methods or concepts. Rather, transdisciplinary work, as Homi Bhabha suggests, “happens at the edge or limit” of our own discipline where we become acutely aware of, and in need of, disciplinary knowledge.”¹⁸

EAMES & PROUVE: REFLEXIVE MATERIAL PRACTICES

Aspects of reflexive innovation in material practice may be examined by comparing the project versus praxis of two 20th c. design innovators; the concept of the architect as “*constructeur*” as proposed by Jean Prouvé, and the bentwood developments of the Eames office. In both of these examples, a differentiation must be made between the *physical* innovation in materials and systems, and the *relational*

innovations in the logistical deployment of new economic, factory production and labor practices. In the case of the Eames office, the opportunistic strategy of linking craft-based artisanal development of the compound-curved bentwood leg splint with the military-industrial establishment, served as a model for much post-war economic development tied to design thinking. The striking contrast between the home made “Kazam!” machine utilizing heat and pressure for bending wood and curing fiberglass resin, and the demands of industrial production of leg splints for deployment in the field, serves as a case study in the use of “performative patterning systems.” The economies of material, and the resolution of stresses in the bending process, were integrated in the shape and form of the leg splint. In addition, the “mapping” of the form onto the body, served as a means to calibrate the performative qualities of design innovation within a constraint-based logic of material (see Fig. 4).



Figure 4: Eames Splint (left), Aluminum Centenary Pavilion by Prouvé (right).

The normative relation of designer versus maker or fabricator was challenged by the organizational strategies of “Ateliers Jean Prouvé.” Neither “Master Builder” nor purely architect in disposition or practice, he understood innovation as a reframing of the entire process of material practice, from singular conceptualization, to performative material development, through control of fabrication as both a proprietary and collaborative practice. His self-described position as a “*constructeur*” continues to challenge our assumptions regarding the relation between architect as an (autonomous) agent, independent of the industrial apparatus of material produc-

tion, the engineer, and the fabricator, enmeshed in the economies and labor forces of material systems production.

A primary aspect of innovative material practice for both the Eames office and Prouvé, regards the encounter with shifting concepts of organizational knowledge & labor, in regard to the development of the *technical objects, processes or procedures*, embedded within rapidly changing definitions of practice.

“Capital intensity is partly conditioned by technological turbulence—a situation in which a product, or the technologies and techniques associated with it, are prone to modification, either because they have not completed their evolutionary cycle, or because change is a built in characteristic of the work.”¹⁹

This notion of an evolving, turbulent Technicity—moving from a less developed, single function artifact, object or system (abstract technical object) towards a more highly evolved, coherent, multiple function composite or ensemble (concrete technical object) is essential in understanding the contributions of both Prouvé and the Eames office towards a modern conception of practice.²⁰

CONTEMPORARY REFLEXIVE PRACTICES

A comparison between the “reflexive” practices of Prouvé and Eames with two contemporary offices, may provide insight towards models of reflexive, post-vanguard practices and their modes of engagement today. The office of Vincent James and Jennifer Yoos

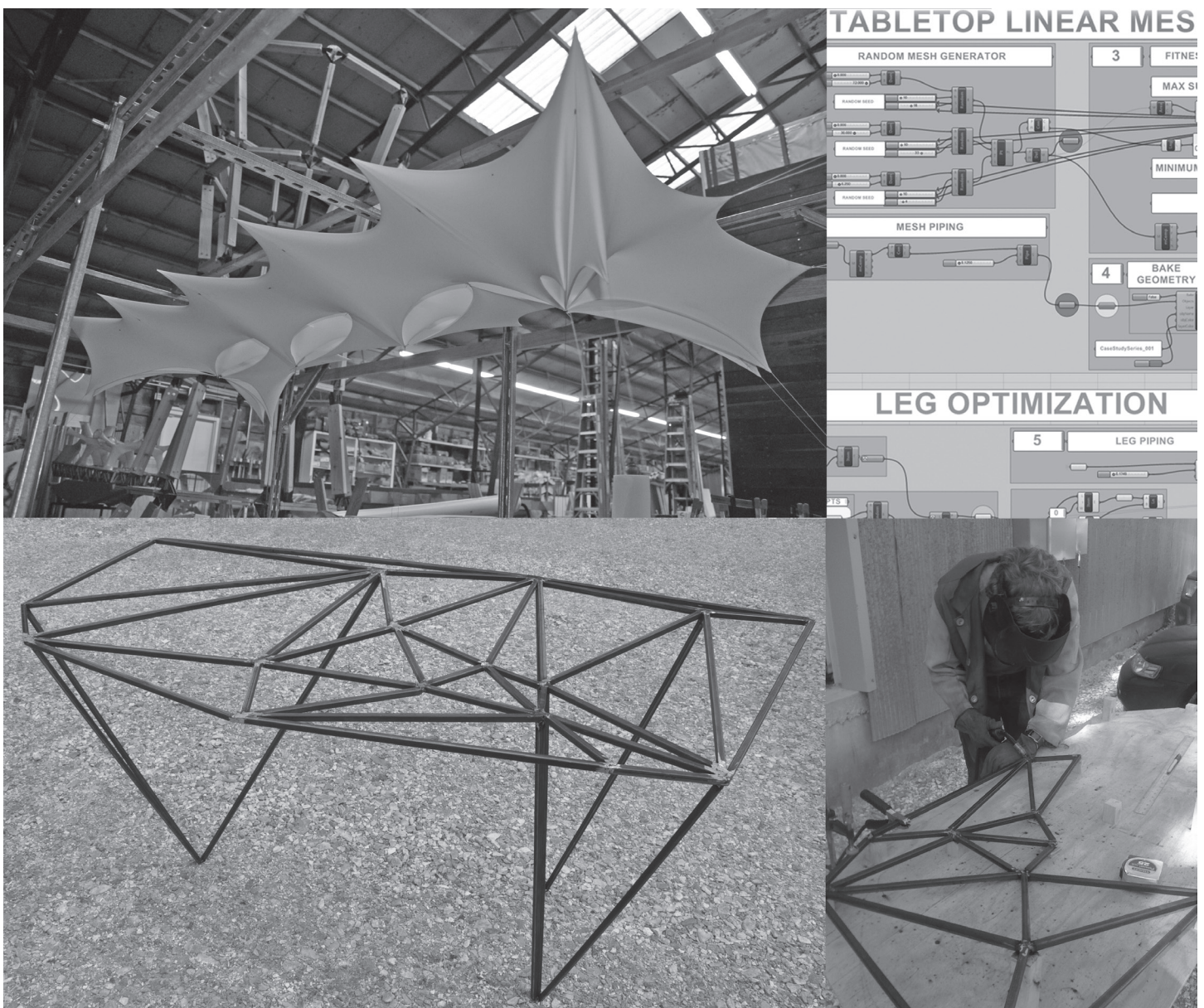


Figure 5: Material + Parametric Prototyping in the author's combined teaching + research “FABLAB.”

(VJAA) in Minneapolis, MN, serves as an example of a “conceptual-pragmatist” approach to innovation and entrepreneurship. In their built work, research and writings, VJAA employ the concept of architecture as engaging a “Temporal Field” of environmental flux, movement and transformation, while maintaining architecture’s “relatively fixed physical formations.”²¹ The office of VJAA may be seen as grounded in a contemporary form of disciplinarity, while engaging post-vanguard conceptual practices.

In comparison with the Temporal Field / Fixed Formation slow evolution of architecture proposed by VJAA, the work of Mos-Office, (Michael Meredith & Hilary Sample) illustrates a more “transdisciplinary” series of opportunistic strategies, merging computation, advanced fabrication methods and complex geometric experiments, within the overall umbrella of practice. Both firms embody the qualities that have been outlined here, engaging Michael Speak’s notion of innovation without either resorting to strategies of resistance, or relinquishing the goals of the architect to market forces.

CONCLUSION

In the concluding paragraph of Tombesi’s essay on the re-organization of labor in architecture, he suggests that academia is the laboratory for promoting new forms of experimental engagement, innovation, and ultimately, practice. In order to move the academic learning environment towards a rethinking of Post-Vanguard practice, a re-negotiation of the Design + Making relation must be considered (Fig. 5).

In a similar manner to the evolving diagrams replacing the static model of Owner/ Architect/Builder, academic design institutions need to evolve a new diagrammatic and spatial configuration for the teaching of design. The introduction of computational and robotic fabrication technologies serves as a provocation to rethink the design studio. Within this context, what is proposed here is the elimination of the separation between the design studio, and the “Fablab” environment, collapsing both into an integrated design, prototyping and large-scale fabrication environment, combined with new strategies for the teaching of entrepreneurial business practices in architecture. The time has come to rethink the engagement of technology + economic models not only in emerging provisional practices, but also in the largely conservative institution that is the academy of architecture (See Fig 5).

ENDNOTES

- 1 Boyer posits the existence of “lag-time places” as a negative consequence of post-modern life in M. Christine Boyer, “The Imaginary Real World of CyberCities,” in *Assemblage 18* (Cambridge: MIT Press 1992) p. 114-127.
- 2 Marc Tsurumaki, “Beyond?,” in *Provisional: Emerging Modes of Architectural Practice USA*, ed. Elite Kedan, Jon Dreyfous, and Craig Mutter (New York, NY: Princeton Architectural Press, 2010), p. 24-27.
- 3 Donald Judd, “*Specific Objects*,” written in 1964. First published in *Arts Yearbook 8*, 1965.

- 4 Sol Lewitt, “Paragraphs on Conceptual Art,” in *Artforum*, June, 1967.
- 5 Boris Groys, “The Mimesis of Thinking,” in *Open Systems: Rethinking Art c.1970*, ed. Donna De Salvo (London: Tate Publishing 2005) p.50-63.
- 6 See the online commentary on Judd’s *Specific Objects* essay, in Aaron Davis, “What You See is What You See: Constructing the Subject-Object,” *Art & Education*, <http://www.artandeducation.net/>.
- 7 Yona Friedman, *Pro Domo* (Barcelona, Spain, 2006). For an extended look at conceptual practices in late 20c sculpture, see Rosalind Krauss, “Sculpture in the Expanded Field,” in *The Originality of the Avant-Garde and Other Modernist Myths* (Cambridge, MA: MIT Press 1991) p. 277-290.
- 8 For a recent perspective on computation with regard to the influences of Lewitt and Eisenman, see Claus Peder Pedersen, “Cubes And Concepts: Notes On Possible Relations Between Minimal Art And Architecture” in *Town Planning and Architecture*, Versitas: Lithuania, 2010.
- 9 For an overview of the shift from critical theory and resistance to the current problematics of production, see Kazys Varnelis, “Ethics after the avant-garde: The critical, the post-critical, and beyond” in *Architecture, Ethics and Globalization*, ed. Graham Owen (New York, NY: Routledge, 2009), p. 148-157. For an in-depth look at “Second Modernity,” see Ulrich Beck, “The Transition from the First to the Second Modernity, in *The Brave New World of Work*, (Malden, MA: Blackwell Publishers, 2000) p. 17-35.
- 10 Varnelis, p. 154.
- 11 John Dewey, “By Nature and By Art,” quoted in Richard Buchanan, “Wicked Problems in Design Thinking” in *The Idea of Design*, Victor Margulin and Richard Buchanan, eds. (Cambridge, MIT Press 1992) p. 5.
- 12 Reeser, A. and Ashley Schafer, eds. *Praxis: Journal, Architecture After Capitalism Vol. 5* Praxis, Inc.: Cambridge, MA. 2003.
- 13 See the essay by R. Somol and Sarah Whiting. “Notes on the Doppler Effect and other Moods of Modernism.” *Perspecta, Vol. 33, Mining Autonomy: Yale Architectural Journal* MIT Press: Cambridge MA. 2002. Pp. 72-77.
- 14 Speaks, Michael. “Intelligence After Theory.” *Perspecta 38 Architecture After All: Yale Architectural Journal* MIT Press: Cambridge, MA. 2006. P 103-108.
- 15 Ibid, p. 104.
- 16 For an English translation of Gilbert Simondon’s essay *On the Mode of Existence of technical Objects*, see the excerpt from a forthcoming *Semiotext(e)* titled “Gilbert Simondon: The Essence of Technicity” by Dan Mellamphy, Ninian Mellamphy et. al., (Cambridge, MA: Semiotexte/MIT Press). Accessed May 22, 2012, http://academia.edu/Papers/in/Gilbert_Simondon_Philosophy_Philosophy_.
- 17 For an in-depth look at the relation between craft & computation, see Malcolm McCullough, *Abstracting Craft: The Practiced Digital Hand* (Cambridge, MA: MIT Press, 1996).
- 18 Mark Linder, *Nothing Less Than Literal* (Cambridge, MA: MIT Press, 2004) p. 2.
- 19 P. Tombesi, “On the Cultural Separation of Design Labor,” in P. Deamer and P. Bernstein, eds., *Building (in) the Future: Recasting Labor in Architecture* (New York: Princeton Architectural Press, 2010) p.117-136.
- 20 For an understanding of the evolution of technical objects from abstract to concrete, see B. Reichlin, “Technical Thought, Techniques of Thinking” in Dumont d’Ayat, C. and Reichlin, B., eds. *Jean Prouvé- The Poetics of the Technical Object*, Weil am Rhein: Vitra Design, 2005.
- 21 V. James and J. Yoos, “VJAA” (New York: Princeton Architectural Press, 2007).