

Architectural Knowledge and the Performativity Criterion: Computation, Mercantilization, and Design Thinking in the “Post-Critical” Era

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“The question (overt or implied) now asked by the professionalist student, the State, or institutions of higher education is no longer ‘Is it true?’ but ‘What use is it?’ In the context of the mercantilization of knowledge, more often than not this question is equivalent to: ‘Is it saleable?’ And in the context of power-growth: ‘Is it efficient?’”

-Jean-François Lyotard, *The Postmodern Condition*

THE END OF THE OPPOSITIONAL

From its inception in October, 1986, until its conclusion in April, 2000, the MIT Press journal *Assemblage* was the predominant forum for academic architectural discourse in the United States. In the inaugural, 1986 issue of the journal, its founding editor, K. Michael Hays, referred to the journal as “a format for oppositional knowledge — knowledge that continually questions received ideas, that challenges entrenched institutions and values, that strays from permissible terrain.” The content of *Assemblage* generated over the next fifteen years unquestionably adhered to this format: articles like Stanford Anderson’s “The Fiction of Function” refuted the philosophical paradigms of Modernism, Diana Agrest’s famous “Architecture from Without: Body, Logic, and Sex” exposed the sexism latent in the canonization of architecture, Mark Wigley invoked Post-Structural philosophy to provide a philosophical alternative to dominant metaphors of architectural stability and “foundationalist logic.” The voices of prominent philosophers like the American Pragmatist Frederic Jameson, the Post-Structuralist Jacques Derrida, and the Lacanian Slavoj Zizek, all found a place in the journal; meanwhile, developments in the hard sciences and mathemat-

ics were employed to question Newtonian space-conceptions, as in Sanford Kwinter’s “Landscapes of Change: Boccioni’s ‘Stati d’animo’ as a General Theory of Models” and Greg Lynn’s “Multiplicitous and Inorganic Bodies.” Generating “oppositional knowledge,” it seemed, meant questioning everything accepted as traditional architectural thought, but questioning it under the aegis of a broad range of intellectual developments, from philosophy to science, from psychoanalysis to gender studies, without a fixed objective. The “format” for architectural thinking provided by *Assemblage* was, by its very nature, an indeterminate one, yielding a plurality of intellectual models for the formation of architectural thought.

The *Assemblage*-era definition of “oppositional knowledge,” for our purposes to be called “critical theory,” has been eclipsed in the last eight years of architectural discourse. On the heels of *Assemblage*’s cessation in 2000, architecture saw the formation of a loosely unified “Post-critical” movement, constituted as a set of polemical articles published from 2002 to the present, by authors such as Michael Speaks, Stan Allen, Bob Somol and Sarah Whiting. While the individual views of these authors varied, all were in agreement on the fundamental thesis that the era for “oppositional knowledge” had come and gone. In *A+U* (2002) Michael Speaks would argue “theoretical vanguards were incapacitated by their own resolute negativity” insofar as they “operated in a state of perpetual critique.”¹

The question of what constitutes “design thinking” today, then, is an interesting one. We find ourselves at a juncture in which the old model — that

"format" for questioning all formats, or the paradigm of "critical theory" — has been discarded, and with it, the plurality of intellectual models it afforded. To be clear, this paper is not a vindication of the model of "critical theory," or a mourning for its loss from architectural discourse. While *Assemblage* was largely brilliant and incisive, it did see a few instances of watered down philosophy, or redundancies in its conceptual scope. More significantly, while the journal saw a largely invigorating fifteen year run, all intellectual projects stand to be invented anew, at some point, and it seems that the editors of *Assemblage* selected the right moment for the journal's cessation. Thus, rather than sing the dirge for oppositional knowledge, this paper seeks to more precisely analyze one, specific, "Post-Critical" tactic for knowledge production in architecture expressed in the writings of vociferous Post-Critic Michael Speaks, and analyzing the strategies of "design thinking" pursued by the architectural practices that he particularly lauds.

THE RESEARCH PARADIGM

The end of criticality and the rise of a new methodology for design thinking ostensibly began in the final issue of *Assemblage*, No. 41, of April, 2000. The tack for the final issue of the journal was simple: the journal's previous contributors were each offered one page of space on which to publish anything they liked — some ventured translations, poems, images of built works, or brief commentaries on the decline of the journal. The critic Michael Speaks, a harbinger of the Post-Critical movement, used his page to dismantle the intellectual tradition that *Assemblage* represented, in a short essay titled, "Which Way Avant-garde?," in which he proclaimed that

Resolutely critical and resistant to an emergent commercial reality driven by the forces of globalization, weighed down by its historical attachment to philosophy, and unable to recognize itself as a new mode of commodified thought, theory has not been free or quick enough to deal with the blur of e-commerce and open systems. Ultimately, theory, and the avant-garde project it enabled, has proved inadequate to the vicissitudes of the contemporary world.²

Alluding to the critical stance of anti-capitalist resistance, or what Hays might call, "the challenging of entrenched institutions and values," Speaks continued:

The assertion is very bald, very clear. Architecture should no longer recoil from the degraded world of business and managerial thinking. On the contrary, it should aggressively seek to transform itself into a research-based business. This sober assessment of the relationship between research and design is now an important feature of the current work being done at the Berlage Institute in Rotterdam and has also become one of the organizing features of Metropolitan Research and Design, a new postgraduate program started this past year at SCI-Arc. It is my contention that this managerial approach provides the intellectual infrastructure necessary for the development of a fleet-footed generation of architects and urbanists ready to meet globalization's challenge: namely, the challenge presented by quantity and commercialization to develop softer design strategies flexible enough to deal with the demands of the market.³

Speaks' manifesto for design thinking was so perfectly diametrically opposed to the aims of critical theory that it seemed a merely a valedictory insult shouted as the door slammed on the older generation of *Assemblage* critics. Where, for the critical theorists, the challenge was against capitalism, for Speaks, the challenge was to meet capitalism's demands; where, for the theorists, existing institutional frameworks stood to be questioned, for Speaks, managerial infrastructure was to be embraced. And, most importantly, where "research," for the theorists, had implied engagement with Continental philosophy or the Sciences for the sake of advancing the formal or semiotic functions of architecture, for Speaks, "research" was market research — a now reverent embrace of the workings of "the degraded world of business and managerial thinking."

It is particularly through the use of this last strategy — the reconstitution of design 'research,' that Speaks aptly explains (and promotes) a set of tendencies that have become increasingly prominent in architectural knowledge production in the last eight years. To better understand the position that Speaks occupies, one must first gauge the contextual circumstances in which contemporary knowledge production functions.

JEAN-FRANCOIS LYOTARD AND THE PERFORMATIVITY CRITERION

Jean-Francois Lyotard's 1979 essay, *The Postmodern Condition: A Report on Knowledge*, was commissioned by the Conseil des Universités du Québec as an analysis of the changing state of knowledge pro-

duction in the late 20th century, in the wake of computerized technology and the global spread of Neo-Liberal Capitalism. While the essay is best known for defining Postmodernity as the age that denounces the “grand narrative,” too little importance has been attached to the real meaning of the text, which was to explain the complex and necessarily cyclical relationship between the computerization and the mercantilization of knowledge that characterizes scientific thinking in the Postmodern era.

Lyotard opens his report with the assertion that, “the status of knowledge is altered as societies enter what is known as the postindustrial age and cultures enter what is known as the postmodern age.”⁴ The nature of this epistemic paradigm shift begins with a reconstitution of knowledge into “quantities of information”— or, units of meaning — that comply with the forms of computational knowledge, or, essentially can be parsed in the language of binary code. Lyotard writes:

The proliferation of information-processing machines is having, and will continue to have, as much of an effect on the circulation of learning as did advancements in human circulation (transportation systems) and later, in the circulation of sounds and visual images (the media) . . . The nature of knowledge cannot survive unchanged within this context of general transformation. It can fit into the new channels, and become operational, only if learning is translated into quantities of information. We can predict that anything in the constituted body of knowledge that is not translatable in this way will be abandoned and that the direction of new research will be dictated by the possibility of its eventual results being translatable into computer language . . . Along with the hegemony of computers comes a certain logic, and therefore a certain set of prescriptions determining which statements are accepted as “knowledge” statements ⁵

The totalizing translation and reduction of all forms of knowledge into the hegemonic language and “channels” of binary code contributes to two other characteristically “Postmodern” shifts in the relationship between knowledge and “the knower;” Lyotard terms these shifts, “exteriorization” and “mercantilization.” First, knowledge is exteriorized insofar as learning is no longer legitimated by a discourse about the development of the individual subject who learns:

We may thus expect a thorough exteriorization of knowledge with respect to the knower, at whatever point he or she may occupy in the knowledge process. The old principle that the acquisition of knowledge

is indissociable from the training (Bildung) of minds, or even of individuals, is becoming obsolete and will become ever more so ⁶

The alienation of the individual knower from knowledge is an attendant effect of a more significant shift in the relation of knowledge to the free market economy, which Lyotard describes as “the mercantilization of knowledge,” or the reduction of knowledge to a “marketable” commodity:

The relationship of the suppliers and users of knowledge to the knowledge they supply and use is now tending, and will increasingly tend, to assume the form already taken by the relationship of commodity producers and consumers to the commodities they produce and consume — that is, the form of value. Knowledge is and will continue to be produced in order to be sold, it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange. Knowledge ceases to be an end in itself ⁷

Lyotard continues to formulate an analysis of the relationship between the mercantilization and the computerization of knowledge in the charting the relationship of Science — the “dominant” form of contemporary Western knowledge — to capitalist production. Lyotard terms this relationship, “The Performativity Criterion,” to imply that scientific knowledge production now falls under a new rubric for its legitimation, or a “criterion” defined by its efficiency. The “Performativity Criterion,” or the “principle of optimal performance,” is the rule according to which Scientific knowledge, under the governance of its own mercantilization, develops its discourse. The performativity criterion can be defined as a simple input output ratio, in which the “criterion” for legitimate scientific knowledge is “maximizing output (the information or modifications [in the general techno-social system] acquired) and minimizing input (the information acquired in the process.” In other words, the discourse of science is appropriated and channeled into a larger economy of production, in which its efficiency and commercial applicability defines its worth. The Performativity Criterion affords a certain cyclical relationship between computerization, or technology, and mercantilization, or commerce. The cycle begins from the traditional discourse of Science — science as science, or science for its own sake. The original aim of science is to produce what Lyotard terms “good denotative statements,” or, simply put, true factual statements —verifiable observations about the material world. To make these

verifiable observations, however, requires a certain amount of accuracy and precision, one that the human sensory capacity cannot offer. This is where science, in its own aim, necessitates the development of technological apparatuses:

What constitutes a scientific observation? A fact that has been registered by an eye, an ear, a sense organ? Senses are deceptive, and their range and powers of discrimination are limited. This is where technology comes in. Technical devices originated as prosthetic aids for the human organs or as physiological systems whose function it is to receive data or condition the context. They follow a principle, and it is the principle of optimal performance: maximizing output (the information or modifications obtained) and minimizing input (the energy expended in the process)⁸

Thus, the standard for scientific verifiability is raised in conjunction with the development of technologies that supplement human sensory capacities — hence, a direct relation between “cutting edge” science and sophisticated utilitarian technology develops. However, sophisticated technology requires capital funds:

By the end of the Discourse on Method, Descartes is already asking for laboratory funds. A new problem appears: devices that optimize the performance of the human body for the purpose of producing proof require additional expenditures. No money, no proof — and that means no verification of statements and no truth. The games of scientific language become the games of the rich, in which whoever is wealthiest has the best chance of being right. An equation between wealth, efficiency, and truth is thus established⁹

Yet, it is here that the vicious cycle begins, for

What happened at the end of the eighteenth century, with the first industrial revolution, is that the reciprocal of this equation was discovered: no technology without wealth, but no wealth without technology. A technical apparatus requires an investment; but since it optimizes the efficiency of the task to which it is applied, it also optimizes the surplus-value derived from this improved performance. All that is needed is for the surplus-value to be realized, in other words, for the product of the task performed to be sold. And the system can be sealed in the following way: a portion of the sale is recycled into a research fund dedicated to further performance improvement. It is at this precise moment that science becomes a force of production, in other words, a moment in the circulation of capital¹⁰

The question of how scientific knowledge “recycles a portion of its sale into a research fund” is quite simply resolved

Capitalism solves the scientific problem of research funding in its own way: directly financing research departments in private companies, in which demands for performativity and recommercialization orient research first and foremost toward technological “applications”¹¹

Hence, simply put: science, in itself, makes use of technology, but technology requires capital; however, those in possession of capital provide funding for technological developments with an interest in the marketing of that technology. In short, science can continue the project of science only so long as a portion of its work is applied to the production and development of its means rather than its ends, as Lyotard terms it, or to marketable technologies. Thus, we have a redefinition of the initial aim of science: where we originally stated that science sought to produce “good denotative statements,” or verifiable observations about the material world, we have now redefined “good” and “verifiable” as merely marketable, applicable. Hence, Lyotard notes:

The question (overt or implied) now asked by the professionalist student, the State, or institutions of higher education is no longer ‘Is it true?’ but ‘What use is it?’ In the context of the mercantilization of knowledge, more often than not this question is equivalent to: ‘Is it saleable?’ And in the context of power-growth: ‘Is it efficient?’¹²

“Performativity,” or, the principle of optimal performance, overwhelms the search for facticity, or scientific truth.

DESIGN THINKING AND THE PERFORMATIVITY CRITERION

It is with the “Performativity Criterion” in mind that we can better understand what Michael Speaks means in his redefinition of design “research.” Imagine that, in Lyotard’s scenario, one were to replace the discourse of “science” with the discourse of “architecture,” and perform the same analysis of the relation between architectural learning, technology, and capital. First, we would ask, as we did of science, what is the aim of architectural knowledge? As a non-reductionist definition of architecture — one which would accommodate a very loosely defined cannon of production — one might offer architecture as, “*the act of making spatial-temporal propositions.*” The aims of these propositions have always been far more ambiguous than the effort for factual “verifiability” in science. The criterion for *how* to make an architectural proposi-

tion is not singly decided by consensus within the discipline, insofar as contemporary design is a pluralized and self-pluralizing discourse encompassing intentions as varied as Bob Venturi's "ordinary and ugly," Eisenman's semiotics, and Greg Lynn's temporal forms, all of which are protected under the weak aegis of the "cannon" as it is upheld in architecture schools today. Yet, what unifies these projects is the act of making the design proposition, and it is in this process that architecture's immediate and necessary need for technology resides. Throughout the history of representational techniques and physical construction alike, the acts of drawing, depicting, and actualizing spatial-temporal form have always been necessarily contingent on the technologies available for pursuing these activities; in this sense, the architectural need for technology is as inevitable, as ubiquitous within the discipline, and as historically long-standing as the scientific need for technology.

Within contemporary architecture today, it is *computational* technology specifically that has assumed a special significance since the early 1990s. While the computer may be a definitively *reductionist* tool, in its method of simplifying all user "input" to the repetitive and simplifying language of binary code, it has been used in profoundly provocative and creative ways by practices such as NOX, Reiser + Umemoto, and Greg Lynn Studio, who see it as merely one tool in executing an independently defined design methodology or intention that is not simplistically derived from, nor solely validated by, its "computational" applicability. But it is not these practices I want to address today. Instead, I want to look specifically and carefully at those practices continually lauded by Post-Critic Michael Speaks to see how they might provide us with some idea for how the architectural relationship to technology plays into Lyotard's Performativity Criterion in knowledge production.

In a later article in *A+ U*, 2002, following the aforementioned "Which Way Avant-Garde," Speaks would issue a bold manifesto demarcating the division between the "effete" and "theoretical" architecture firms of the past and the young, promising, architecture firms of the future. Assessing the state of the (then newly inaugurated) competition for the rebuilding of the World Trade Center site, Speaks refers to contemporary transformations in knowledge production and their effect on architectural

practice. His article noticeably and purposefully tip-toes around the white elephant of Lyotard's hugely famous — and implicitly anti-capitalist — text on Postmodern knowledge production, referring instead to analysis provided by a business-friendly commentator:

The events of September 11 and the new focus on intelligence [intelligence in the sense of the Central *Intelligence* Agency] that has emerged in their wake underscore a transformation in knowledge and the standards used to determine its relevance. Management pioneer Peter Drucker has pointed out, for example, that the accession of modern capitalism to world system status was enabled by a fundamental change whereby knowledge was no longer concerned with philosophical or religious truth, but with doing, with action. Knowledge was applied to tools in the first, industrial period of capitalism. As Drucker suggests, a second phase of transformation occurs after the Second World War in which knowledge is applied not only to tools, but in addition, knowledge is applied to knowledge itself. This transformation ushered in the management revolution and signaled the emergence of what Drucker calls "the knowledge society." Taking a more pessimistic view of what they prefer to call the "society of control," Michael Hardt and Antonio Negri, authors of *Empire*, the highly acclaimed neo-Marxist study of globalization and politics, nonetheless agree with Drucker's assertion that the new economic order ushered in by globalization is knowledge-based¹³

Acknowledging the changing relationship between knowledge production and global capitalism (and subtly implying a disavowal of a neo-Marxist critique, calling Hardt and Negri "pessimistic"), Speaks would go on to articulate a criterion for successful architectural production in the contemporary era — a criterion that sounds not unlike Lyotard's "performativity criterion":

It is design intelligence, that "unseen" array of techniques, relationships, dispositions, and other intangibles, that enables post vanguard practices to innovate by learning from and adapting to instability, and in so doing distinguish themselves from their vanguard predecessors [meaning, the *Assemblage* generation of "critical" thinkers]¹⁴

That desired "array of techniques" for architectural thinking was defined as production-oriented, technological operations that enabled a design practice to fully evaluate how to *efficiently* produce and improve built form, such as

Versioning, a form of rapid prototyping in which vector-based information is used to create techniques

adaptable to almost any scale intervention. In offices like Los Angeles based Greg Lynn FORM and Paris based Bernard Cache of Objectile, prototypes are not considered final designs but instead create feedback loops that drive the innovation process itself. Prototypes create intelligence by generating plausible solutions that become part of a firm's distributed intelligence. Techniques and designs developed in prototyping tea sets are thus available for use in urban scale projects and vice versa . . . Rapid prototyping underscores the necessity to invent new techniques that then become part of the intelligence makeup of each practice . . . Combining the development of such techniques with specialized cultural and corporate expertise, offices like AMO/OMA in Rotterdam, George Yu Architects in Los Angeles, Lang Wilson PAC in Vancouver, and SHoP in New York City, specialize in design intelligence that extends from branding and marketing consulting to product and building design ¹⁵

It is this last point — the relationship between “branding and marketing” and “product and building design” — that brings us to the next step on in the cycle of efficient performance. Insofar as practices like Greg Lynn FORM use technological development as a heuristic tool not in the service of directed “research” aimed at making efficient construction systems, but as a kind of aesthetic experimentation for its own sake, it is safe to say that the work of these firms is not efficiency-determinist. However, other firms on Speaks' list seem to fall prey to a cycle in which the technology employed in the architectural design process is used to limit design thinking itself, by constraining aesthetic or spatial decisions to the language of modularity, typology, repetition, all to the ends of *achieving greater efficiency in the construction process*. Efficient construction, of course, yields a potential capital-gain *for the client only*; the relation between technology and wealth here does not begin with initial capital investment, as it does in the production of Scientific thought, but with potential capital gains in a reduced-labor building process. Thus, it is at this juncture that a design practice looking to revise its business model will seek to capitalize on the technology-wealth relationship by taking ownership of its construction process, as well, and assuming the role of the developer and building for speculation. Once in this role, the designer has decided to fully commit his decisions to the “Performativity Criterion,” or the principle of optimal performance: architectural thinking means thinking about how to design the constructed object in the most efficient way possible, so as to minimize all labor costs and maximize profit gain.

As an excellent example of this model, take Speaks' above-mentioned New York-based SHoP Architects. As SHoP principle (and primary spokesperson) Greg Pasquarelli was a graduate of the Villanova School of Business prior to his attending the Columbia Graduate School of Planning and Preservation and entering a career in architecture, the design strategies of the firm are heavily influenced by the logic and the rhetoric of that “degraded world of business” that Speaks promotes. SHoP is one of the few contemporary architecture firms who claims a place within “academic architecture” while still acting in the role of the developer. For several years, the firm has been building for speculation and most recently received loans for \$150 million to pursue a major commercial development, “East River Waterfront Esplanade and Piers Project,” in New York. In the signature logo on their website — a graphic icon and motto which principle Greg Pasquarelli has displayed repeatedly in his lectures around the country — SHoP claims to be the “Both/And” of academia and “service firms,” implying, *the right confluence of intellectualism and marketability*. As such, the question the skeptical critic may ask, is whether that confluence of intellectualism and marketability does not simply and reductively lead to *an intellectualism of business itself*, or a “research” that evaluates how to make design profitable, and most of all — to achieve this profitability — how to make design thinking *efficient*. The SHoP website advertises a number of flashy catchphrases that describe the firm's design processes, many of which so transparently describe the three-way relation between design thinking, computation, and marketability that they could have been lifted straight from Lyotard's *Report on Knowledge*. One reads: “Use technology to build practice; see practice as technology;” implying, the process of design and construction is perfectly reducible the technological capacities that make it possible; another reads: “How it's built doesn't matter except when it's the only thing that matters,” implying that the mode of building production is “the only thing that matters,” or the only determining guide driving their design logic. Finally, and most tellingly, is the motto: “Efficiency and great design are not mutually exclusive.” While the statements, lectures, and some of the mottoes of SHoP have repeatedly maintained the claim to something “*conceptual*” in the firm's work — meaning, an aesthetic or social intention beyond optimizing the ‘performance’ of the construction system — the later (recent) work

of SHoP remains purely defined by a kind of performativity criterion, or what Lyotard called that “equation between wealth, efficiency, and truth.”

Take, for instance, their Porter House condo project in the meat-packing district of New York. Sharing economic risk with the developer, the firm negotiated fiercely to maximize the square footage of the building by purchasing the air rights above the adjacent building and constructing the maximal allowable cantilever — defined as “maximal” because it yielded the most cost-efficient ratio of structural support (material and construction costs) to square-footage gained, without hitting the ‘margins of diminishing returns,’ or the point at which the structural system needed to support the cantilever would cost more than the profits gained from selling the residential units inside. Moreover, the entire façade of the building was designed computationally as a panelized system in which zinc panels and window units all conformed to a set number of prototypical sizes and were manufactured off-site and embossed with numeric labels to ensure an efficient construction process. The building was marketable, cost-efficient, and paved the way for SHoP to continue its business-based architectural practice. And yet, the “architectural thinking” at work in the design process was reduced to the logic of the Performativity Criterion: the building stands as a testament to the fact that design can be defined solely and directly in relation to cost-efficiency — and not with the aim of a socialist program, such as that which characterized the modular constructions of High Modernist Functionalists — but with the aim of profit maximization.

To criticize the Performativity Criterion as it applies to design thinking is not to entirely negate the vocational aims of many contemporary practices; that architects like SHoP have a desire for commercial success and a viable business model is fully respectable, especially insofar as economic leverage can provide a designer with greater agency in conducting a design practice, and in promoting aesthetic, social and urban-scale innovations. The question, though, must be asked: at what point does the “criterion of optimal performance” actually overwhelm the agency of the designer entirely, or, simply put, *at what point does design thinking become sheer business thinking?* When aesthetic and urban decisions are reduced to questions of maximizing square footage and profit-gain, the in-

tententionality of the architect has been constrained by a capitalist model of knowledge production in which all design decisions are based on an economy of efficiency. The problem that architectural knowledge confronts in this matter is no different from contemporary crises of funding in the sciences; while Neoliberal Capitalism may provide the inevitable economic context for architectural practice, its logic cannot become the sole determiner of design thinking. While the *Assemblage* generation and its particular methods of oppositional and philosophized architectural thought may have encountered their own limitations, the crucial position that must be maintained during the current architectural “changing of the guard” is for design thinking that aspires not to efficient construction for the sake of capital gains, but to a project — whether philosophical, aesthetic, or political — that offers more than the mere production of wealth.

ENDNOTES

1. Speaks, Michael. “Design Intelligence.” *A+U* (December 2002): 10-18.
2. Speaks, Michael. “Which Way Avant-Garde?” *Assemblage* 41 (2000): 78.
3. Ibid
4. Lyotard, Jean-François. *The Postmodern Condition: A Report on Knowledge*. Translated by Geoff Bennington and Brian Massumi. Minneapolis: University of Minnesota Press, 1984, pp 3
5. Ibid, pp 4
6. Ibid, pp 3
7. Ibid, pp 4
8. Ibid, pp 44
9. Ibid, pp 44-45
10. Ibid, pp 45
11. Ibid, pp 45
12. Ibid, pp 51
13. Speaks, Michael. “Design Intelligence.” *A+U* (December 2002): 10-18.
14. Speaks, Michael. “Design Intelligence.” *A+U* (December 2002): 10-18.
15. Speaks, Michael. “Design Intelligence.” *A+U* (December 2002): 10-18.