

# RE:MODELING

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Architectural culture in the United States has in the course of this century developed into a complex set of semi-autonomous disciplines, from mass practitioners who create the largest percentage of our built landscapes to designers who articulate a small number of highly competent fashionable works and theorists who idealize the conditions of architectural practice, yet create work which is largely unbuilt and often unrealizable. This production-based fragmentation, in the end, has augmented the development of a set of critical situations of the building (the traditional focus of the architectural practice) within a cultural, rather than a merely physical context. It seems unfortunately unsurprising that within these fragments there is an almost universal respect of the significance of built form, even though it has been the cultural undermining of this significance that has contributed to the profession's fragmentation.

Nonetheless, these critical situations, rather than forcing a further breakdown of the architect's task, offer to the profession a radically new model of operative practice, one that positions the focus of design on the concept of inhabitable environment (in a broad sense) rather than (more narrowly) on the construct of building making.<sup>1</sup> The first of these situations has positioned the building-as-cultural-artifact explicitly as an economic commodity, forcing its participation within American capitalism as a discrete unit of post-industrial production. The second, a development grown from the matured cynicism of architecture theory, has evolved theory-making into a significant practice of its own; a practice which, through its tools of representation, has made its own cultural products that compete with the building-as-commodity-object. And the third, which has in turn evolved from the maturation of the first two, proposes a fundamental ideological distinction between the making of "architecture" and the making of "buildings."

It is clear that the existence of these conditions documents a radical revision of the traditional practice of building design and construction, but if we consider explicitly what has occurred within architecture offices, these conditions can rarely be seen to have had more than scant significance. An industrialist economy begat architectural modernism, replete with operative ideologies, but while one could argue that a post-industrial economy begat architecture's version of post-modernism, this has elicited primarily a stylistic response,

narcissistically basking in its flattened cultural conditions. In its utmost isolation, the practice of architecture has remained fundamentally unchanged since its inception. The professional fragmentation I introduced, in fact, documents the development of parallel practices which have evolved specifically because architecture itself has not. As a designer interested in participating in a culturally relevant design process, I find these "alternate" practices particularly compelling. It is at their crossroads that I see the existence of a new type architectural production: One which maintains the fundamental intentions of the traditional practice of architecture, but which has an expanded capacity to consider the role of these intentions within the dynamic of contemporary culture.

Most fundamentally, the proposition that architecture is somehow made essential through built form is simply no longer appropriate. The means of addressing the design of space, of human habitat, have expanded vastly in this century and no longer defer to the "art of building." Television and mass advertising directly affect our visual and spatial landscapes; entertainment and consumer cultures have modified the human perceptions and expectations of architectural forms; and faster, more dispersed communication infrastructures (both mechanical and digital) have narrowed our perception of spatial context. A legitimate practice of architecture today would of necessity consider the relevance of these issues not only to physically constructed, inhabitable buildings, but to the many alternative methods of constructing our human environment. Structurally, any practice may be seen to have both a task and a mechanism. The task is the directed undertaking, independent from the means of its accomplishment; the mechanism, the process and system used in achieving this undertaking.

In architecture, the task has generally been the design and construction of human social environment (in all of its scales of sociability); its mechanism, the making of buildings. If we are interested in considering a significant remodeling of the practice of architecture, we must seriously reconsider the relationship of this fundamental dichotomy to the definition of the practice itself. This paper takes the position that there is a need to reconsider the balance of these two intentions; and that it is the mechanism proper that deserves the more radical reconsideration: While architecture must continue to fulfill its historically defined role (the design and

construction of human social environment), it must begin to seriously redefine its historically defined means (building). Manfredo Tafuri posits that “the crisis in modern architecture begins in the very moment when its natural consignee — large industrial capital — goes beyond the fundamental [utopian] ideology [of modern architecture].”<sup>2</sup> This moment, for Tafuri, is the moment where architecture “renounces its propelling role in regard to the city and structures of production and hides behind a rediscovered disciplinary autonomy, or behind neurotic attitudes of self-destruction.”<sup>3</sup> In other words, it is at the point where the ideologies of modern practice are subsumed by cultural capital and its production that we see a fundamental split between the making of architecture (robust with operative ideology) and of buildings (a mere physical process).

While Tafuri’s critique posits that this making of architecture is a self-destructive, autonomous practice, I am suggesting that a reconsideration of the mechanism of the making of architecture can liberate it into a productive, culturally integrated one. My proposition however, immediately suggests the problematic means of maintaining a practice within the domain of modern economics. Given that American corporate production has commodified architecture within an economic-aesthetic-iconographic value system, will not the extra-building products of this reconsidered operative practice be as easily commodified? The realization that this will in fact occur is at the foundations of my thesis. This culturally operative practice must simultaneously diffuse its efforts with cultural production and propose an alternative collectivity of these diffused elements.

Significant to this post-industrial condition, and essential to my pursuits here, is the understanding of the impact of the informational mode of development on the economy of objects.<sup>4</sup> Unlike the fundamental economic unit of industrial production — the physical product of human or machine labor — the fundamental unit of informational production is the electronic bit, an intangible, omnipresent changeling; an essentially valueless piece of electrical flow. In the history of capitalism, nothing has been so simple and efficient to create, manage, manipulate, and communicate as the electronic representation of information. That a bit can simultaneously be a fragment of a telephone conversation, elements of a photographic image, or a geometric description of architectural form has made it essential to the proliferation of organizational control over traditional means of production, including that of the architectural practice.

This has positioned the object (including the architectural object) in a difficult situation; if the value of a concept as liquid as information can be created from nothing, we have violated a fundamental law of traditional economics. Profit can be made without labor or production. This is a radical proposition with respect to the consumer artifact, as it begins to suggest valuation systems which are autonomous within the constraints of supply and demand economics. The information artifact becomes valued purely through the construction of desire. This, in effect, is a re-contextualization of a point that Tafuri has made in his work on contemporary architectural

production: as soon as the economic validation of intangible elements has become realizable, and the physicality of the built object as a valued artifact becomes superseded by the fluidity of the intangible, the ideological project of architecture is obliterated.

It is far simpler and more profitable to sell access rights to digital media than it is to trade physical representations of it. In the same way, it is far simpler to modify the content of a television broadcast than it is to renovate a major urban infrastructure.<sup>5</sup> It is important to recognize, however, that these “simpler” modifications still have the same (physical, logistical, financial) impact of the more traditional ones. The media-based control systems I am examining here are those which as electronic media are instrumental means of achieving predetermined goals, not means of using media to reach alternative goals. With its ideology superseded by mediated representations and augmented spatialities, architecture must revert to a unempowered act of making buildings. The ideological project that remains is relegated to its own self-referential, academic practice.

As I suggested at the outset of the essay, there exist building (production), design (operation), and theory (ideology); separate, autonomous, and frequently uninterested in each other. An operative ideology encompassing these three, however, is obliterated only as long as it attempts to understand practice in the traditional (modern) terms of an architect seeking to put faith in the physical significance of building creation. What in reality has been obliterated is not the ideological project of architecture, but the cultural significance of building, of the meaning implicit in architectural form, and the ability of building to address the needs of human environment to the extent that it historically has. If these are recognized within a professional ideology, this ideology can once again resume its operational significance.

I’d like to consider three specific examples which propose a diffusion of the traditional architectural task into the realm of the informational. Whether via an explicit mediation of physical space (an information of visual data flow) or via more subtle means of modified communication infrastructures (an information of database management), these phenomena represent conditions wherein the operative ideology of architectural design must consider a range of activities much broader than that of building design.

Craving a publicness of domestic life once embodied in the public ostentation of royal courts, since lost by the desire for privacy of the turn-of-the century bourgeois, American culture has developed outside of the practice of architecture a new mechanism to reinstate domestic publicity: the soap opera.<sup>6</sup> This serialized presentation of domestic architecture, masked in a narrative of gossipy social behavior, is constructed entirely from within the practice of television production. Yet the “architectural” impact is significant: The construction of a vicarious social and architectural experience is serving as a model of behavior in the same way that the medieval royal court served as a model of public behavior, and in the same way, these experiences can be consumed by the desires of the middle class.

Similarly, the redefinition of the contemporary executive office has occurred primarily through shifts in the provision of communications technologies, the alteration of the economics of transportation, and the solidification of the franchise as a stable financial device (although even this is now being challenged by new, more fluid types).<sup>7</sup> In other words, the place of the traditional office has been transmuted by cellular technology, cheap flights, and Kinko's®. Architecturally speaking, the result has been the elimination of any meaningful development of the physical office space since the late 1970s office park other than the efficient replication and decoration of strip-mall types and corporate tower tops. Technologically, however, this transmutation has resulted in vast improvements in cellular technology, the commercialization of the internet, the development of the Worldwide Web, the opening up of new east-west flight lines, and the reduction in cost for most business-hub national and international flights.

And finally as my examples go, significant modifications to the mechanism of shopping have been made since the pseudo-science of mall-making shifted the task of store design from the practice of architecture to the field of real-estate development. For at least three decades (the 1950s through the 1970s), there can be seen a "first level" separation of the task of mall design into this other practice. Deeply participant in the flows of capital, however, even this practice has been forced in the last 20 years to see the real-estate component of its practice (that is, the component concerned with *real estates*) as somewhat ancillary. Within a traditional definition of the architectural task, the making of the shopping venue is no longer an architectural, or even a real estate exercise. It has become an exercise in constructing desire, simulating fantasy, and engineering occupation; an exercise which can be executed through means which have absolutely no reliance on what we have historically called architecture.

These examples should be seen as a clarification of the cultural separation between the task and mechanism of architectural design. What has allowed the programmatic elements in these situations to flee from the practice of architecture is a complex collusion of late capitalist consumer desires, the mediating of culture, and the growing attitude that architecture has a merely perfunctory value. Each of these, in addition, is vastly influenced by the economic and political capacities of information and its digital manipulation. If we consider, for example, the realms of building which have an impact on the mass conscious in America, we must turn primarily to three types: the proliferating single family house, the large office towers and shopping complexes, and the architecture of entertainment and leisure, from serialized fast-food establishments to fantasy hotels and casinos and amusement parks. Within each of these, there is embedded a serious economy (and political economy) of means; respectively, of emotion, scale, and desire. If we consider the means by which these architectural types enter into the mass conscious, we must face the reality that they are entirely concerned with visual style and economic efficiency. The building has, in fact, become feasible only when its valuation as a consumer artifact exceeds its

constructive value, when in other words, the building has no inherent value. Extravagant form, advanced technology, or critical speculation can only occur if the financial return (which may nonetheless be speculative) is proven to be greater than the investment in these "experimental" additions. In effect, the building is so dissolved into the systems of capital production, its significance is removed entirely from its physicality.

Built under severe financial oversight, maintained through complex database or security technologies designed for the management of data, and destroyed immediately upon cultural irrelevance, the building is a subject of informational control. The building is frequently offered as a mere component in a lifestyle, workstyle, or leisurestyle; each of these being formless cultural artifacts alterable by the manufacturers of desire at a moments notice, the building too must fulfill this criteria of fluid adaptability. As I've suggested, this system of architectural valuation, meshed within the economy and politics of a digitally mediated information culture, actually proffers an alternative means of operative practice. It offers a means of reconsidering architecture, no longer as the mere practice of building — that is, as a practice of pure physical labor, subject to the whims of culturally manufactured design — but as a means to once again address the social environment of human culture on a wide scale. As building is now firmly embedded in the capitalist practices of consumer production, and as its physicality has in many cases been liquefied by them, there seems to be no reason why these practices cannot be ameliorated into the ideologies of architecture.

The critical problem is understanding precisely to what extent these practices can be used operatively within the architectural practice. I believe that the mechanisms of digital production and creation offer this potential to architects in a unique way, specifically due to this particular liquidity of the bit. That, in fact, we can compete (if competition is the preferred metaphor) within the complex fields of economic forecasting, real-estate management, entertainment production, and systems programming on their terms (i.e., information management and production), we certainly have the capacity to expand the traditional ideologies of architecture into a practice vastly relevant to the cultural production of environment. I offer this in many ways as an operative response to Tafuri's conclusion in *Architecture and Utopia* (the title of the final chapter, admittedly, is "Problems in the Form of a Conclusion"):

*The fact is that, for architects, the discovery of the decline as active ideologists, the awareness of the enormous technological possibilities available for rationalizing cities and territories, coupled with the daily spectacle of their waste, and the fact that specific design methods become outdated even before it is possible to verify their underlying hypotheses in reality, all create an atmosphere of anxiety. And ominously present on the horizon is the worst of evils: the decline of the architect's "professional" status and his introduction into programs where the ideological role of architecture is minimal.*

This new professional situation is already a reality in countries of advanced capitalism. The fact that it is feared by architects and warded off with the most neurotic formal and ideological contortions is only an indication of the political backwardness of this group of intellectuals.<sup>8</sup>

To re-conceptualize an operative practice (ideology) of architecture within this cultural field, I have begun to investigate a set of technologies that architects may opportune themselves of within the scope of these informational practices. It seems that certain opportunistic means must avail themselves to a practitioner interested in this redefinition of work, and I believe that a properly considered opportunism is essential to prevent a further fragmentation or derailment of the practice's intentions. Concentrating on technology is an especially difficult task, as their very limited particularities are often obstructive to the creative project of design. Yet, the mechanism of opportunism suggests a creative adoption, an appropriate appropriation, rather than a technophilic incorporation. I am making the proposition, in effect, that the profession use the systems and logics of computation as a means to *remodel* itself; to become surrogately embedded within the digital contexts that are currently supporting the extra-architectural fabrication of our human condition.

Specifically, this issue of remodeling is at the essence of my consideration. It implies not only that the profession remodel itself using the technologies of cultural production, but that this remodeling be also about modeling, about the processes of representation and simulation of complex architectural systems (formal systems, self-intelligent systems, human-interactive systems, etc.). This remodeling must work on multiple interdependent levels such that the understandings of the profession and the practice be predicated upon fluid systems which can be modeled, theorized, and systemically modified rather than discreet projects which are proposed, designed, and constructed. This seems to be the most significant offering of these technologies to architectural processes, as they themselves have adopted many of its fundamental techniques (three-dimensional visualization, data analysis, etc.). Examples ranging from intelligent solid-material visualization systems and software techniques for special effects to virtual set design and behavioral modeling initiatives demonstrate the extent to which digital media production has become significantly architectural.

Tactics of visual simulation, or the creation of architectures through visual significance (i.e., the repetition, via media, of certain simulated architectures) no longer only create a desire for architecture as product (as did catalog homes, etc.), but actually present fictive realities for visual inhabitation. To vicariously inhabit the upper west side of Manhattan, one merely needs to turn on television. The more real these places become, and the more jaded viewers become to their fictional constructs, they embed themselves in the normative personal histories of experience. They are inhabited virtually, and are designed to be inhabited only in this way. Coupled with this filmic simulation, computer technology is now not only able to handle the mathematics of visual effects production, but can realistically simulate

the actual material and tectonic physicalities of objects.<sup>9</sup> The realism of visual simulation technology in conjunction with the success of film as a means to construct alternative realities begins to further erode the effects' 'simulatedness,' in that these simulated physicalities move from the merely visual to the culturally real. The slippage which exists between that which we see (film, TV, publication) and that which we experience (urban life, human relations, etc.) becomes more invisibly bidirectional. Desires are manufactured within each realm for explicit use in the other.

The simulation, in fact, is gaining greater autonomy from that which it is simulating. To create materially-specific physical collisions for example, software designers have created intelligently adaptive and behavioral visual objects. The simulated materials, in fact, know their materiality and can effect the parameters of this materiality as necessary. Cloth simulations, for example, can be composed of a set of "smart" threads that understand their flexibility, absorption, and connectivity to other threads. And while we are speaking of a mere visual simulation, the media production industry has moved a step closer to the eradication of the discreetness of the object. The information that represents the forms and materialities of these objects is embedded within the information that represents their intelligence. There is, in fact, no qualitative difference between an object, its representation, and its behavior; these are all components in an informational process.<sup>10</sup> The ability to embed limited computational intelligence into systems of formal generation can offer designers within a remodeled practice the ability to fuse the fluidly malleable informational systems of cultural production into the design process. It may be no longer essential to depend on the physical properties of objects to embody their physicality. Through an object's behavioral qualities, memories, and self-representations multiple such physicalities (bound within the cultural information that composes it) may be simultaneously possible.

Limited by their existence purely within the realm of visual simulation, these methods have spawned the development of physical mechanisms that literally transgress the digital and physical spatialities. Currently used primarily for entertainment purposes, there have been a number of systems deployed to integrate human movement and interaction into digitally-created spaces. These mechano-spatial devices exist to map physical human movement onto digital databases; "motion control devices," "haptic feedback interfaces," "virtual reality caves," and the like have represented a major entry of digital spatialities into the architectural. Not only do they require the physical inhabitation of a human, but their design is intended to translocate this inhabitation into the digital realm. Requiring a design of space for de-inhabitation, their existence has created new physical contingencies for architectural form and its occupation. New conditions arise for the creation of a space that is inhabited as if it were another space by isolated individuals tethered to high-tech costuming. In reality, the developmental focus has been on the equipment and the interface, and has been neglecting the consideration of the significance of crossover (physical/non-physical)

spatialities. This bidirectional blending of mediated and physical spatialities in real space and real time, in fact, present the most critical architecturalizations of information technology; they exist both as traditional architectural problems of building design and as radically new problems of an architecture transgressing into new spatial realms.

And finally, employing theories of child psychology and learning, new research in robotics has spawned two particularly interesting developments relevant to this spatial transgression. The creation of collaborative colonies of what are called autonomous agents — robots (software and hardware based) which are physically independent, have autonomous processing capabilities, and rely on group communication to accomplish given tasks — has forced researchers to reconsider the traditional mechanisms of information communication between robots. It is now possible for a number of robots to learn how to accomplish tasks collaboratively, and pursue the task's completion with a type of colony-like behavior, using the colony's environment as a means of information reference and exchange.<sup>11</sup> Theoretically linked to this research, although as of yet independent from it for technical reasons, there is a significant amount of contemporary robotic research concerning the ability of robotic systems to learn how to complete tasks by watching a human or a previously-trained robot complete them.<sup>12</sup> What is particularly interesting about these computational phenomena is that they have led scientists to directly consider two criteria about robotics that have until now escaped their study: space and embodiment.

In other words, the robots, without any preordained knowledge of their scope (for hardware robots, this is the physical environment) must rely on the perception of the space and of other robots to both learn and work collaboratively. That meaning/knowledge/data is now understood as a fundamentally spatial perception, new theoretical considerations of the inhabitation of a shared digital/physical environment must evolve. A different type of crossover spatiality than that made evident by human-interactive equipment, this spatiality is specific to the inhabitation of digital technology in physical space. Even at the primitive state of this research, the consideration of spatial characteristics is taking on a fundamental significance; architectural demands are already being made by these new inhabitants. It is not outrageous to suggest that these systems have introduced into contemporary computer engineering certain notions of lacanian psychology (when the robot sees itself in a video monitor, does it recognize its "self?"<sup>13</sup>) and phenomenological philosophy (can we consider the space at the surface of a perceived other — the "flesh" — as significant?<sup>14</sup>).

The significance that these technological developments have to the products of the profession of architecture is varied, from reconsiderations of design methodologies to developments of new breeds of occupants and their spatial needs. Their fundamental significance, however, is instrumental rather than task-oriented. From each of these research projects can be taken certain tools (literally software and hardware products) that are relevant to a set of architectural pursuits

within the remodeled practice. Once adopted, these tools can begin to operate upon both the products of the practice and the representation and perception of the practice within these accommodated disciplines. The goal is to derive a means of considering and designing for the wider field of human inhabitation, physical and non-physical; to embed digital processes of a cultural significance (all the examples provided above are at the cutting edge of entertainment, military, and corporate research developments) into the reconsideration of "architecture" is a necessary step to reach it. In fact, the alternate practices which have developed these technologies are looking to accommodate architectural practice more and more substantially. In many ways, I am suggesting the reversal of this trend.

Admittedly, the proposition of these examples as possible foundations for an experimental remodeling of architectural practice begs the proposition of a design example which successfully draws upon them. At this point, however, I feel that the proposed operative practice must remain creatively experimental before even the parameters of a "successful project" can be determined. Rather than becoming another idealized, self-referential, theoretical practice however, it is important that the accommodation of and experimentation with these informational techniques be continually developed in the context of an operative practice of architecture. These tools offer architecture the ability to consider a wider terrain of activity within the scope of its practice, and must be specifically and creatively applied to this task to realize the impacts that I am suggesting are possible. It is important to maintain a focus on the mechanisms of architectural design within the context of these cultural technologies, such that an even greater diffusion of the practice can be avoided.

*Any theory that talks about architecture only, that does not relate architecture to the larger social, material field is utterly useless. [But] at the same time, any theory that does not articulate the concrete specificity and semi autonomy of architecture's codes and operations misses a major medium of social practice ... [As] long as architecture is understood to build or to embody just whatever such [external power structures] commission, then any analysis of architecture will dissolve into a consideration of political, economic, and social ideologies associated with the governing structure rather than with the ideology architecture itself constructs.<sup>15</sup>*

It is essential that the importance of these criteria be stressed, especially within the tangentially architectural scale of my proposition. To remodel the practice is not to eradicate it.

## NOTES

<sup>1</sup> I will struggle, at numerous points in this essay, to derive useful terms for the names of and contents of what I generally refer to as the "traditional practice of architecture" and the "remodeled practice of architecture." Generally speaking, I consider the former to exist when the focus of activity of the practice is

concerned with the conceptualization, design, and construction of a physical building; the remodeled practice exists when this focus is directed at the building and its cultural contexts (advertising, ownership, profit-making, etc.)

<sup>2</sup> Manfredo Tafuri, *Architecture and Utopia*, p. 135.

<sup>3</sup> *Ibid.*, p. 136.

<sup>4</sup> It is important to contextualize two independent notions of an informational economy within the development of late capitalism. Manuel Castells, in *The Informational City*, posits that there is a complex, economically recursive relationship between information production in its many guises (media production, database systems management, computer manufacture, research, etc.) and the configuration of the post-industrial landscape. Drawing from this work, I posit that the particularities of digital information have contributed most specifically to a reconfiguration of these physical landscapes into mediated landscapes, with both physical and digital-media based spatial components. It is important to understand that this is in addition to the spatial reconfigurations Castells speaks of, which are not entirely tied to digital information processes. In other words, the process of post-industrial, information-business corporate relocation and the development of new mediated spatialities resulting from these corporation's products are independent, yet powerfully inter-related.

<sup>5</sup> See Allucquère Rosanne Stone, *The War of Technology and Desire at the Close of the Mechanical Age*, for her elucidation of the "fiduciary subject" in electronic space, a subjectivity defined purely by logistical means. Control over a subject is more easily (and more subversively) executed through control over its fiduciary (informational) representation than its physical embodiment. The construction of this fiduciary subjectivity, therefore, is seen to be a priority of controlling organizations. (Consider, for example, our fiduciary representations: social security numbers, drivers licenses, addresses, etc.) This is rooted in the theories of Michel Foucault, where historical evidence of the manipulation of social roles by spatial codification (via prisons, asylums, hospitals) is presented.

<sup>6</sup> It is important, at this point, to consider in tandem two particular sources: Jurgen Habermas, *The Structural Transformation of the Public Sphere*, and Joshua Meyrowitz, *No Sense of Place, the Effect of Electronic Media on Social Behavior*. Together, these works attest to a significant transformation of publicity and privacy through the history of non-spatial media. Habermas, through journalism and public debate, Meyrowitz through television and computer media.

<sup>7</sup> See Joel Warren Barna, *The See-Through Years*, and Sharon Zukin, *Landscapes of Power* for clear discussions of the significant shifts in corporate building production across the industrial/post-industrial shift.

<sup>8</sup> Tafuri, *op cit.* pp. 177-178.

<sup>9</sup> One of the most diverse developments in this direction is underway by Renault Research, in collaboration with the National Audio-Visual Institute of France (INA). The *Racoon* project is concerned with the photo-realistic, materially accurate simulation of prototype automobiles. Information can be gotten directly from Renault at Bruno Simon, Renault Design, 860 quai do Stalingrad, 92109 Boulogne Billancourt, Cedex, France, or via phone at 33.1.4654.5556. Imagery from the project can also, at the time of this writing, be accessed from the INA web site at [http://www.ina.fr/CS/BDD/fich\\_049.fr.html](http://www.ina.fr/CS/BDD/fich_049.fr.html).

<sup>10</sup> Some of the most progressive work significant to the interests of formal simulation have been developed by Karl Sims at Thinking Machines Corporation. His "Virtual Creatures" research is concerned specifically with the development of genetically-evolved forms adapted to execute behaviors such as swimming, walking, and jumping. See the bibliography for source information.

<sup>11</sup> Research from the Artificial Intelligence Research Institute at the Spanish Council for Scientific Research (CSIC) and the Polytechnic University of Spain is at the forefront in the overlap of autonomous robot interaction and spatial interpretation.

<sup>12</sup> The work of Yasuo Kuniyoshi of the Electrotechnical Laboratory of Japan, currently at MIT, is among the most visionary in this respect.

<sup>13</sup> Jacques Lacan, "The Mirror Stage as Formative of the Function of the I."

<sup>14</sup> see Maurice Merleau-Ponty's *The Visible and the Invisible*.

<sup>15</sup> K. Michael Hays, "On Turning Thirty," *Assemblage* #30, 1997, p. 9.

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