Contradicting Complexity: Generative Systems and the Insurgency of Misfits

The past two decades have witnessed an eruption of formal complexity in architecture simultaneously diverse in its phenotypical qualities and consistent in its complicated style—architectural intricacy amassed in the topological array of non-standard parts. Broadly inspired by Deleuzian philosphy, catastrophe theory, and interdisciplinary models of complexity science, this loosely-knit movement has promoted a similarly diverse set of architectural methodologies, descriptors which include algorithmic, animate, emergent, generative, morphogenetic, parametric, ad nauseam.

Though the science of complexity had been integral to the architectural discourse since the mid-twentieth century, this latest generation is unique in their aggressive and collaborative use of the computer, using digital technologies to explore new diagrams, forms, and material assemblies. Imbued with a post-critical optimism, these practitioners demur from direct engagement with socio-political formations so as to nurture disciplinary autonomy, where the particulars of in situ practice privilege architectural process over representation. Without alternatives, we risk a post-historical condition of innovation for innovation's sake, where the only formalist project left is to find new technologies and territories of application, fill in theoretical niches, or strive for higher-orders of elegance. To overcome this impasse, it is helpful to revisit the transitional moments when theories of complexity were strategic modes of critique levied against the reification of form, concerned more with programmatic openness than merely a prescription of formal methods. In this paper, I will return to the impact of Robert Venturi's seminal work, *Complexity and Contradiction* (1966), in order to rehearse its renunciation of modernist reductivism and, generations later, its own subsequent rejection by digitalists, citing Venturian composition's inability to engage urban complexities wrought by global and neo-liberal forces. By focusing on Venturi's theorization of contradiction, a term often caricatured as a set of pictorial techniques, I intend to reconcile the polemic rift between Venturi's semiology and the post-linguistic aspirations of the digitalists.[1] In so doing, I hope to forge an alternative path where generative systems might engender

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contradictory misfits that escape the solipsism of technical virtuosity, whereupon the fools of other worldly systems come happily rushing in.

Complexity enters into the American architectural discourse through the mid-twentieth century writings of Jane Jacobs and, later, Robert Venturi. They both draw upon Warren Weaver's discussion of "organized complexity" in his important essay, *Science and Complexity* (1948), as a critique of the reductive functionalism promoted by the modernists, albeit in very different ways. In her famous book, *The Death and Life of Great American Cities*, Jacobs explores complexity of urban functions and vitality as a distinct problem separate from architectural composition: "A city is not put together like a mammal or a steel frame building—or even like a honeycomb or a coral. A city's very, structure consists of mixture of uses, and we get closest to its structural secrets when we deal with the conditions that generate diversity."[2] Jacobs' determination of complexity in the city is an empirical and verifiable phenomenon, behaviors resulting from unique interaction of multiple urban and architectural systems that, while it may coincide with aesthetic issues, are both distinct from and generated by an entirely different set of conditions.

Unlike Jacobs' urban functionalism, Robert Venturi seeks to recover the complexity of architectural composition whose difficult whole requires the unity of "a large number of parts that interact in a non-simple way."[3] With only glancing reference to Weaver's theories, Venturi pivots towards complexity as a cultural paradigm, citing lessons from New Criticism and modern art, seeking to destabilize the form-function determinism of modernist architects, who:

> "in their attempt to break with tradition… idealized the primitive and elementary at the expense of the diverse and the sophisticated… acclaimed the newness of modern functions, ignoring their complications. In their role as reformers, they puritanically advocated the separation and exclusion of elements, rather than the inclusion of various requirements and their juxtapositions."[4]

As such, Venturi's text is a late-modern critique, both anti-modern and anti-functionalist, fixated on the autonomy of the architectural object. Unlike the modernists' fascination for tabula rasa and new industrial technologies, Venturi rediscovers a vast architectural archive (with a special fondness for Italian Renaissance and Baroque) in order to analyze and make explicit formal problems and tendencies regardless of the building's epoch and style. These case studies are pluralistic, deploying close readings to precise analytical conclusions. By underscoring the corruption of a priori systems of order and composition, contradictory forces ignite part-to-whole relationships which "involves struggles and hesitations for the observer, and makes his perception more vivid."[5] Against the modernists, Venturi detaches the fixity of use-meanings associated with form through his notion of "vestigial elements," which emerge from a "more or less ambiguous combination of the old meaning, called up by associations, with a new meaning created by the modified or new function, structural or programmatic, and the new context…it promotes richness of meaning instead."[6] Not merely exploiting the use of historic quotation and pastiche (which Po-Mo architects became known and subsequently reviled for), Venturi is fascinated with the resonance of architectural effects produced by a variety of techniques: plastic deformation, juxtaposition, historical associations, or a hybrid combination thereof, all of which decouple form from function as the modernists had so valiantly purified.

Ignoring its exile from the digitalist manifesto for a moment, a close reading of Venturi's contradiction reveals its continuing relevance today, especially its affinities with digital smoothness. In particular, "the double-functioning element" is a remarkably relevant contemporary concept, where smooth transitional plasticity of architectural form is capable of encapsulating double or multiple meanings. Venturi points to this multiplication of indeterminacy within the Baroque repertoire where "buildings abound in drip mouldings which become sills, windows which become niches, cornice ornaments which accommodate windows, quoin strips which are also pilasters, and architraves which make arches."[7] Venturi finds delight in the distortions of classical firmitas where exaggeration, extension, and curvilinearity transform both geometric form and hierarchical codification of elements. His interest in the mannerist techniques of the Baroque stems from the mischievous contortions of building traditions and components that literally stretch the truth of their own episteme. In some cases, this tendency towards multiplicity of function and aesthetics carry over into modern architecture as well. Describing Louis Kahn's Richards Medical Center, Venturi writes:

> Kahn's clusters of columns and his open piers "harbor" space for equipment, and can manipulate natural light as well, like the rhythmically complex columns and pilasters of Baroque architecture. Like the open beams in the Richards Medical Center, these elements are neither structurally pure nor elegantly minimum in section. Instead, they are structural fragments inseparable from a greater spatial whole. It is valid to sense stresses in forms which are not purely structural, and a structural member can be more than incidentally spatial.[8]

In this instance, structural members are not confined to the tectonic sobriety of classical order or the modernist point-grid. Structure is bundled together as an ensemble of cross-purposes and opportunistically deployed for programmatic, affective, and indexical purposes. The part is no longer a compositional element with its own autonomous gestalt but inflected towards a larger swarm of elements. Interestingly, this description of the double-function anticipates the later formal biases of parametricism's "maximum emphasis on conspicuous differentiation and the visual amplification of differentiating logics" and "the elegance of ordered complexity and the sense of seamless fluidity."[9] So while Venturi is persona non grata in the manifestos of the digitalists, there remain allied agendas.

Though the double-functioning element continues to resonate in the fluid methods of architecture today, Venturi's other sub-categorization of contradiction, the "Both-And," at first glance, seems hardly compatible with the later concerns of digital complexity. However, this version of contradiction holds the potential levers to unhinge the closed-loop autopoeisis of digital complexity. "Both-And" architectural elements begin with part-to-whole relations built upon hierarchies that delegate meaning and value to its constituent parts. Ultimately, contradiction requires an inherited or established structure and value system to violate. All platonic architectural types undergo a design process of transformation and decomposition as they confront the exigencies of site and programmatic briefs. Venturi valorizes this degradation as integral to the design process: "Apparent irrationality of a part will be justified by the resultant rationality of the whole, or characteristics of a part will be compromised for the sake of the whole. The decisions for such valid compromises are one of the chief tasks of the architect."[12] This dictum encourages insurrection of the part which destabilizes or defies the top-down relationship of law-governing systems, those that

generate and distribute the constituent parts. As the architecture competes with other pressures, this turmoil inevitably gives birth to mutant and anomalous parts. Likewise, feedback from the bottom-up enriches complexity within the whole often producing multiple gestalt readings. What is interesting here, and not made explicit, is the potential for this insurgent part to reference forces and entities external to the building. Turning to Venturi's analysis of the central stair in Furness' Pennsylvania Academy of the Fine Arts, we see evidence of this behavior:

> "The main stair...is too big in relation to its immediate surroundings. It lands on a space narrower than its width, and faces an opening narrower than its width. Furthermore, the opening is bisected by a post. But this stair is ceremonial and symbolic as well as functional, and it relates to the hall immediately beyond the opening, to the whole building, and to the great scale of Broad Street."[11]

The misalignment of scale becomes an index of otherness, those exogenous forces and entities which both defines what the architecture is not but then becomes enfolded within the intimate distortions inside. So while the stair provides a fluid and ceremonious connection between floors, the disjunction between the stairs and proportions of the ground floor landing disrupts the global integration of the building. As a result, the misfit stairs becomes a contradictory hinge, decoupling itself from the ceremonious connection between floors, while its engorged scale recouples with the unseen cityscape outside, thus imbricating two figures into a new difficult whole. At first, this analysis is concerned with the difficulty of integration and revels in the composition of mismatched parts. But more pertinent to our contemporary concerns is the ensuing dialectic of the whole and part, where a generative system can produce elements that, in turn, no longer situate nor moor themselves to the founding system. As I will later show, by envisioning new capacities for "both-and" elements, they can be coupled with the continuous hierarchies of parametric and generative procedures, thus providing new circuits of relations out of otherwise unilateral flows of quanta.

As previously mentioned, however nuanced Venturi's transitional manifesto may have been, his theories eventually become synonymous with the gratuitous exuberance of Po-Mo applique and, shortly thereafter, Deconstructivist decomposition. In the 1990s, the tide turns against structuralist semiotics and its conflated associations with palimpsests, ruptures, collage, and collisions. The digitalists work to dismantle the legacy of contradiction. In a call to arms, *Architectural Design'*s special issue, *Folding in Architecture* (1993), ushers in a renewed vision of architecture's collaboration with complexity with new forays into the digital domain, a significant preface to the coming onslaught of computation and a monstrous novelty of form Warren Weaver could only have imagined. Included in the issue, Greg Lynn's seminal essay, *Architectural Curvilinearity*, calls for a method beyond "violent formal conflicts" where calculus inspired curvature and the dexterity of animation software enables new formal techniques:

> "Common to the post-contradictory work...are characteristics of smooth transformation involving the intensive integration of differences within a continuous yet heterogeneous system. Smooth mixtures are made up of disparate elements which maintain their integrity while being blended within a continuous field of other free elements."[12]

With these formal techniques now liberated by personal computing, Lynn captivates a new generation of designers promoting such methods as a way out of contradictory if not downright disgruntled form-making. Ironically, just as the new digitalists cast out Venturi, they welcome the arrival of Deleuze, his essay *Le Pli* (The Fold) serving as a veritable masthead to a new movement. In this article, Deleuze contemplates the intensive qualities of the fold, a refrain on complexity which, like Venturi's, rests upon heavy references to baroque architecture. In susbequent years, architectural exploration into the sub-fields of complexity science and the research of the Santa Fe Institute contributes to a formal repertoire far eclipsing that of Venturi-inspired complexity.

As architectural projects exhibit more phenotypical variety—hairy, gradient, smooth, meshy, craquelure, ad infinitum—as practiced, the correlational systems underwriting them have become more and more constricting of architectural identity. It is the very adaptability and redundancy of these numerical controls and virtual procedures that produce its own solipsism of form as set apart from its urban and socio-political contexts. With variability of algorithmic protocols, its autonomous law-governing complexity translates and transfixes all external data from urban, ecological, and other environmental systems, thus eliminating systematic and ontological differences within its own shapely folds. In order to reinforce stochastic change between the interface of architecture and all that is other, we must remind ourselves of the very open-ended process, similar to Venturi's indeterminacy, that dynamical models of complexity have promised to offer but increasingly preclude.

In *Landscapes of Change*, Sanford Kwinter describes a dynamical theory of morphogenesis where form is an irruption of "dissipative systems" that are continuously open and dynamic, each system with inputs and outputs of information and energies.13 In practice, stochastic diagrams stop at construction documents, a threshold where the unfolding of emergent behavior or parametric variation is final, a calcification of structural and material assemblies. Alternatively, an unmolested morphogenetic architecture is largely unconcerned with context, its objecthood being the very site of material ecologies which generate form as a final minima of interrelated forces. This is one reason why the most advanced speculation in new material tectonics often come in the form of fab-lab pavilions. In both cases, the diagrammatic and material procedures expire and its stochastic folding get frozen within time, an exquisite corpse of representation. Without cultivating a minor insurrection, we would be left without the dissipative system which holds promise of giving the values of indeterminacy and difference back to the city "at entirely different scales of action."[14]

By now, post-traumatic hesitance over semiotics and iconographic meaning prevents progress in the state of the art. Simultaneously, digital complexity has become hunkered down with its own preconceptions of valid signifiers of visual complexity. We must begin to incorporate effects, language, and behaviors that are either non-visual or, even more difficult, that which does not look complex or dynamic. Turning to Kwinter's re-telling of Rene Thom's predator-prey loop, we can see how complex systems share a continuum with shape-based grammars and signification. In this analytical model, the appearance of animal prey within the predator's field of vision triggers a "sudden eruption of particular geometric configurations in the outside world...a chance encounter of two flows on the same fold that causes their mutual, spontaneous geometricization and common unfolding into a single form: the "capture."[15] When studying Waddington's
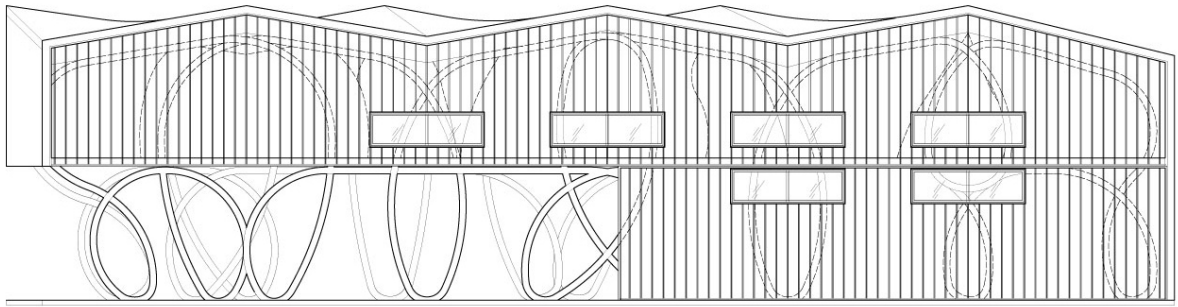
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epigenetic landscape and Thom's swallow-tail diagram, we tend to celebrate the geometric forms, the structural wires, and surface undulation. Yet, as illustrated by the "capture", these landscapes contain singularities which unfold in representations, instinct, and charismatic gestalts. Digital complexity has been short-sighted in the unwillingness to take on semiotic pleasures, limiting complexity to the complicated deployment of non-standard intricacy and the deformation of non-coordinate geometries, a reification of complex systems that arguably is a process of signification itself.

 There is a threshold where "beneficial novelty"[16] can no longer be achieved without opening up digital complexity to radical otherness. Returning to contradiction after the digital turn is to search for a dialectic beyond the torpor of complexity's deep genetic folds. Alongside complex systems, a renewed interest in Venturi's contradiction will offer form-effects different from what is already available in the postmodern archive. I will examine several contemporary projects whose loose grouping here should not be definitive nor categorical. Rather, they simply demonstrate various qualities that do not fit comfortably within the dominant narrative of digital complexity's intensive and self-referential logics. These projects exhibit moments when their generative systems inadvertently produce aberrant objects or singularities that are incongruous if not outright contradictory to the originating rules of the system.

The most common irritant to dynamic complexity seems to be the specter of architectural type as a regressive entity. Architectural typologies' long history of struggle between formal models and the semiotics of composition are deeply entangled and revisited by every generation.[17] Digital complexity tries its best to wiggle out of its tyranny, attempting to bypass the coordinate systems of classical or typological architecture. Greg Lynn's *Embryological House* is a famous example, where the cellular object was designed on the foundation of Deleuze's object/*objectile* concept: the final object is not an architectural solution but instead an iterative event unfolding from an evolutionary set of potentials. However, in a later project, Lynn's *Slavin House*, a more typical process occurs as concerns over economy, construction, and site begin to corrode and degrade the parametric relations guiding the architectural elements. The conceptual design begins with the self-intersecting curvilinearity of the spline, as if it were cut-and-pasted from the regulating isocurves of the *Embryological House*. As we sift through the iterative design changes, the curving spline loses parametric autonomy. At the outset, the house's envelope begins as a set of lofted surfaces derived from the elevational figure of the spline. Yet, as the design evolves,

Figure 1: *Slavin House*, by Greg Lynn

the lofted surfaces lose much of its curvature and begins to rely more heavily on the typological shape of a roof shed. But this is not merely a devolution of form into semiotics. The shed roof still pitches at angles parametrically tangent with the curvature of the spline. Also, Lynn's descriptions of the project emphasizes the operational procedures where all architectural elements, punched openings, courtyard, and other inside/outside relations, are derived from the malleability of the spline-structure's parametric shape. So while the middle regions of the building are easily understood as modulated relations, the roof and lateral surfaces begin to drift away from their parametrically derived hierarchies. With even higher contrast, the readymade punched windows further disrupt the fluid calligraphy of the structure even though their positions follow the protocols of the global matrix. Rather than look away, the promiscuous interplay of these sharp-cornered vestigial elements against a blobular substrate produces a tension of lo-kitsch and sci-fi that arguably produces a more robust artifact. It is this genre-bending that can be legitimately understood as a higher-order complexity, that cultural indeterminacy can also be an effect of catastrophic change.

Another way to extend the algorithmic process beyond its own generative limits is to defile the monoculture of self-similar parts. As understood by Patrik Schumacher, the many parts of a complex system act in unison towards a communicative capacity where "orientation in a complex, lawfully differentiated field affords navigation along vectors of transformation...affording inferences and anticipations."[18] The *Kunsthaus Graz*, by Peter Cook and Colin Fournier, is a biomorphic architecture where its self-similar parts behave in a very different way. Squishing its bulbous form into the constrained site, the glassy dark skin of tesselated panels and puckered nozzles stands in stark contrast to the historic fabric. Not of the digitalist generation, Cook avoids fetishization of the form's complexity by describing the interaction of multiple systems radically differentiated from

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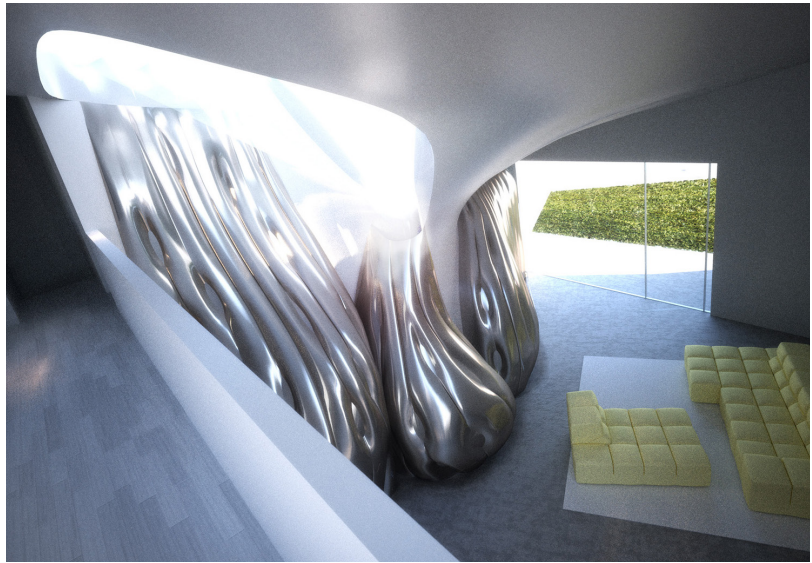
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one another. As the friendly alien, the building's unofficial name, swallows the urban promenade up into the building, the interaction of these two systems produces a different type of anticipation than Schumacher's, one which Cook calls a "delayed-action theater" where one travels up the escalator "secretly" and with "nonchalance" arriving in the upper floors to the surprise of the city and one "naughty" nozzle perfectly punctuating the sequence.[19] Systematically arrayed across its fluid surface, fifteen north-facing nozzles manage natural and artificial light. This sixteenth nozzle is deviant, drifts down lower than the others and cocked to one side, unfaithful to its self-similar brethren. Though conceived by the surface logics of the exterior skin, this cuckold tethers itself to an urban circulatory system with its portal window finally framing a dainty portrait of the Schlossberg clock tower beyond. By shifting lower towards the floor slab, this nozzle perches at viewing height taunting museum-goers to crowd and surge around the naughty hole. This is not the parametric swarm, but the case of a single mad bomber cleverly blended into the crowd. The nozzle bears the same shape, but functionally and ontologically proposes a different existence far from equilibrium.

A common role for parametric assemblies is the management and augmentation of environmental attractors, often a compelling alibi for the deployment of intricate facades and skin ornamentation. The sculpting and redirection of light, air, and water give motivational force to the instrumentation of topological surfaces. In the case of the *Succulent House* by Heather Roberge (Murmur), rain water collection is the functional catalyst, modulating the embedded sheet logics of an interior bladder as if the double layered poche of the walls and roof dripped down into swollen shimmering mass. This nature infused bladder is room-scaled and fabricated from a plastic irridescent membrane, a supple yet disturbing surrogate for the interior garden courtyard. Set adrift, the crinkled bladder problematizes the status of its own objecthood as a fragment, a displacement where its disconnection speaks to other ecological phantasms. Like Furness' stair, the discomfort between the misfit object and its container is a relation of both nesting and estrangement. One imagines the bladder crinkling and expanding with rainfall, somehow both exhibitionist and inscrutable, both qualities undesirable in a house guest. More evocative than endogenous sheet logics alone is it's incorporation of the outside, both exterior to the physical building and the roof-sheet

Figure 3: *Succulent House*,
by Heather Roberge (Murmur)

systems itself. The bladder sits restlessly amidst the furniture, condensation from an indeterminate "hyperobject", the *unheimlich* reminder of an ecological crisis.[20] This outside intervenes within the niceties of a suburban home and the nesting of this double scale induces a quivering tension between anxiety and pleasure. This uncanny effect rests upon the intricate materiality of the sac to induce an estranged specificity; one cannot imagine the same effect if the bladder were a machinic or platonic shape so common to architectural and equipment vernaculars. This material and sensual overabundance dislodges the signifiers of both housing type and the contemporary topological project. The surface project and its sheet logics are not meant to smooth over heterogeneous figuration, instead, producing the very affect of discomfort and incompatibility between American residential fabric and the solubility of the eco-crisis.

Twenty years after *Folding in Architecture*, the continued pursuit of infinitesimal folding is hardly a controversial pursuit. On its own, complexity cannot produce the beneficial novelty that ultimately drives disciplinary innovation. Having achieved and possibly surpassed its avant-garde sovereignty, digital methods can once again welcome competing interests so productive during the uncertainty of transitional periods. The architectural examples offered in this essay are but a few where anomalous parts and misfits betray the very complex systems which generate them. This misbehavior points to the ruptures, at times formal but always conceptual, which wrestle with unfriendly valencies of complexity: the flotsam and byproducts of economic, cultural, and socio-political systems that are often immune to the isomorphic charisma of parametric form-making. In actuality, these ruptures or singularities are the unfolding of events into higher orders of complexity, the "n+1" space of incongruous gestalts, non-visual behaviors, and vestigial histories. Especially with the globalization of architectural practice, digital complexity must not regress towards a new International Style, where algorithmic control and adaptability repress the immanence of cultural and representational conflict. By rethinking contradiction, we have the discretion, both smooth and irruptive, to reconfigure the interaction of architectural and urban systems deeply ensconced in an open-ended and indeterminate world.

ENDNOTES

1. This grouping of a diverse body of work under the term "digitalist" relies upon the common denominator of their intense utilization of computer modeling. This is not to sublimate the theoretical suppositions to such a limiting moniker since digitality is only one conceptual aspect thereof.

2. Jane Jacobs, *The Death and Life of Great American Cities*, Vintage Books Edition, December 1992 (New York: Random House, 1992), 376.

3. Warren Weaver as cited by Venturi. Robert Venturi, *Complexity and Contradiction in Architecture*, Second Edition (New York, New York: The Museum of Modern Art, 1977), 88.

4. Ibid., 16.

5. Ibid., 25.

6. Ibid., 38

7. Ibid., 38

8. Ibid., 36

9. Patrik Schumacher, "Parametricism: A New Global Style for Architecture and Urban Design," *Architectural Design* 79, no. 4 (2009), 16.

10. Venturi, Complexity and Contradiction in Architecture, 25.

11. Ibid., 25

12. Greg Lynn, "Architectural Curvilinearity: The Folded, the Pliant and the Supple," Architectural Design, no. 102 (1993).

13. Sanford Kwinter and Umberto Boccioni, "Landscapes of Change: Boccioni's 'Stati D'animo' as a General Theory of Models," *Assemblage*, no. 19 (December 1992), 59.

14. Ibid., 59.

15. Ibid., 61

16. In his introduction, Jesse Reiser couches beneficial novelty in its capacity to leverage disciplinary change, a significant task that far exceeds formal novelty. See Jesse Reiser, Atlas of Novel Tectonics, 1st ed. (New York: Princeton Architectural Press, 2006).

17. Arguably, typology is architecture's most disciplinary-specific genetic code with the generative capabilities parallel to the biological systems that are so often mimicked by the digitalists. For further reading, see Anthony Vidler, "The Third Typology," in Architecture Theory Since 1968 (New York, New York: MIT Press, 2000); Chris Lee, The Fourth Typology: Dominant Type and the Idea of the City, 2013, http://www.youtube.com/watch?v=lGZK2klZGi0&feature=youtube_gdata_player.

18. Patrik Schumacher, "Arguing for Elegance," *Architectural Design, Elegance*, 77, no. 1 (2007), 36.

19. Peter Cook, "The Plug-in Citizen. Interview with Peter Cook," *Domusweb.it*, accessed August 27, 2014, http://www.domusweb.it/en/architecture/2010/12/11/the-plug-in-citizen-interview-with-peter-cook.html.

20. Timothy Morton's term, hyperobject, describes those ecological entities that are paradoxically presently felt through its local residue and withdrawn into an indiscernible post-human scale. See Timothy Morton, *Hyperobjects: Philosophy and Ecology after the End of the World* (Minneapolis: Univ Of Minnesota Press, 2013).