From Primitives to Patterns

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1.0 Introduction: Cross Disciplinary Dressing

The relationships between clothing, fashion, automobile design and modern architecture are legendary and well documented. Equally well-known are the prescriptive patterns - articulated as languages and codes by Christopher Alexander and the New Urbanists respectively – used to propagate "good design". The knock against fashion and cars is that they always change; the trouble with the "fundamental" patterns of Alexander et al is that they never do. They are either too timely or hopelessly timeless, a longstanding architectural paradox; surprising then, that the *combination* of these extreme definitions of patterns is not only possible, but is produ ctive. Specifically, patterns are highly calibrated devices which can better integrate the extra-disciplinary technologies and techniques of clothing and automobile design into architecture, and in turn generating new modes of variation and adaptability.

Today, the ability for architects and the forms they generate to adapt to rapidly changing contexts is essential. Increasingly architecture is judged by its ability to effectively perform aesthetically and operationally; incorporating complex programmatic solutions into immediately recognizable and transmittable forms. Structural systems, methodologies, materials, etc. are required to be *diagrammatic*; they must be imbued with, or even generative of, a variety of possible scenarios. [1] Enter patterns.

2.0 Multifarious Patterns

They are particularly well suited to handle the competing formal, functional, and representational demands placed on architecture today. Patterns are simultaneously process (patterning) and content (a pattern). As methods, images, graphics and codes, they foreground architecture's visual aspects while shaping matter and behavior by stealth. Like the double use of patterns in clothing design, where they serve as both a production technique (template) and as a motif (print or weave), contemporary architectural patterns are deployed in multifarious ways.

2.1 New Patterns

These are not your father's patterns. Contemporary patterns must generate original forms and adapt to a variety of pre-existing situations. They must operate as a new type of "design primitive". The use of the pattern-as-primitive is analogous to the way an otherwise generic garment (e.g. a business suit) is altered to fit the contours of a specific body. Unlike the stability of previous definitions of architectural patterns, a contemporary understanding of them defines them as the beginning condition to be transformed into a more complex organization, one specifically calibrated to meet the specific demands of a particular architectural problem.

Like alternations made by a tailor, the manipulation of these new patterns can create something that fits, feels and looks like new,

yet without ever losing its original identity. Through the use of computer animation programs, the flexible patterns of today are able to sustain a particular visual identity while morphing between other types of primitives. These elastic surfaces maintain their legibility even as they are twisted, bent, distorted, or ruptured to meet a building's operational demands. In other words, they keep their look, even as they absorb typological, structural, and materia-morphic input.

2.2 Pattern Behaviors

These new capacities, which are both conceptually and technologically linked to fashion and automotive design, are elaborated in projects described below. The radical elasticity of patterns can be seen in the design of a structurally colored wall system; a system whose primitive condition is a relatively simple folded geometric pattern, which can morph into highly differentiated yet familiar shapes as it adapts itself to changing structural, atmospheric, and ventilation requirements (figure 1). The capacity for patterns to generate unique solutions is shown in the design of a highly customized building material (figure 2). Finally, both are present in a project where the design guidelines of a New Urbanist suburban development are transformed into a set of original aesthetic, spatial, (and potentially social) arrangements (figures 3-5).

But, before we examine these case studies, a more general definition of patterns and their analogous relationships to the design and production of architecture, clothing, and cars needs to be established.

3.0 Moving Patterns

The anthropologist and polymath Gregory Bateson defines a pattern not as a fixed state, but as a predictable yet flexible entity. Further, Bateson describes patterns as operating according to an aesthetic logic that functions at the level of "recognition and empathy," and not according to the rationalist techniques of analysis and classification. He maintains that patterns are not inherently timeless or fleeting but instead conform to a circular, or better yet, a spiraling logic.

> We have been trained to think of patterns, with the exception of those of music, as fixed affairs. It is easier and lazier that way but, of course, all nonsense. In truth, the right way to begin to think about the pattern which connects is to think of it as *primarily* (whatever that means) a dance of interacting parts and only secondarily pegged down by various sorts of physical limits and by those limits which organisms characteristically impose."[2]

While Bateson makes the hierarchy clear, nevertheless, it is essential that both poles are always present: the changing relationships (the performance of the "dance") and the form (the choreography or "physical limits") must be recognizable at every moment.

3.1 Paradox of Patterns

As a rule then, patterns are paradoxical. They are at once singular *and* plural; seemingly stable, yet fluid; simultaneously defined as a point of origin or an ideal starting point, rule, or model, *and* the distributed configuration of these points and models. The capacity for patterns to embody such contradictory concepts is perhaps best observed in the context of clothing design and manufacture.

3.2 Pattern as Template

Traditionally, a pattern is typically a two-dimensional outline, guide, or template used to define an area of cloth to be cut. The cut material is subsequently joined with others to make a three-dimensional garment. Thus, these patterns are a modified projection of the body; translating a 3D form into a 2D graphic in order to make communication and fabrication easier. They are also devices to make easily repeated and standardized parts. And, whether used in the creation of a couture gown or a mass produced men's undershirt – patterns are a means to an end: they are pragmatic devices.

3.3 Pattern as Motif

Of course, patterns are also a property of the fabrics that the aforementioned patterns inscribe themselves onto. These visual motifs – classic examples include polka dots and tartan grids - are as much a "raw material" for a garment as the physical properties of a textile. The sequence of design can move in either direction; one can design the cut and then find a pattern that conforms or contrasts to its profile, or a specific weave or print can suggest the cut or line to follow.

3.4 Patterns and Repetition

Common to both types of patterns is repetition, either latent (template) or manifest (motif). The establishment of a template is typically (but not always) done with the intention of making more than one article. This version of the pattern is an underlying (and stable) model which guarantees that each item made from it will be identical. Pattern books for both clothing and architectural designs are paradigmatic of this demand for conformity to an accepted norm. As a motif, patterns are defined by the distribution of like elements following a set of established (if not always visible) rules. Such motifs can be embedded into the weave of a textile (i.e. are tectonic), or are printed onto a piece of fabric (decorative). Conventionally, repetition is accompanied by conformity; deviation is discouraged.

4.0 Made to Order

Concepts of tailoring and alteration have long been integral to the manufacturing of clothing, and, these age-old techniques have undergone several important mutations in response to industrialization, and more recently, digitization. Using a template pattern to create numerous identical articles of clothing allowed manufacturers to rather seamlessly incorporate technologies of mass production. Along with other industrial products, including the automobile, clothing is changing with the advent of mass customization - as evidenced by such projects as NikeID, Surefoot ski boots, and Freitag bags. Automakers such as Audi use fabrication advances such as CNC milling and plasma cutting to enable quicker retooling of their production lines and subsequently a wider range of options for buyers to select from.

4.1 From Clothes and Cars to Buildings

The potential for this kind of broad customization, commonly referred to as mass-customization, has crossed over to architecture, conceptually and technically, by way of the same CAD/CAM devices available to automotive and fashion designers. In short, a higher level of customization – we are told – is soon to be available to the masses for both clothing and buildings alike. Thus, not only is the traditional status of the template pattern threatened, but so too are the traditional forms of architectural representation.

5.0 Alternatives to Mass Customization

The cultures of clothing and cars offer other generative models besides mass production and mass customization, specifically alteration and customization, both of which are more focused on diversity than similarity. The objective of both techniques is to create a unique variations of an otherwise standardized object; to challenge mass manufacturing by proposing unorthodox alternatives. While they both operate as a form of critique, they are even more valuable as means for expanding architecture's possibilities. The difference between the two being that alteration – which has adaptation as its biological and architectural correlates – is meant to propagate a primitive by making it useful in many situations, while customization is averse to copying.

6.0 Formal Wear

Between the one-of-a-kind garments made for a particular body (i.e. couture), and the standardized mass produced items for supposedly standardized bodies (i.e. ready to wear), lies a genre that is conventionally known as "formal wear," commonly suits for men and gowns for women. These items are made (from patterns) in standard sizes, but are then altered to better fit the particular buyer. By making them able to be altered, they are easily proliferated as a uniform – they are simultaneously specific to each body yet highly reproducible.

6.1 Patterns as Adaptable Primitives

In architectural design, the analogous process of adjusting ready-made or standardized

"primitives" (broadly defined as generic formal systems or methods of form generation) to specific situations, sites, or even bodies, can be called adaptive design. The complexity and malleability of historical primitives – which include the ancient orders, ideal geometric forms such as the sphere and the cube, typologies, styles, grids, and the nine-square - have served to expand architecture's ability to incorporate non-formal information and extra-disciplinary knowledge into a project. As in evolutionary biology, adaptation increases the odds of reproduction, and consequently allows primitives to migrate across material and representational boundaries. For example, a primitive graphic pattern can be adjusted to work structurally in a particular material at a particular scale, and can then be further transformed to engage behavior, circulation, thermal conditions, etc.

6.2 Effective Aesthetic

The selection or generation of a primitive pattern can go a long way toward initiating an aesthetic domain, and is able to undergo dramatic deformations without leaving that domain. These deformations, however, not only solve practical problems; the distorted patterns they produce also contribute to the project's aesthetic and atmospheric sensibility. This is true in buildings, cars, and clothing.

The significance of this sensibility, which is responsible for producing desire, is often dismissed as being superficial or is suppressed by other more functional concerns. Yet Reyner Banham elevates intense aesthestic responses to the foreground when he champions cars for being more culturally active than buildings; arguing that their form "carries the sense and the dynamism of that extraordinary continuum of emotional-engineering-by-public-consent which enables the automobile industry to create vehicles of palpably fulfilled desire. Can Architecture or any other Twentieth Century art claim to have done as much?" He interestingly identifies the "body-stylist" as the key figure.

> "Arbiter and interpreter between the industry and the consumer, the body-stylist deploys, not a farrage of meaningless ornament, as fine art critics insist, but a means of saying something breathless, but unverbalisable, consequence to the live culture of the Technological Century."[3]

Taken out of context, this quote could apply to a designer in fashion, architecture, or the automotive industry, and it is along aesthetic fronts that patterns offer a myriad of links between the three fields. While sensibilities and effects in any designed object or environment are generally believed to be loosely under control, they actually rely on precisely calibrated lighting distributions, material organizations, and effervescent forms to be most effectively crystallized; elaborations which patterns deftly create.

6.3 Elastic Alternations

Recent examples of primitives used in architectural design - all of which can be described in terms of their patterning, i.e. repetition of similar or identical elements - include dynamic cellular accumulations, CNC fabricated material studies, deformed structural systems, and diagrams documenting functional relationships. In such examples, each element, or any series of elements, or the rules that organize the elements within a pattern, can be understood as primitives that are embedded with various possibilities of development which are activated by the intentional design decisions of an architect and the contingencies of a given site, program, client etc. The skill of this architect/tailor is in inflecting or informing the pattern with the demands and desires of the project. And the range of pattern modifications is diverse – operations include amplification, distortion, erasure, animation, duplication, merging, and projection – and changes are proportionally effective with increased intricacy.

6.4 Elemental Redundancy

Each element within a selected primitive-pattern has the capacity to function in a structural, spatial, functional, or ornamental domain. For example, the abstractly thin lines which make up a seemingly flat 2D pattern can be thickened, warped, elevated, etc. in order to accommodate the forces acting on them. Some, most, or every such element may be affected by the requirements of a project; those that are not make their

contribution by marking the presence of the original condition.

A process that relies on adapting or altering primitives thus has built in limitations; these limitations are present in the pattern's internal code and serve to open up, not suppress, new design possibilities.[4] Architecture is long accustomed to working within limitations – budget, material properties, site, etc.; what the pattern-as-primitive offers is a contemporary device for organizing them.

7.0 Customization and Democracy

In contrast to adaptation and the aspiration to perpetuate reproduction (even with alterations), customization has long existed as a device for expressing and producing individuality. The logos of mass customization is one of choice – I select the particular color combination I desire of Nike Air Max running shoes from the range of available options. To customize a pair of shoes would conventionally mean buying them off the shelf and then altering them yourself, not so much to make them work better or to influence others to do the same, but to propose an alternative that you believe is better, or at least more desirable. Art critic Dave Hickey elaborates the democratic nature of such practices in the car culture of the 1950s and 60s when he points out that those who did it

> "understood its politico-aesthetic implications, understood that we were voting with cars – for a fresh idea of democracy, a new canon of beauty, and a redeemed ideology of motion. We also understood that we were *dissenting* when we customized them and hopped them up – demonstrating against the standards of the republic and advocating our own refined vision of power and loveliness."[5]

Because current technology allows architects to make, adapt, and customize patterns more easily than making one-of-a-kind forms, it is clear that patterns make good primitives, and provide even newer versions of "power and loveliness."

8.1 Case Study 1: Migrating Patterns

An example of an adaptive pattern – one where a found 2D graphic pattern is modified to meet extra-graphic requirements – is exemplified in the partition system below. (Figure 1). The design begins with a standardized elevation pattern that is subsequently folded in plan – to a series of self-similar pleated segments – to provide rigidity. By texturing individual surfaces and intersecting multiples, the form can be calibrated to meet structural (it conforms to the moment diagram much like the Firth of Forth Bridge in Scotland, but with point loads rather than uniform loads), spatial, and atmospheric conditions asked of it. After the design of each panel is complete, a cnc-milled mold is used to thermoform the various sheets.

The primitive shape and texture are altered to fit a multiplicity of needs, migrating from graphics to structure to ventilation (weather patterns), yet the original pattern is also easily recognized, and both the physical and aesthetic connections between the panels are easily made, without their ever being identical. The result of the alterations being functionally specific, ornamentally rich, and atmospherically intense.

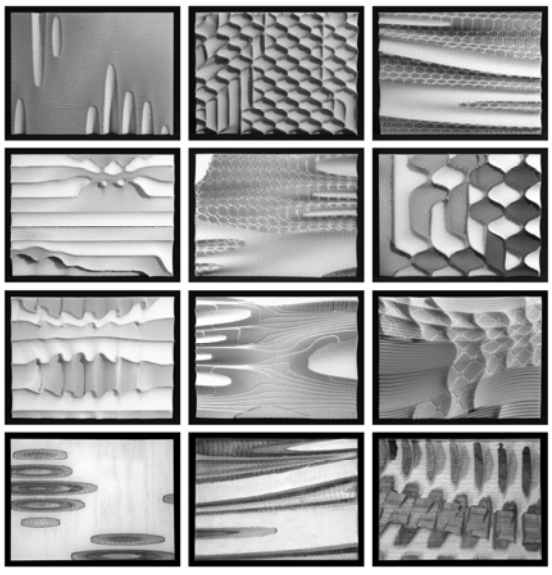

Figure 1. Patterned customization of form and color in standard rigid foam insulation and plywood panels.

8.2 Case Study 2: Customized Building Materials

In these material studies (Figure 2), a single pattern is not reproduced across a number of different systems as in the previous example, but a standardized building material is customized in different formal and color patterns. Here, the materials – rigid foam insulation, plywood sheets, and MDF – are primitives and the patterns are the means of individuating them. It is important to remember the legacy of the technologies in play: both CNC machining and airbrushing are native to the world of car customization. First introduced in the assembly line, they've been more recently adopted by custom shops and can be seen on shows like Pimp My Ride (MTV) and American Chopper (Discovery Channel).

Typically their use is most economical in large production runs, mostly because they require excessive time and material. But a new genre of more underground, indie projects is on the horizon. In these studies, form, pattern, material, and marquetry are integrated and linked to lighting and thermal patterns.

In this particular project – the design of a wine bar interior in Santa Monica – the goal was to divide two 36-person tables into a number of zones with soft boundaries. Zones are differentiated by the pictured insulation panels, which were designed for a suspended ceiling/wall system that asymmetrically filters light and heat evenly emitted from behind. The soft thermal and light boundaries they create are reinforced by the variably milled patterns on the table tops. As a result, continuity is maintained in the oversized tables so that they can function communally,

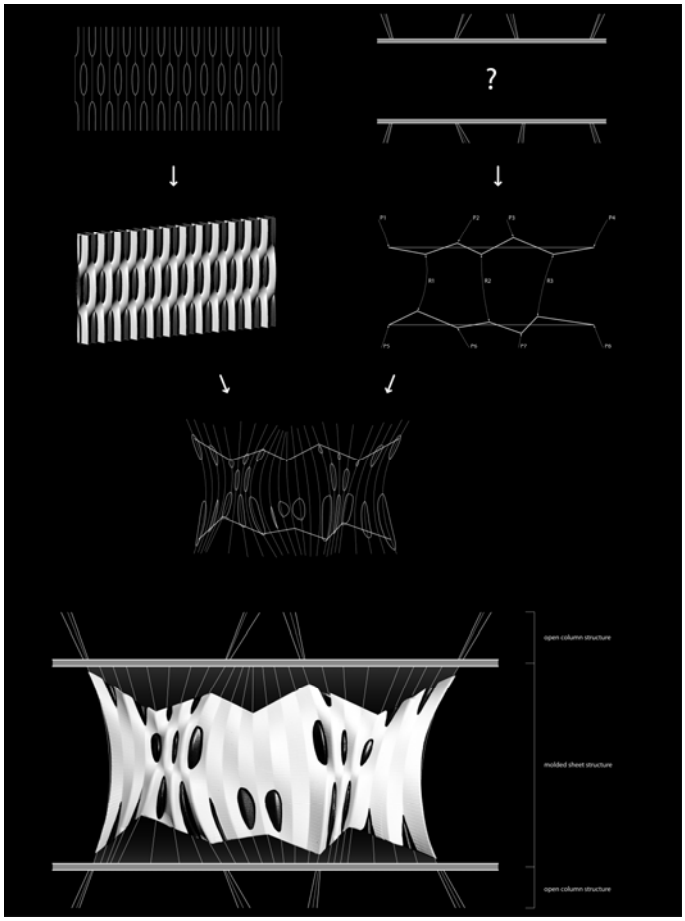

Figure 2. A graphic pattern (left) and moment diagram (right) are combined in a thermoformed wall prototype.

but smaller constituencies can cluster and develop in the tables' different zones.

8.3 Case Study 3: Suburban Patterns

Students in a recent design studio investigated a different use of primitive-patterns, one where various types of patterns within Stapleton, CO, a massive suburban project currently under construction, provided a basis for proposing alternative residential development models.[6]

An inventory and analysis of various limitations imposed by the development's New Urbanist spatial (orientation, adjacencies, open spaces), visual (intricacy, view, color, etc.), formal (typological), and economic (pricing strategies and influences) guidelines revealed a number of latent and literal patterns. Working in teams, students documented a particular system of variation – understood as visual or temporal patterns - (e.g. in façade composition, real estate value, lot types, lawn distributions) and researched a related topic germane to contemporary suburbia in the western U.S. By using the topical research to formulate a revised agenda for residential development, they were able to propose unusual, if not altogether new, patterned organizations of streets, lots, lawns, building massing, mechanical systems, and facades, etc. In short, conventional development patterns provided the projects' genetic material on one hand, but were radically reconfigured on the other.

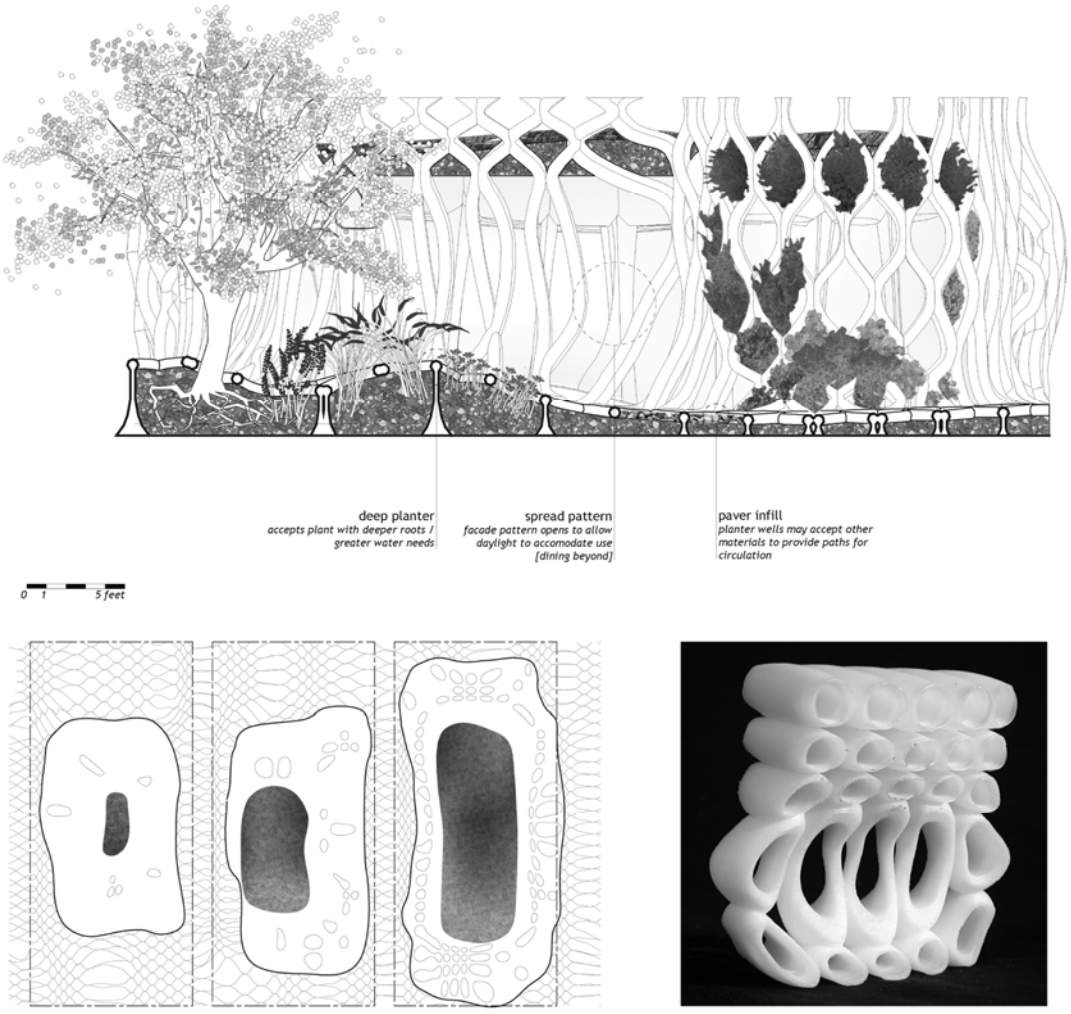

Figure 3. Differentiated patterns in elevation (top), study model (bottom right), and courtyard variations (bottom left).

8.4 Case Study 3.1: Alternative Lawns

The irrigated lawn is a highly contested component of the Western suburban house and this group's research suggested that it is not sustainable in the long term. Lawns in Colorado, a state whose arid climate and historical pattern of draught conditions is typical for the region, account for nearly three-quarters of the average household's water consumption, and for this reason they proposed to eliminate it. In the Stapleton development landscaping serves two purposes: it provides a platform for recreational activities and also establishes visual coherence along the street. Separating those two programs, which are normally integrated in the lawn, allowed for the reintroduction of landscaping as an artificial turf court (activity) and a xeriscaped façade (visual). (Figure 3).

The group adapted an abstract formal pattern from a separate exercise to the lighting and botanical requirements of the façade. Versions of the house with larger turf courts are pushed to the perimeter of their lots, which has two related consequences: the façade is more visible from the street and therefore is more planted, while the court becomes a greater source of light for the interior. Each cell in the façade pattern is adjusted based on sun exposure, angle of repose, and desired color schemes, while maintaining continuity for an integrated irrigation structure. The pattern as a whole is both elastic – able to adapt to a variety of conditions and demands – and capable of assimilating systems of geometry, climatic control, plant distribution, and lighting.

8.5 Case Study 4: Manifold Massing

Part of Stapleton's initial socioeconomic agenda was to provide housing with a variety of costs in order to create a mixed income development with pricing patterned in the neighborhood plans accordingly. Rather than segregating housing types and their associated standards of living from one another, the developers attempted to integrate them by factoring in such luxuries as mountain views and adjacency to recreational facilities and schools.

Now that houses are being sold, and even re-sold, it has become clear that the mixed income agenda is exceedingly difficult to achieve. Pricing is subject to too many variables in the long term and therefore cannot be predicted or planned. So this group opted to homogenize the development's pricing pattern at the outset – to give every house the same real estate value – with the intention of allowing a particular house's market value to be more organically established over time. Research on the topic yielded a clear connection between cost, house size, lot size, and proximity to parks.

By redistributing the existing parkland throughout the lot pattern, most houses in the proposal are located within a park block, many immediately adjacent. Lot size and interior square footage increases with greater distances from parks, but most importantly a number of new house types emerge on lots that a park crosses. Patterned porosity in their facades and massing allow parks to literally penetrate the houses and establish unexpected programmatic relationships. The formal pattern of the houses themselves correlates to the proposed park and street patterns at the neighborhood scale and an initially uniform pricing pattern at the scale of the development. (Figure 4).

8.6 Case Study 5: Intricate Planning

Another team examined how the distribution pattern of lot types relate to the patterned allocation of mass customized house types. They concluded that the neighborhood is organized by a direct correlation between façade intricacy and visibility; more specifically, the house types with the most elaborate facades are located on the corners of the busiest streets. As one moves from the corners into the blocks and from larger to smaller streets, the number of layers in the façade (porches, bay windows, colonnades, dormers, etc.) diminishes.

In response, they chose to redraw the neighborhood plan in order to maximize visibility while sustaining the existing level of variation among the houses. (Figure 5). One of the advantages of designing with patterns is their quantitative precision, so while general rules of visibility apply in Stapleton, the proposed alternative enables much tighter control. The new pattern suggests a broader range of possible house and lot types, including ones that can be viewed in the round along the medians of oversized boulevards. As in the other examples, the pattern here is not only capable of being tailored to particular restraints, but is also generative of unorthodox suburban models.

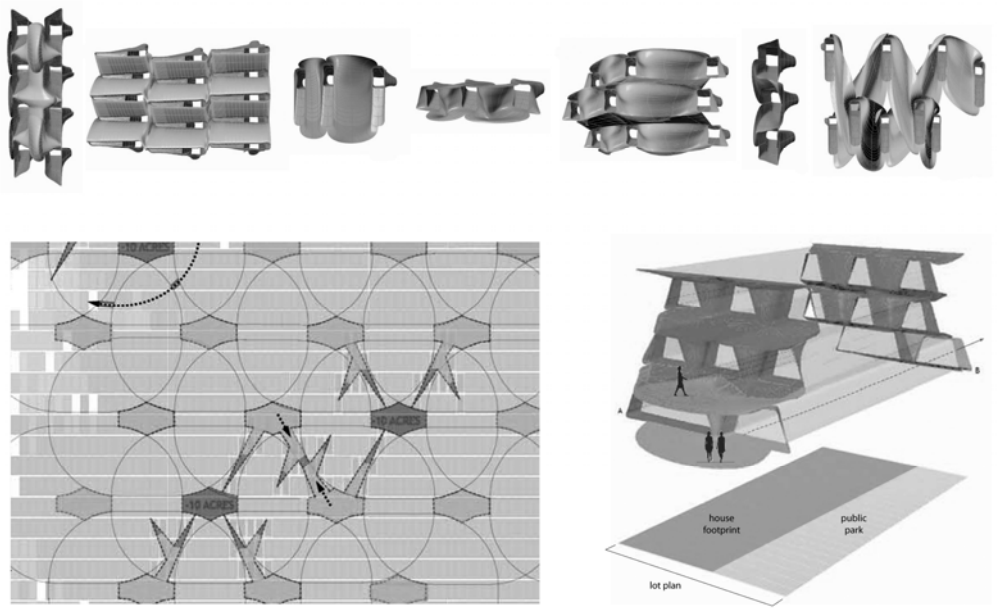

Figure 4. Patterned facades (top), new plan with park-lot overlaps (bottom left), and porous massing (bottom right).

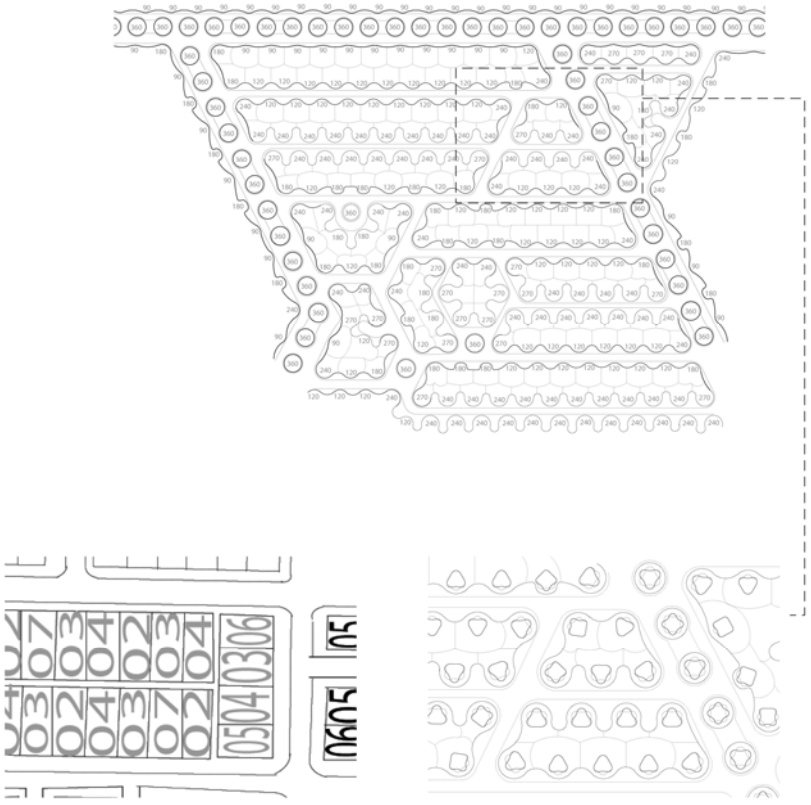

Figure 5. Current neighborhood plan (bottom left), new plan (top), and corresponding façade intricacy distribution (lower right).

9.0 Conclusions

The formal agility of these and other contemporary projects that begin with a primitive-pattern should not be viewed as merely the result of a smart new design process, but as an initial step in generating a new intelligence. Fueled by the introduction of new technologies and revised conventions of style, form, and permanence that it borrows from the fashion and automobile industries, architecture becomes an ongoing process of both formal and disciplinary deterritorialization; one which remixes discrete discursive and epistemological domains by predicting and producing unseen links between them. In other words, by working with and through patterns architecture can generate, modify, and deploy designs that have the capacity to engage and integrate ever more divergent temporal and formal demands. In short, the use of multi-functional and intelligent patterns and primitives allows architects to again solve formal and pragmatic problems synthetically and with style.

Endnotes

[1] Deleuze and Guattari provide a definition of the diagram as an anticipatory device: "Defined diagrammatically in this way, an abstract machine is neither an infrastructure that is determining in the last instance nor a transcendental Idea that is determining in the supreme instance. Rather, it plays a piloting role. The diagrammatic or abstract machine does not function to represent, even something real, but rather constructs a real that is yet to come, a new type of reality." Gilles Deleuze and Feliz Guattari, *A Thousand Plateaus* (Minneapolis: University of Minnesota Press, 1987), 142.

[2] Gregory Bateson, *Mind and Nature*: *A Necessary Unity* (New York: Dutton, 1979), 13.

[3] Reyner Banham, "Vehicles of Desire", A Critic Writes: Essays by Reyner Banham, (Berkeley: University of California Press, 1996),5-6.

[4] As Stravinsky pointed out, "The more constraints one imposes, the more one frees one's self. And the arbitrariness of the constraint serves only to obtain precision of execution."

[5] Dave Hickey, "The Birth of the Big, Beautiful Art Market", Air Guitar (Los Angeles: Art issues. Press 1987), 61.

[6] According to their website, www.stapletondenver.com, it is the largest urban development currently under construction in the U.S., with plans to provide housing for 30,000 and jobs for 35,000.