SITU STUDIO

Out of Control: Experiments in Participation

Constructed several times in several different locations, each with different and unknowable results, Solar Pavilion 2 is an experiment in indeterminacy. From the earliest stages of the design our goal has been to develop a local assembly system with a simple set of rules that would provide a high level of freedom for the configuration and reconfiguration of the Pavilion. Proceeding from this set of locally defined construction rules meant that we do not, and in fact cannot, produce images or drawings to coordinate the final outcome. The photographs and plans shown here are an attempt to document and communicate the work after the fact and, in a similar mode of reflection, this article itself is an attempt to articulate afterwards what has happened; to situate it within a genealogy of projects with similar ambitions and to think about the relationships between the use of images and the potentials offered by emerging fabrication technologies.

We have taken the occasion of this essay to look back at a series of projects which have similarly attempted to open up the design process; away from a top-down paradigm of form-giving towards processes that are more automatic or, at least, less deterministic. But in looking at these works from an historical distance we can see that although they share a similar desire to escape the totalizing ideologies of high modernism, they have often engaged a contradiction themselves through the conceits induced by their own use of images.

Authoring the Unauthored

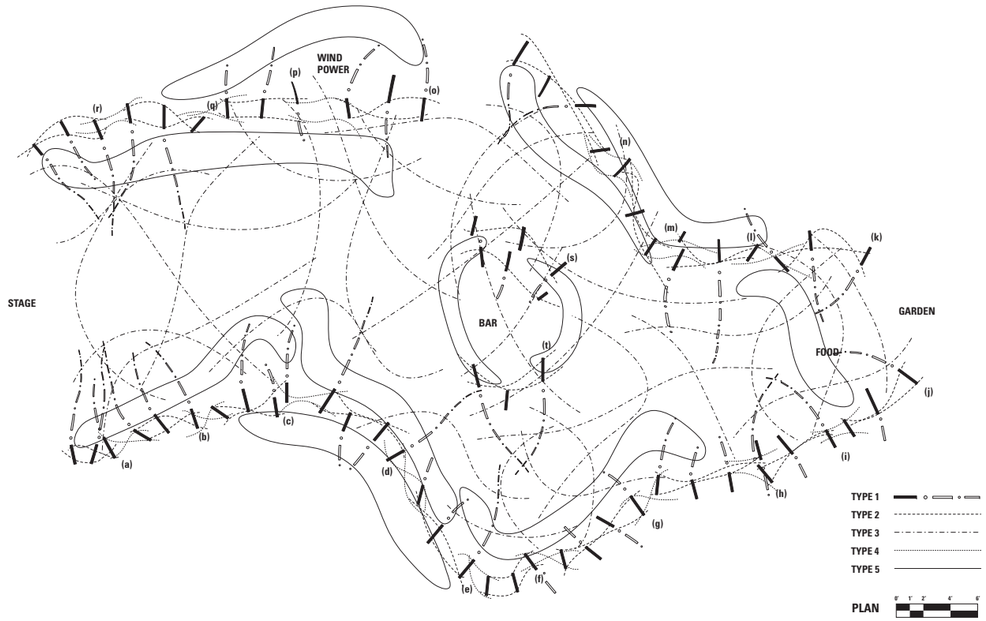
Many architect visionaries of the 50s and 60s were either seeking or celebrating indeterminacy in their work as a means of distancing themselves from the tendencies of much of the modern movement. Alison and Peter Smithson, Aldo Van Eyck, Bernard Rudofsky, Reyner Banham, Cedric Price, Archigram, Yona Freidman and Constant Nieuwenhuis all searched for ways of deriving form from exterior inspiration. They drew from divergent sources in the development of science and especially from biology, cybernetics, computation and linguistics, but also from cultural trends in pop culture and a resurgent interest in the vernacular or the “primitive.” Whether it was the complexity of activity on the street, the biological motif of clusters and organic patterns, the infinite arrangement of activities in flexible structural networks, the inflatable, deployable, throw-away or plug-in, or the “non-pedigree” communal organizations of primitive settlements, what these tendencies shared was that they were a means of generating architecture that was seen to be automated and distanced from individual authorship.

The conceit that lay embedded within these intentions was that the dynamic changes these figures hypothesized had to be represented if they were to be communicated, and in this way were bound to be frozen in renderings of their projective futures. The images they produced fixed the constantly changing potential that they were proposing and channeled otherwise unpredictable outcomes into heavily composed pathways. New Babylon, for example, was a hypothetical urban game of continuous and active environmental participation, where all the walls were movable at the flip of a switch. But in all of the images and models of the project that Constant produced he had been forced to select an array of forms and shapes from the reserves of his own imagination which would be representative of the complex world that would emerge from the interaction of its imagined nomadic population. He was forced to be the sole author of an image which sought to communicate a principle of non-authorship. This problematic was evident in the tensions that existed between Constant and Guy Debord surrounding the paradox of what a Situationist Architecture might look like.[1] The same could be said of Peter Cook’s *Plug-In City*, Cedric Price’s *Fun Palace* and Yona Friedman’s *Spatial City*. Although they were perhaps more utopian, aspirational or rhetorical in character, at some level, either by themselves or by others, the more specific characteristics of form foretold by their images would be literalized in later built works.

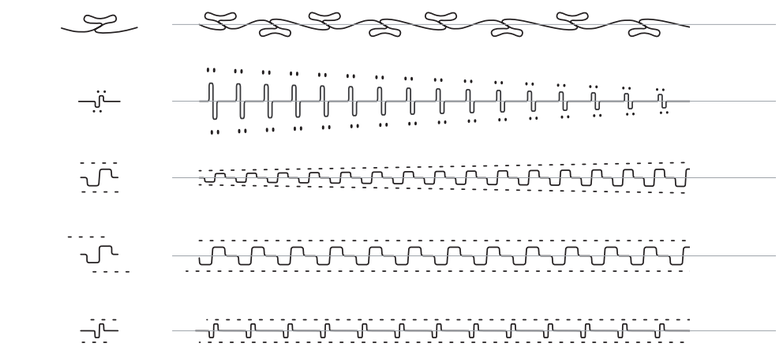
What belies the utopian role of these ad-hoc aesthetics is their direct translation into the forms of other projects. Alison and Peter Smithson’s Sheffield University project, for example, was indicative of a Brutalist ideology which often sought to render the dynamic potential of the building in terms of an articulated distinction between over-emphasized structure and secondary and changeable units for inhabitation. Similarly, Kisho Kurokawa’s Nakagin Capsule Tower was directly inspired by Archigram images. Although the capsule units were pre-fabricated and craned into place and even connected to the structural shaft by four high-tensioned bolts that could allow them to be moved, this gesture was never actualized and the project never evolved or changed as promised.[2] The variety of orientations and expressive articulation of each individual cell against the structural core, with its biological motifs of stem and branch structures, now appears to be primarily a frozen gesture of its own aspirations towards indeterminacy.

We can recognize the same conceit continuing throughout neo-avant-garde architectures to the present. The qualities of processes and transformation, in 1970s architecture inspired by the trace and the index ended up as an image of such transformative processes. Despite attempts to describe final forms with a dynamic vocabulary, such as “punctured,” “compressed,” “scattered,” “interpenetrating,” or “agitated,” their dynamism was never a quality of the final object, but rather one of conceptual exercises that often took place in drawings and then overlaid upon the object as a metaphor.[3] The fluid architectures of the past decade have been similarly motivated, appropriating Deleuzian notions of smooth space and striated space. Despite the sociopolitical origins of this idea, it was more often represented as an image through variations on curvilinear shapes. In comparison to the original concept, the generation of such work gained traction through newly

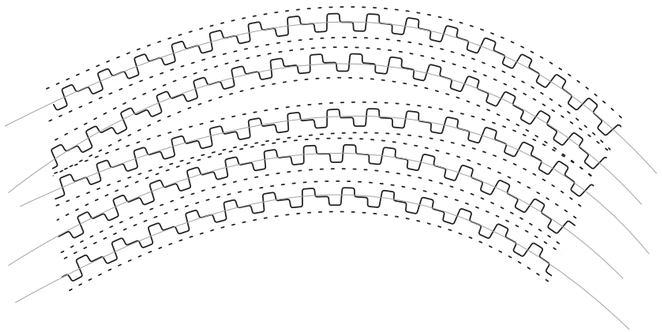
Solar Pavilion 2, Situ Studio, July 2007. CitySol Festival, New York, NY. Photo courtesy Keith Sichio



Plan, Solar Pavilion 2, Situ Studio, July 2007. CitySol Festival, New York, NY.



A.



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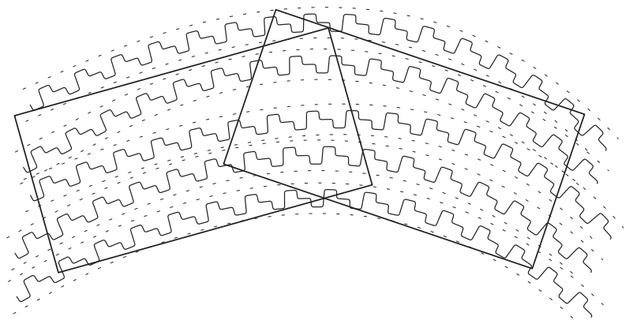

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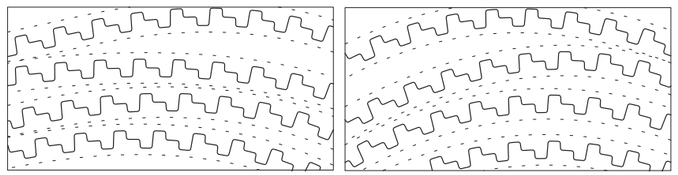


D.

A. Joint profiles, B. Script to propagate joint profiles among given curves, C. Overlayed on 4 x 8 ft. plywood sheet, D. Toolpath for CNC cut sheets. Solar Pavilion 2, Situ Studio, 2007.

available modeling software and developed a pedagogical role in the academy.

Another trend in recent design strategies, which builds upon a lineage of statistical and graphic representation going back at least as far as Hannes Meyer's Bauhaus, is the visualization and analysis of quantitative information. Earlier interests in program analysis using graph theory that once helped architects arrange rooms according to circulation calculations has, more recently, been extended to the mapping of broader phenomena such as geopolitical contexts and changing demographics. In architecture, the adoption of these strategies can occupy a curious relationship to the making of images - the traces of motifs, compositions and colors and their formalization in comparison to the graphs that one usually finds in a peer reviewed scientific paper often suggest an aesthetic sensibility at work in the layout if not also the compilation of data. An analog of this conflation might be found looking as far back as Marcel Duchamp's Coffee Grinder—a piece which, while driven by an ambition to overcome the retinal through the neutrality of the draftsman's tools and the banality of its subject matter, is nonetheless as seductive an image as any other. The graphs, statistics, charts of the more recent past tread a similar line—where ambiguities in the status of the images allow them to oscillate between the dispassionate and the highly composed.

The most recent incarnation of this conceit is in the adoption of advanced computation techniques from the biological and physical sciences, such as generative growth simulations, scripting and parametric modeling, to create non-standardized architectures which can potentially allow for local responses rather than universal impositions. The images produced by programs such as Maya are often purported to be natural, or at least to simulate natural processes of form creation. A typical generative process may involve creating a virtual cellular automata and then, within its digital environment, allowing it to grow according to programmed rules. The simulated moment of natural selection occurs intermittently throughout its growth according to a host of design criteria and then finally frozen at a specific moment within this ongoing cycle in which the design has evolved to be suitable for its task and ready for manufacture. Ultimately, the relevance of these processes to the final object often remains metaphorical and/or visual, while the strategies that govern their realization are of an entirely different logic.

The images produced by these projects highlight an affinity between the architect's intent and a general anxiety present in design culture regarding freedom and control. They figure this affinity towards greater freedom as an appeal towards a mode of creation that is sufficiently removed from subjective determination. It is as Colin Rowe said of "escapist myths" which he saw as "still active in endeavoring to relieve the architect of responsibility for his choices and which all alike combine to persuade him that his decisions are not so much his own as they are, somehow, immanent in scientific, or historical, or social process."[4] The difficulty seems to be in pursuing these ambitions without resorting to images that only serve intentions that could arguably be taking place at the level of spatial organization, constructional logic and production systems.

Local Control, Global Uncertainty

Our recent experiments have been at a small scale and have only had to engage the limited logistical criteria of a temporary deployable structure, but by virtue of this modest scope of production the Solar Pavilions (both 1 and 2) have presented an opportunity to test hypotheses about local rules of assembly at an architectural scale. We aim to experiment with the output potentials of local digital fabrication (all the components of the pavilion were fabricated in our studio) and to create an open construction system that encourages participation and prohibits a repeatable configuration. The goal is to defer the aspect of indeterminacy to the actual on-site construction process, rather than to any point within the design process.

The Solar Pavilion 2 is the second of a series of structures that we originally designed and fabricated for the CitySol festival in New York and later installed at two other events. The pavilions are a kind of constructional game in which any number of players can participate in making local design decisions under our overall direction.

CNC router cutting .5 in. plywood sheet. Solar Pavilion 2, Situ Studio, 2007, Photo courtesy Situ Studio

Deploying the pavilion at the CitySol Festival. Solar Pavilion 2, Situ Studio, 2007, Photo courtesy Situ Studio

The forms that result are partly a product of the internal logic of the components, partly a product of our stewardship, and also partly a product of the unique human dynamic of each group of volunteers, and the particular circumstances of each site and program.

In our studio, using our CNC router, we cut 200 plywood sheets into thousands of component strips. The pattern cut by the router is generated by a simple script that propagates a connection profile along a series of curves and so provides each strip of plywood with a continuous interlocking edge. The basic elements of the pavilion are these arcing pieces of plywood that can connect to any other piece at any point of contact through the use of flexible tie straps. The pieces are grouped into five types—differing in curvatures, thicknesses and depths—that correspond to different structural conditions that may be present within the overall system. Minor variations within each group resulted in 30 unique pieces in total. The universal connection along their edge combined with the variety of curvatures and profiles provided a sufficient degree of freedom to force indeterminacy and variability in each assembly event.

In developing the design we focused on the local logic of the component pieces—the characteristics of each joint shape, the efficiency of a tie-strap—and were less concerned with how they would synthesize into a whole. Our initial decisions were based on factors including structural ability, efficiency of material, and ease of assembly. The overall structural behavior relied on redundancy, in which the weaving and interconnecting of pieces stabilizes the whole in a complex network of forces. Many hours were spent developing and testing the various properties of these components, always at full scale in our studio, in order to create a system that would adjust to a range of conditions. Computation was used in this process only to aid in the tasks that were either monotonous or difficult.

The role of 1:1 testing was critical at this stage. We played out scenarios of construction almost to the extent of mocking up the entire structure at full scale. The script that we developed allowed us to automatically produce zero-waste cut sheets beginning from a single joint shape. We experimented with the variations of their interlocking positions and stressed these to their breaking point in learning what possibilities were inherent within the pieces and what the critical environmental and material factors would affect them. For example, during this process we discovered that deeper notches on the profiles would be better suited to the task of securing the elements that would act horizontally; ensuring that they would maintain beam depth and not twist into a flat position. We also discovered that the forces in the structure would often take a few days to reconfigure themselves under slight changes in temperature and humidity. It was only through such full-scale testing that we could gain an awareness of how the macro characteristics of the whole depended upon the sequencing of construction and the time-scale of its various micro adjustments.

Solar Pavilion 2

Solar Pavilion 2 has been constructed three times and each time the event has taken place on a different site, with different participants and different sets of programmatic requirements. The first deployment took place on the east side of Manhattan at Stuyvesant Cove Park in the summer of 2007. It accommodated a bar, a food counter and places to rest in the shade. The second event took place at the DUMBO Art Under the Bridge Festival in October of 2007, where the pavilion adjusted itself along a narrow site into a linear arcade that sat between the remains of two mid-19th century warehouses. The third construction took place at the SCOPE Art Fair in Miami, where the pavilion was reconfigured again to function as a filter to channel the flows of entry, egress, and VIP access into the larger tent structure behind it.

The construction of the pavilion begins with the arrival of a 20' shipping container on site that contains all of the pieces of the 2500 sq. ft. structure stacked flat. The assembly starts with the deployment of a number of self-supporting column clusters, type 1, around the site. These are made of a number of thicker plywood pieces that have been pre-assembled in a way that allows them to collapse into a flat bundle when a single tie-strap is removed, while all the others remains intact.

Solar Pavilion 2, Situ Studio, July, 2007, CitySol Festival, New York, NY. Photo courtesy of Keith Sirchio

A coding system that uses different colors of tie straps allows these bundles to quickly unfold on site and lock into rigidity. The construction expands and interconnects around these primary elements with the team attaching types 2-5 according to their respective structural roles. As different people select new pieces to add to the system, it begins to move, tilt and lean, often passing through points of instability before connecting to neighboring clusters. The process is akin to crystallization, as overall stability increases through the accumulation of pieces, one by one. At the early stages the structure is prone to slipping from apparent stability to instability and back again before settling into newer configurations. As the structure begins to weave together and become interdependent, initial pieces might be moved, or their connection points might be adjusted up or down one or two notches along their edge to tighten or release tensions that have been developing and moving around through the structural cage as it grows. This process relies heavily on human intuition as to the best selection of new pieces or the awareness of where forces are developing and so anticipating where a certain looseness of connection should be built in. Over the life of the pavilion, notations were made on the plywood parts to indicate certain configurations that worked especially well. In subsequent construction events, these notes, or traces, became suggestions to how one might go about placing a part in a similarly successful way. Each set of volunteers that has helped to install this pavilion has brought a different sensibility to its assembly and had a significant impact on its formation.

After the plywood structure is complete a skin of overlapping flexible tiles of biodegradable corn-based plastic are hung from the underside to provide shade and cover for the events. Like the plywood parts, the skin was fabricated with a zero-waste mandate, in which two curved cuts in a square sheet produced four tiles with nothing left over. This simple, flexible shingle system could be raised in different sequences and tied to the structure at different lengths allowing the skin to adjust to the spatial outcome of any particular iteration of the structure's organization.

It is the simplicity of the pavilion's rules and the fact that small quantities of customized components can be both economically manufactured and assembled that offers a hypothesis for new systems of decentralization in the construction of local environments. The aspect of participation is extended beyond the design stage into, more significantly, the fabrication and construction stages. The basic question is whether decision-making power can be distributed to the builder and the user among other parties, as a means to allow a design to evolve. Is it possible for the construction process itself to be redesigned, allowing certain freedoms to be manifested in places beyond the architect's studio? The decentralizing possibilities of digital fabrication linked with such simplicity of use could potentially introduce these ideas where form emerges gradually out of a multitude of autonomous processes; processes that are not digital algorithms, but rather human ones. Granted, the limited structural and programmatic requirements of

Solar Pavilion 2, Situ Studio, December 2007. Scope Art Fair, Miami, FL. Photo courtesy Situ Studio

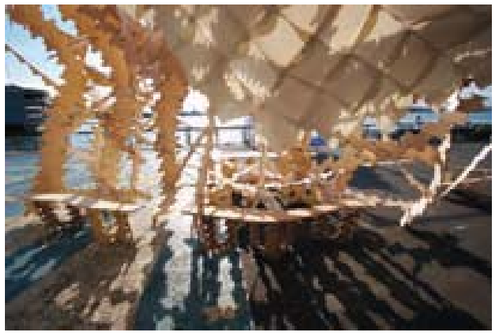
a temporary pavilion readily allow for these experiments to occur, but their success implies a potential for implementation in more diverse situations.

There remains an opposite tendency for the use of digital fabrication and advanced computation that involves the privileged position of images in the process of design and manufacture. As one of the leading proponents of non-standard architecture, Bernard Cache has warned, “if, indeed, a non-standard architecture consists of generating more or less soft surfaces which will then be called a building by transferring them onto a battery of production software in order to create very expensive kinds of sculpture which no longer have any relationship with the historical and social sedimentation that makes up a city, then we are only perpetuating the Romantic myth of the artist-architect”[5] As the necessary translation from file to factory is often sold as a smooth process with little relationship to a contingent material world the Solar Pavilion 2 was, for us, an opportunity to explore these contingencies in the context of a set of tools that have fundamentally changed the relationship between form and representation.

References

1 Probably most Situationists realized the near impossibility of constructing true situationist architecture. Asger John apparently concentrated on the construction of Situationist theory rather than of genuinely Situationist works, and hopelessly ambitious Situationist projects rarely went much further than the written idea. Debord left his maps fractured and uncertain, without proceeding to depict a unitary urbanism proper, so it is unsurprising that he considered Constant’s projections of an uncontested future space to be highly improbable.
Simon Sadler, The Situationist City *(MIT, 1999) p. 159*
2 The tower currently faces imminent demolition due to fears concerning the toxicity of the materials with which it was originally built—the appeals of the architect at the end of his life to replace the plug-in units one-by-one with updated and safe capsules have been rejected by the building’s management association.
3 See Robin Evans, “Not To Be Used for Wrapping Purposes: A Review of the Exhibition of Peter Eisenman’s Fin d’Ou T HouS Shown at the Architectural Association, London,” (1985) Translations from Drawing to Building and Other Essays *(Architectural Association Publications. 1997)*
4. See Robin Evans, Not To Be Used for Wrapping Purposes: A Review of the Exhibition of Peter Eisenman’s Fin d’Ou T Hou S Shown at the Architectural Association, London, (1985) in Translations from Drawing to Building and Other Essays *(Architectural Association Publications. 1997)*
5. See Deleuze and Guattari, 1440: “The Smooth and the Striated,” in A Thousand Plateaus: Capitalism and Schizophrenia, *(University Manitoba Press, 1987) p. 523*
6. Colin Rowe, Introduction to Five Architects, *(New York: Wittenborn, 1971) p. 6*
7. Bernard Cache, and Patrick Beauce, “Towards a Non-Standard Mode of Production,” essay published in Phylogenesis foa’s Ark *(Actar, 2004) p. 390*

Situ Studio *was founded in 2005 while its partners were studying architecture at The Cooper Union. Operating at the intersection of architecture and a variety of other disciplines, Situ Studio’s work has been enriched by close collaborations with geologists, writers, engineers, biologists, activists and artists. Recent projects include the design and fabrication of Solar Pavilion 3 and a demographic mapping project with Brooklyn Public Library that is focusing on the visualization of census information for the institution’s branch planning and analysis.*



Solar Pavilion 2, Situ Studio, July, 2007, CitySol Festival, New York, NY. Photo courtesy of Keith Sirchio

Solar Pavilion 2, Situ Studio, October, 2007, DUMBO Art Under the Bridge festival, Brooklyn, NY. Photo courtesy of Situ Studio

Solar Pavilion 2, Situ Studio, July, 2007, CitySol Festival, New York, NY. Photo courtesy of Keith Sirchio