

Parametric

# Voices

*The Editor asked a dozen some-odd architects to reflect on the current state of development of parametric design, offering, as prompts or provocations, the following questions:*

1. *One correspondent has remarked, “[parametric design] is really different from wanting a wall somewhere.” Do you agree? How so?*
2. *In the early days of algorithmic form-making, a noted practitioner of the genre, in response to my query whether it might be the case that all these oddly-shaped buildings were just repeating the anti-contextual sins of modernism, reassured me by saying, “Don’t worry, Tim; it’s just cult work.” Is it?*
3. *Of course, the previous question assumes, incorrectly, that parametric design is necessarily biomorphic or otherwise wiggly. While some celebrated work would suggest as much, parametric design can employ conventional formal vocabularies. Should it? What is the potential for integrating parametric techniques into normative practice?*
4. *What misconceptions are apparent in my questions so far?*
5. *How would you characterize the goals of parametric design? Its promise? Its limitations?*
6. *How do you view the relationship between parametric design and Integrated Project Delivery?*

*Here are the responses, which in some cases refer back to one or more of these questions directly, in other cases do not:*



**Mark Anderson, FAIA, Principal, Anderson Anderson Architecture, San Francisco;  
Associate Professor, UC Berkeley**

There may always be cult-like enthusiasms associated with any new technology, giving rise to opaque language and theory and often conflating particular forms

Autodesk Gallery, San Francisco  
Anderson Anderson Architecture/McCall Design Group,  
photo by David Wakely

favored by that initial user group with the essence of the technology itself. This probably was initially true of the enthusiasm for parametric modeling by architects exploring its range of potential. There isn't anything formally specific to parametric design, however, and its use in both academic study and professional practice is already far beyond theoretical studies and abstract formal explorations.

There have long been two threads in parametric design in architecture, the more down-to-earth applications in BIM modeling being earlier, more invested in by software manufacturers, and more broadly disseminated in daily practice. More experimental applications are only recently becoming readily available for broad investigation by architects who do not themselves have access to custom software design knowledge and scripting tools. Just in the last year, new software such as Grasshopper have widely re-ignited an interest in scripting and parametric design among students and experimental architects beyond a limited minority. At the same time, old-line parametric BIM modeling tools, such as Revit, which are closely based on conventional practice and conventional architectural forms, are also edging closer to being a common software expectation in everyday practice. While these two tools are vastly different, they both represent efforts to capitalize on increasing computer power to change forms of practice and avenues for creative experimentation based on logical applica-

tion of a profusion of available information.

The most interesting promise of parametric design is not directly in its ability to experiment with new forms or to facilitate a more efficient and accurate practice of documenting construction. The fundamental importance of parametric modeling is in its potential to utilize the vast riches of environmental data that the progress in computer tools makes available for consideration. For example, where analogue calculations of sunlight or seismic forces have traditionally been applied at a gross scale focused on worst-case instances and then applied uniformly across all or significant portions of a building, parametric modeling tools can process data and respond adaptively at a micro-scale across surfaces and structures. It becomes practical, within the limits of design time, design consciousness, and even limited fabrication budgets, to make a continuum of design adaptations unique to the particularities of many more conditions encountered on a project site. This potential to shape a building according to a far broader and yet more precise range of criteria suggests many changes and improvements in design and construction process, in fabrication logic and affordability of customization, in fine-grained sensitivity to environmental, social, and cultural context, and—not least of all—in the resultant profusion of utterly logical and yet wildly unexpected and totally cool new spaces, forms, and experiences.

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Palomar Medical Center West, CO Architects

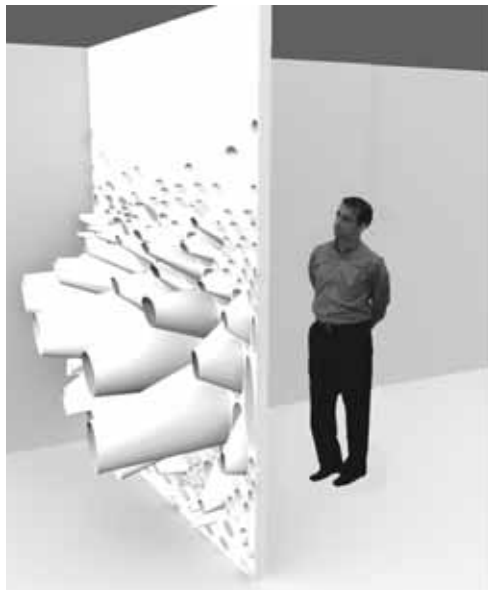
Of course, some malevolent cultural force might also parametrically limit divergence from particular norms—new dimensions in misguided community design standardization—fixing robotic governors on this hot rod engine of progress and putting all of this promise to evil risk. This is one good reason to appreciate any cult out on the *avant garde*—let's hope that they can stay well out ahead of any technological catch-up by nay-saying reactionaries, and stretch our imaginations along the way.



Phil Bernstein, FAIA, LEED AP,  
Vice President for Industry Strategy  
and Relations, Autodesk;  
Lecturer, Yale University

In the work sponsored by Autodesk at Yale, we are interested in a couple of questions with regard to parametric modeling. One is, are we seeing the incorporation of substantive contextual or other data into the modeling of building form, or is it still mainly indulgent shape making? A second is, where and when will we be seeing a seamless integration of, for example, Rhino and Revit, such that a cutting-edge designer might participate in a robust IPD process?

A real BIM process (rather than just form modeling with a tool like Rhino or Maya, neither of which are BIM, because they are not “building aware”) carries with it by defini-



UCLA Design | Media Arts “Second Natures” exhibition, DurfeeRegn, photo by Roberto Paz

tion “substantive contextual data,” since the entire construct is tectonically aware. What the designer chooses to do with that information is the real question. Some of our research at Autodesk now involves overlaying BIM meta-data (what we call contextual data) with scripting and algorithmic templates to help inform or drive the design process.

The question of a “swirly designer” participating in a pure IPD process is provocative. That designer has to be willing to participate in a process that gives him/her deep responsibility for things beyond the swirl. Gehry would embrace such an idea; Libeskind, less likely. Revit is making good strides on the swirly front and will eventually render the distinction in tools meaningless, in my view. It’s not the swirl that’s relevant—it’s the role of the architect.



**Thomas W. Chessum, FAIA,  
CO Architects, Los Angeles**

Integrated Project Delivery (IPD) is the information hone that sharpens the parametric design tool. In and of themselves, these two progressive devices of architectural practice offer exciting resources for the pursuit of a higher architecture, but their greatest potential is found when combined; they potentially reposition the architect into a role that reconnects the profession with the idealized architect of the Greek origin of

the word *arkhitekton* (*arkhi-*, chief + *tekton-*, builder), i.e. chief builder.

Integrated Project Delivery, with all its possible variants, contractual formats, and intentions, provides, of greatest import, the ability for the architect to truly collaborate with the building and materials craft in the creative act of architecture, from concept to realization. The resulting collaboration among the parties (designer, builder, owner) ultimately informs and enriches the architecture to the extent that it is embraced as a resource and essential part of the tectonic responsibility of the profession. On its own, the parametric design tool, whether purely design-focused or Building Information Model (BIM) virtual architecture, makes it feasible for the architect to accept and manage extensive and varied constraint information during the design process and to carry that knowledge in its architecturally resolved form forward into the realization phase. The parametric tool becomes a resource, reference point, and place of origin for other parties in the endeavor.

When joined, IPD and the parametric tool find their true complement. IPD gains the vehicle by which the knowledge of all parties is shared in an open, transparent, and understandable venue, and the parametric design tool gains the quality and breadth of information that can be used to enrich the architecture. The architect, as the originator and source of this collected and organized knowl-

edge captured in virtual architecture, becomes the center of this activity seeking architecture in its fullest realization.



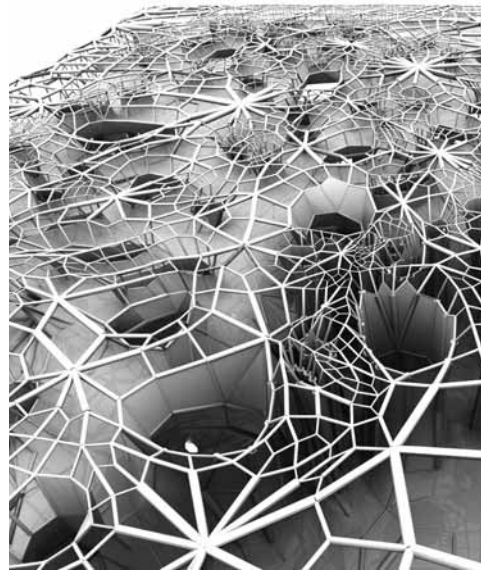
**Tim Durfee, Principal, DurfeeRegn,  
Los Angeles; Research Professor, Art  
Center, College of Design, Pasadena**

Whether it was Dylan going electric at Newport or Nintendo turning 32-whole-bits, there will always be someone who is going to get in a twist when a new technology threatens to disturb the tasteful establishment. Despite the historically close connection that the design and construction of buildings have with technology, architects can be notoriously reluctant to embrace new ways of working. While some of the forms generated with parametric software can still provoke, it is the inherently relational way the software operates—rather than the forms it is capable of generating—that holds the more profound implications.

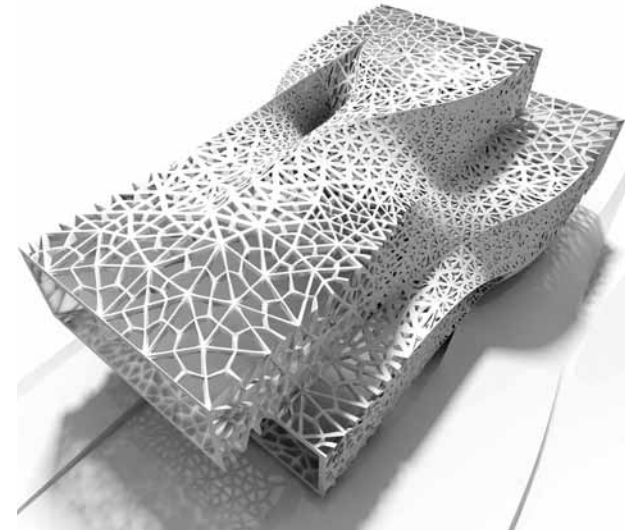
The centuries-long construction of systems for designing the not-yet-built has formed architecture years ago into a sort of relational science. In this period of vast networks, however, this disciplinary capability to understand things in terms of their association to other things will expand a chain of coordination beyond the BIM-like technical synchronization of an architectural project to effect far-flung,



Schindler's Paradox Box, Griffin Enright Architects



GEotube Salt Tower Proposal, Dubai, Faulders Studio



Jellyfish House, IwamotoScott Architecture

external systems—from huge municipal services, to private real estate agencies, to personal Twitter feeds.

In addition to the expansion of connections horizontally across systems, current software also helps to realize the ancient aspiration for relational systems across scales: from the nano, to the object, to the building, to the city, to the networked globe. This capability to generate and control information in a scale-less environment furthers a shift away from an emphasis on the dimensional to the relational, where elements are defined more by intrinsic and scalable values than by fixed points in space.

As software continues its natural evolution toward more perfect simulation of the natural world, architecture will be re-cast as a (mere) expression along a scalar continuum of fundamentally interrelated elements, including the political, social, cultural (the 'software' of the city, to architecture's 'hardware'), and, eventually, including the 'natural' world itself.



**John Enright, AIA, Principal, Griffin Enright Architects, Los Angeles; Assistant Professor, University of Southern California**

Parametric design is ultimately a more significant manner for architects to deal with *information* and *process*. Information within a design problem is a varied but steady stream that

feeds design from conceptualization to realization, yet process involves the manner in which information is implemented toward a given problem. Much has been written regarding this "feedback loop" between information and process, which exists at many levels, whether that be within the eye and the hand, the verbal and the mind, or the physical and the visual. What digital computation has begun to achieve in architecture today is a more rapid and dynamic feedback loop between how architects manipulate and conceptualize information vis-à-vis process. It has enabled a multiplicity of reiterations to be examined in relation to the parameters that are defined by the designer.



**Thom Faulders, Faulders Studio, Berkeley; Associate Professor, California College of the Arts**

In many ways, parametric means for achieving design goals are already normative and conventional: not in the pejorative sense of conventional, meaning "uninspired," but in the context of the widespread use and deployment of parametric modeling techniques to derive architectural intentions and manifestations. In my office, the parametric tools fall under two headings. One is as a form generator: we'll have a certain design direction in mind, and new and unanticipated results emerge through the shifting input of various

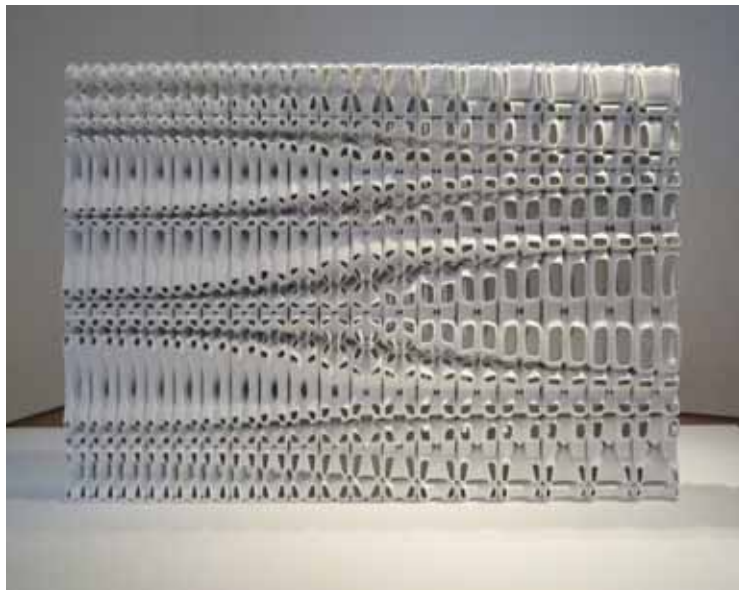
data factors. You might call this a type of digital empiricism: we must experience the results and gauge the often-unpredictable effects after the fact, as opposed to theoretically directing the product beforehand. We can decide to place a wall, but we might not always know precisely where it will land, as its location is related to and influenced by an entire set or family of parameters.

Our other means of using parametric tools is that they allow us to achieve and quantify for construction/fabrication a complex array of forms—ultimately our design intentions as related to whatever we are trying to address architecturally. Parametric software is often a shortcut that allows us to create very complicated or difficult-to-construct designs, in that the embedded information can not only continue to be altered, but also captured for direct fabrication output. For me, this is not solely about form generation, but the ability to respond architecturally to a degree that would be quite formidable without the use of these technologies.



**Lisa Iwamoto, Partner, IwamotoScott Architecture, San Francisco; Associate Professor, UC Berkeley**

Parametrics privileges relational and conditional criteria in the design process. What relates to what? In what order? With what



Migrating Formations, Contemporary Architecture Practice

kinds of constraints? Asking these questions is not particularly new to the architect; parametric software simply forces us to ask them in a direct and literal, though often highly complex and sophisticated, manner. Deciding which relationships to highlight therefore shapes the design process, whether it is about programmatic adjacency, cost estimation, form generation, structural or environmental performance, or integrated building systems.

In our office, the parametric process is geared to our design interests, which vary dramatically with project type and scale. Voussoir Cloud was scripted to synthesize intentionally opposed structural form and performance criteria in relation to material behavior and localized geometry, as well as to streamline the fabrication process. Conversely, the initial massing of Edgar Street Towers developed from relationships between the building volume, zoning envelope, and site conditions of the local and larger Manhattan street grids. Here, parametrics afforded rapid design permutation and iteration.

When you ask about the promise and limitations of parametric design, they really have to do with the imagination and agility of the architect. As with many technological and design movements in the past, certain branches become overly prescriptive and dogmatic in their approach. This is certainly a danger with parametrics, because it can be seen as a problem solving optimizer or design justifier

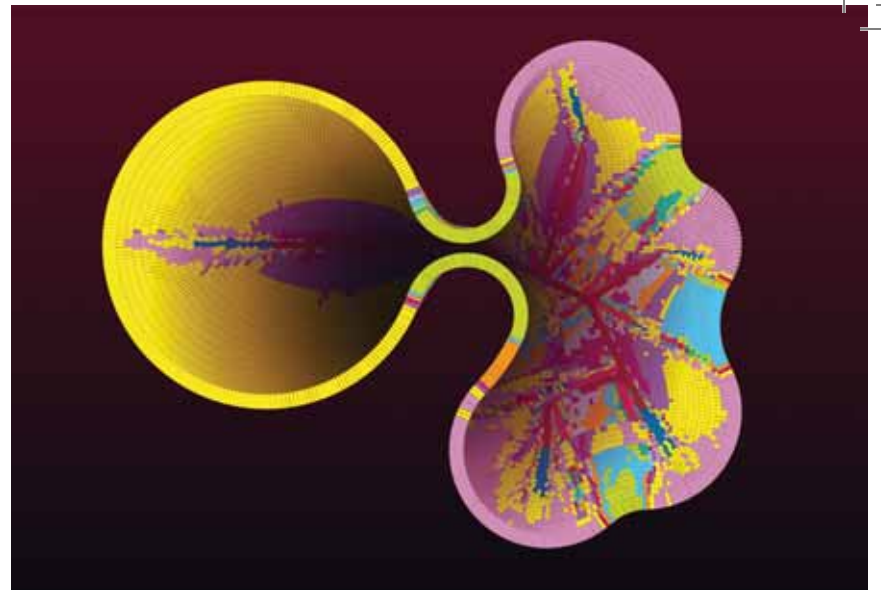
without dealing with the unquantifiable qualities of design—the qualities that ultimately make for good architecture.



**Hina Jamelle, Director, Contemporary Architectural Practice, New York; Lecturer, University of Pennsylvania, Philadelphia.**

If used properly, contemporary digital techniques can be a powerful tool in architectural design, construction, and cost management. Models that acquire intelligence are a great benefit to architects in general, as they can incorporate manufacturing data and cost variables in the same models that generate the architectural design. We have sat down with clients in Tokyo and changed a variable showing what the outcome is on the design in real time. Once the client was satisfied with the design and its cost, the model was sent directly to the manufacturers. This enabled us, the architects, to direct the fabrication process and achieve the design intentions while saving materials and costs. It also empowers the architect again as we control the entire process from design to manufacturing.

Parametrics are a tool. One needs to control the tool by developing particular techniques and having these techniques so refined that the architect can guide their outcome. In our case, a design sensibility guides the use of this tool by specifically developing spatial tech-



Community Center, Uganda, reflected ceiling plan, MOS

niques. For example, the chisel was readily available to all sculptors, but there is only one Michelangelo. In the same way, what differentiates certain architects working with parametrics is their ability to develop a set of techniques and to control them to such an extent that other factors become important—such as an aesthetic sensibility, innovative solutions to clients requirements, or some such thing that provokes new architectural questions or solves familiar architectural problems in new ways.



**Michael Meredith, AIA, Principal, MOS, New Haven, Connecticut, and Cambridge, Massachusetts; Associate Professor, Harvard University**

Parametric design is just a way of thinking of the interdependence between the part and the whole. It is not about fragmentary design or collage. It's not a radically new idea, just a new way of organizing parts and wholes. Previously, we used the *parti*, regulating lines, diagrams, etc. as the methodology for organizing elements.

There is always a danger of conflating the technique of producing architecture and its image. Parametric design already exists, and it's producing incredibly banal buildings, so the technique isn't necessarily corresponding to the image. The wiggly stuff is part of a sort of neo-expressionist attitude that uses para-



Hangzhou Stadium, China, NBBJ

metric design, but there was an expressionist architecture that was post-modernist and modernist and classical. The question of whether one's work is expressionist or normative offers a false choice. I have no desire to be a normative practice, nor do I have a desire to produce expressionism.

Techniques and methodologies are wonderful provocations, but no longer enough on their own as architecture. The brilliance of Formalism was that it was explicitly against the pseudo-science of Functionalism, which was turning the architecture profession into a technical service industry. In that world, engineers trump architects, because the architectural project becomes one of optimization. Formalism reframed architecture as a cultural historical discourse, but as Formalism has evolved and changed over time it has become the positivist endeavor that it was explicitly fighting against: make a formula that makes form. We're now in a weird situation in which both Formalism and Functionalism are no longer useful, and we need to find new narratives for architectural production.



**Nathan Miller, Designer and Parametric Specialist, NBBJ, Los Angeles**

Architects have been engaged in algorithmic form making since well before computers entered into the dis-

cipline. Antonio Gaudi's work using chain models to find the optimal structural shapes for his La Sagrada Familia is one example of such analogue, algorithmic form making. We could even go so far as to say that the system of classical column proportions outlined in Vitruvian texts is a formal algorithm. The difference between *now* and *then* is that advanced digital tools have enabled architects to consider the algorithm in much more precise and quantitative terms.

In general, algorithmic design is about defining the precise rules and constraints that govern a design and then testing variations within those constraints. At its best, algorithmic form making is not a closed, 'anti-contextual' process leading only to interesting shapes. It is, instead, an *open process* in which the specifics of site restrictions, environmental conditions, material properties, and construction methods can all be choreographed into a robust form-making or form-rationalization algorithm.

Parametric design is primarily the *design of processes* and does not necessarily presuppose a particular kind of form. This process is valuable in any circumstance that requires the designer to leverage advanced computational tools to engage complex design problems. For a project that tends to be geometrically normative but programmatically complex, such as a hospital, the architect may want to invent a custom algorithm to help solve space adjacencies

or factor in rules from the building code quickly and efficiently.

Due to its strong link to technology, we cannot divorce a conversation on parametric design from a conversation about the digital tools used by designers. Nor can we divorce it from a discussion on problem-solving processes, which often require that an architect create and/or develop custom toolsets (scripts, plug-ins, software) independently of what is given in out-of-the-box CAD/BIM packages.

In short, to consider parametric design today is to consider that the architect not only designs buildings, but also the processes and tools used to design it: as Marshall McLuhan wrote, "We shape our tools, and our tools shape us."

In a parametric paradigm, the architect understands the design process as the systematic, precise, and holistic choreography of information itself. In lieu of stacks of 2D sheets or large, platform-specific 3D models to describe a complex design, the architect may instead opt to share a mathematical function, script, or database in which parameters and creation instructions can be explicitly defined in no uncertain terms. All toward the objective of creating a precise, performance-based architecture that is responsive to the increasingly complex problems facing the built environment today.



Caption ??? (Greg Otto image)



**Greg Otto, Principal, Buro Happold Consulting Engineers, Inc., Los Angeles; Adjunct Professor, University of Southern California**

As an engineer, I like to think about parametric design as performance-based design, where parameters are optimized according to performative requirements. Having been trained as an architect, however, I am not interested in *uber*-efficient, engineered systems; rather, I am interested in complex, multi-variable systems in which compromise between competing performative requirements is revealed, resulting in hybrids—optimized solutions for particular sets of conditions, be it location, climate, use, etc. In such cases, strategies go beyond the purely formal.

Parametric design is often misappropriated within architecture to describe highly formal work using the digital medium. As one of my professors at MIT consistently reminded me, “garbage in is garbage out,” and certainly this adage is true in architecture. Parametric design is about relationships. If the relationship is only among spatial coordinates, then the proposition is nothing more than a formal fetish hiding behind a misappropriation.

Parametric design should be a standard working methodology within architecture. It certainly is integral to our interdisciplinary working. It is an extension of the old “option analysis” methods used to establish highest

value solutions. Now, with microcomputers, we can run tens of thousands of options within a short time frame to identify highest value solutions defined by a wide spectrum of criteria: performance, cost, constructability, and so on.

Experience tells me that the bias of architecture is the formal, and in operation it forges a silo not unlike that of the HVAC engineer who cannot see beyond his duct to realize there is a bloody beam in the way! Parametric working requires interdisciplinary collaboration that is simply not taught in current architectural education. Real content (coming from outside the profession and found in the sciences) is essential to make parametric design valuable beyond the “bitchin’” object.

Parametric design offers a new opportunity for the architect to regain the role of master builder. It requires, however, a new paradigm of working. While it is easy to point one’s finger at the architect, it is not completely fair; the bigger question to ask is, “Where will the architect find partners for such collaborations?” Certainly, the education of the building engineer is an even bigger failed project.



**Pierluigi Serraino, Assoc. AIA, Architect (Italy), and Author, Alameda**

Although not mutually exclusive, parametric design can take place without Integrated Project Delivery and vice



Flex Physical Therapy & Fitness, Pierluigi Serraino, photo by David Wakely

versa. The only common denominator of these two areas of research is that they both require the use of digital technology. Their dependence on the computer, however, makes them too much distant cousins to be a cozy family.

By intervening at a topological level, parametric design deals with shape optimization per specific criteria stated prior to its recursive process. It connects form searching to a set of performance-based objectives that will yield a shape unknown in its geometric identity to the designer. No predetermined geometry makes parametric designs recognizable when compared to other kinds.

The British Museum Great Court Roof by Fosters and Partners is a publicly visible example of this innovative approach, in which built form is free of historical memory and results from tangible engineering challenges: to mediate in structurally efficient terms the transition between the rectangular edges of the inner courtyard and the circular perimeter of the rotunda.

Integrated Project Delivery is a distinctive approach to the merging of interdisciplinary expertise into a fully coordinated built artifact. It falls under the rubric of professional practice and has virtually no impact on design expression. Its acronym is dangerously close to the IDP (Intern Development Program) and throws even the specialized audience into easy confusion. But, in essence, it is another response to the inherently risky



Jet Noise Wall, Andersen Air Force, Guam, Nick Sowers

business of building, for the client's benefit and the joy of insurance companies. Can it really work, though? Architecture is still a field where proper names have more cachet than anonymous teams. Firms in which the cult of authorship reigns are poor candidate for IPD—too much flatness in the hierarchy.

If the designer is after the *ineffable space* that so spellbound Le Corbusier's audience, in all likelihood it will be parametric design that will yield that dream.



Nick Sowers, M. Arch. Candidate,  
UC Berkeley

My thesis project, which is just getting under way, will lean heavily on the new possibilities offered by software such as ArcGIS, rhino+grasshopper, and a sound-scripting tool called Supercollider. I am looking at jet noise on Guam, which is due to increase with the largest military buildup in the Pacific since Vietnam. The thesis will develop an architecture that responds parametrically to the sets of data that are made available by environmental impact reports on jet noise, as well as the geographic data on the civilian side: census data, density, etc. It is an architecture of negotiation via an armature of parametric design.

My understanding of the statement, “[parametric design] is really different from

wanting a wall somewhere,” is “parametric design is meant to be a means for evolving new materials, new structures, or new theories on space, and not so much a tool to just do what architects do (put a wall somewhere) in more automated ways.” If that is what is meant, I don't necessarily agree. The “somewhere” in that statement can be parametrized in interesting ways. A wall that is trying to find the optimum solar gain, for example, might emerge from a very complex set of calculations, the tracking of which could be very exciting. Placing a wall based on principals of solar gain is not a new process to architects, but how we do it could be changing entirely. Parametric design is changing the *ways* architects do things, not necessarily changing *what* we do.

There are these GPS-controlled drone bulldozers (<http://www.toolbase.org/Technology-Inventory/Sitework/gps-tools>), which theoretically could give a Zaha some new, territorial-scale, 3d printing capabilities; or, more likely—and what the machine was developed for—do the grading for suburban tract homes at a fraction of the labor cost. Parametric modeling is permeating the world in which architects operate, without architects even introducing the tools.

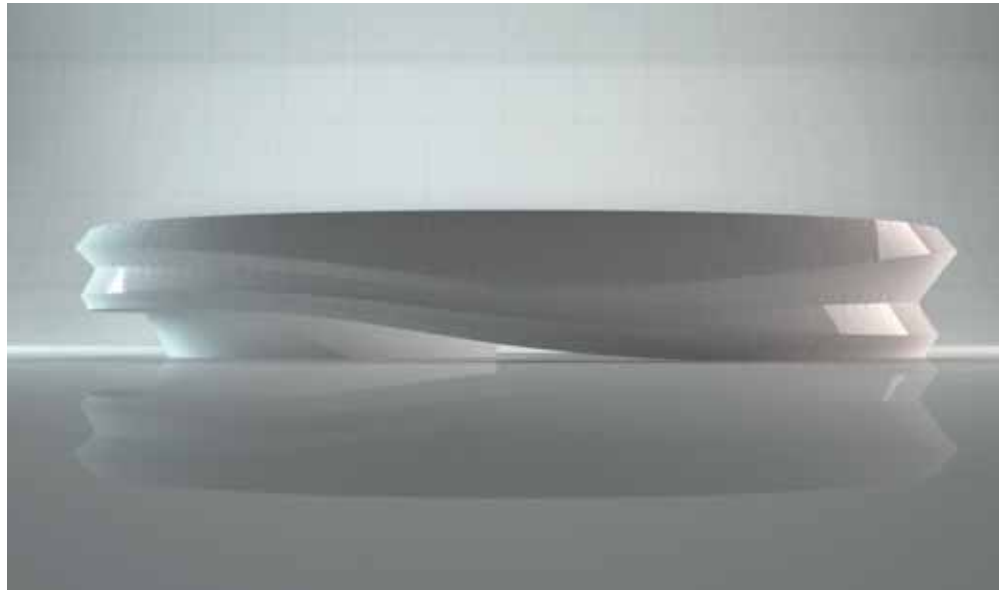
There's always a desire to push the limits of a new tool or system for designing, but that doesn't mean breaking all the rules to do so. The more powerful parametric work isn't

striving to exist on a new planet, but is rather remaking and remixing what is already around us. SHoP's work, in particular the façade they did on 290 Mulberry (<http://www.shoparc.com/#/projects/featured/290mulberry>), evokes the more pragmatic ideals of parametric design. The basic idea is using parametrics to make it cheaper to do more complex work.

While it might seem contrary to the contemporary trend for using parametric design to realize ever more complex and fantastic visual landscapes, parametric design has the possibility to release architecture from the tenacious hold on design by the regime of visual culture, i.e., the production of images for magazines. I'm talking about other ways that we understand space, in part related to David Gissen's book *Subnature*. Can parametric design include more atmospheric, even previously unwanted spatial phenomena like dust, gases, and mildew? Of particular interest to me, it will open new possibilities for design of the sonic environment. We can map sound in ever more complex ways, which might actually yield simple architectural forms—but having the power to shape sonic environments beyond the context of the music hall, even to build cities based on sound: that would be cool.

Parametric design has the potential to provide a unified front line to the multiple scales that assail the designer. In my thesis, for example, noise absorption analysis at the material scale could work in tandem with

right and following page, Skidmore Owings & Merrill LLP, project for a rapidly growing Internet company in China, creating a physical place for experiments in social/digital interaction and for large-scale internet game performances, concerts, fashion shows, and other art and cultural events. Exterior form study and plan and partial elevation views of parametric model illustrating structural stresses.



macro-scaled analysis of jet noise contours in order to produce a sound-attenuating barrier. Via rhino+grasshopper and arcGIS, I am able to combine manifold site and atmospheric parameters into a single mechanism.

Limitations? The human mind is the only limitation. Our scripts will only be as smart as we make them. There's also a danger to believe that, because something is designed parametrically, it is correct. We have to keep our "hand" in the design and be skeptical about what the computer turns back to us.

#### SOM San Francisco

arcCA addressed our questions to Craig Hartman, FAIA, design partner in SOM's San Francisco office. Craig, in turn, sought the thoughts of his design team.



Carrie Byles, AIA, Managing Director

There is no requirement that parametric design be wiggly. SOM has used parametric tools to optimize the application of a window wall system for complex buildings. The equations driving the model are set up to use rectilinear components with as much repetition as possible, to reduce construction cost while optimizing the performative aspects of the wall through environmental analysis tools. This complex analysis would be practically infea-

sible by hand and is ideally what the power of parametric design is all about, allowing the architect and engineer to explore a greater number of more complex options to push building design to a higher level of performance and elegance.

With the new awareness of climate change and the urgent requirement for higher performance buildings, multi-disciplinary design powered by parametric design and tighter integration of real time environmental analysis is here to stay. When we look back in time to this decade, there will be a perceivable shift in the quality and performance of our buildings, as well as in the form of the built environment.

The greatest limitation right now is that architects don't always have an ability to approach their designs as mathematical equations. It can also be frustrating to reach a point in the process and realize that you want to change an aspect of the design model that you had not thought to make one of the variables. On the other hand, there is no reason to be overly dogmatic about parametric design's application; there is much to be gained from integrating PD into one's practice in specific areas of design, research, and analysis.



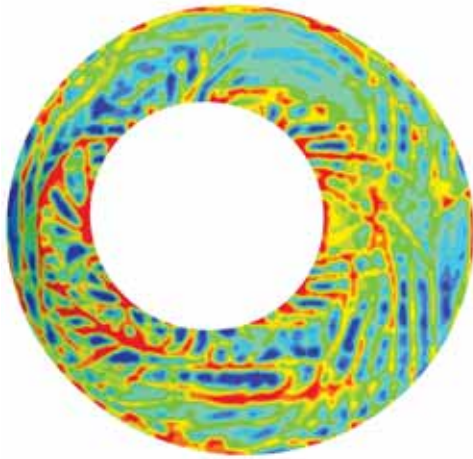
Structural Group: Mark Sarkisian, Eric Long, and David Shook

The power of parametric modeling is the actionable execution of ideas. Parametric design is the utilization of quantitative rationale to achieve design. It is an exciting field of study, but one that is often misused. Designers need to spend the appropriate time and effort developing a sound basis for the development of forms and systems.

The incorporation of normative practice is important to keep costs at reasonable levels and novel ideas realistic. This can be done in an automated fashion by generating a set of 'interpreting rules' for the application of a parametric design.

One misunderstanding is the notion that parametric design is generally targeted to exterior form making. The true power of parametric design lies in the ability to incorporate a multi-disciplinary set of design variables, such as structural engineering, MEP systems, and environmental analysis, to enhance traditional goals of form, context, and space making.

Its promise lies in the discovery of new ideas, concepts, and relationships to design high performance buildings based on multi-



disciplinary objectives. Its limitations lie in the natural tendency to exert bias to a pre-developed solution and the need to rationally interpret the results.

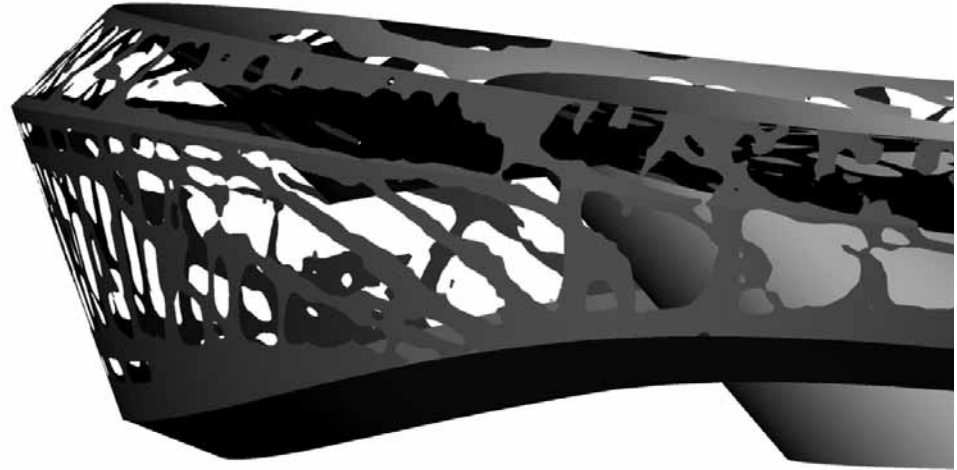
The power of parametric design can be further exploited by the integration of contractor-influenced variables such as fabrication, delivery, cost, and schedule into the architectural and engineering design goals. A truly collaborative environment, free of egos and fear of litigation, is necessary to fully integrate parametric design into the IPD process.



Craig W. Hartman, FAIA, Partner

First, it is important to distinguish between digital design and parametric design—and the formal speculations with which they are often associated, such as the blob architecture of 1999-2000 or more recent organic/biologically based architectural forms. Parametric design is essentially digital design with an embedded value system. Both are simply tools. They can be used to arrive at, or even generate, form, but the nature of form—orthogonal, fluid, or otherwise—is decided by the architect, not the tool.

The reason fluid architecture is most often associated with digital and parametric design is simply that the visualizing, dissecting, and quantifying of non-orthogonal form and volume are much easier using computational sys-



tems rather than traditional handmade drawings and models. This architecture is not a cult experiment. The past, from Borromini to Eero Saarinen, is replete with masterworks of fluid, organic space, and the future will be even more so, given the possibilities of computational design in the hands of talented architects. But whether the future looks more like Borromini or like Hilberseimer is not necessarily a question of computational design.

Putting formal questions aside, parametric design is a great leap forward in achieving intelligent built form, whether a teacup or a city. At SOM, we are using it across all disciplines—graphic and product design, engineering, urban planning, and architecture. It allows us to quickly understand the intersection of multiple variables ranging from economics to performance to form. It is very much in its infancy, but it is without question the most powerful new development in architecture. As a tool, parametric design promises to make buildings and cities more efficient, livable, and sustainable, because we can quickly understand the integrated performance results of design decisions.

As applications become commercially available, they will inevitably become integral to every design practice. And, without question, the nature of design practice will continue to quickly change—as it is in our own studios—absorbing specialists and researchers who are capable of manipulating and

advancing the tools.

Where does this lead? One might speculate that architectural form could become very deterministic. That once all the proper design values are loaded into supercomputers, artificial intelligence and value-based parametric design will spit out the perfect city, building, or tea cup with the push of a button. But architecture is a cultural art form of humanist values. The ethos, talent, and vision of the architect using the tool remain the critical factors. Despite the tools, the sensibilities of a Borromini will still be welcome. ●