

## Never enough (transform, repeat ad nauseam)

The architectural field's current use of the parametric has been superficial and skin-deep, maybe importantly so, lacking of a larger framework of reference, postmodern semiotic signification, everything visual eventually devolves into symbolic imagery. The recent architectural production has been dedicated towards a post-post-modern architectural production as a way to escape significant and subvert modern architecture of radical distortion as stretched out shapes, extreme continuity semiotic legibility (twisted hyperbolic forms, stretched out shapes, extreme continuity of planes and surfaces, etc.). I would argue that the "parametric work" being produced today fits within an evolution of so-called postmodernism, concerning the image and referent although the parametric is the tautological modular image of quantity; referent although the parametric is the tautological modular image of quantity; the indexical referent is itself and analogous systems. To the extent of the profession has utilized parametrics today, there is very little instigating complexity other than a mind-numbing image of complexity, falling far short of its rich potential to correlate multivalent processes or typological transformations, parallel meanings, complex functional requirements, site-specific problems or collaborative networks. When something supposedly looks "parametric" today, it's aesthetic (re)production—the repetition of quality and taste. The mastering of hi-tech engineering software is ultimately used to produce ornate architectural decoration. The escape of referents through radical distortion becomes just another referent, albeit a solipsistic one.

Due to the inherent specificity of computational complexity or the desire for visual unifying consistency, parametric design typically reduces the number of formal variables, but maximizes their variability through transformational affects which are engendered via quantity. Although, this is extremely pragmatic in the production of panelized doubly curved surfaces (which is how we've used it in the temporary Huyghe puppet theater project and the Drive-in screen, ground, projection booth) it can quickly devolve into an aesthetic solely based upon the transformation of parts within a field, a totalizing smooth and singular formal aesthetic. The parametric is a totalizing aesthetic built upon the legacy of American formalism, an ideology which has since transformed from an important critique of functionalist dogma as a positivist and naïvely utopian discourse into its own positivist position ("it has to be that way because of the geometry or form" or "the software did it").

Parametric design fits within an architectural discipline that is simultaneously searching for a unified organizational clarity (the diagram, part, etc.) and visual complexity (Venturi), but no matter how patterned, totalizing and parametric it is, architecture is inevitably a fragmented, orphaned object, even if it is a field or in a field. It requires differentiation for it to become Architectural, and it is the socio-political that allows it to escape the emptiness of objects. Architecture requires social engagement; it requires cultural/social relevance. It is not the parametric, the relentless malleability of form, nor is it complexity for its own sake, but rather a complex of complex relationships that produce architecture. The operational paradigm we're interested in is akin to Pierre Bourdieu's "field of cultural production," where form is the playing field within competing vectors within a larger cultural field.

forces (instead of internalized language games). The specificity and agency of architecture can only happen within the particulars of its situation and in relation to the larger field. Architectural production is no longer the Marxist "us vs. them" dialectical model of resistance. In architecture there is only criticism within the market culture and something can only become critical in relation to things outside itself. Similarly, we always considered the dialectical opposition of form vs. material, at the least, exaggerated. It's an opposition born of post-modernist signification, where form is more critical/meaningful to signification than material in which the form is based. This distinction is too simplistic and dogmatic. The potential of complex parametric relationships are to become radically inclusive and reconcile this artificial, form-vs-material binary. Parametric models offer another type of play and design process based around multiplicity of scalar parameters, but it never resolves what parameters are necessary for architecture.

Like the other architects in this book, we're guilty as charged—formalists, specifically interested in fields of formal relationships. For us, the persistent architectural narrative of formalism has evolved so that the specificity of use is more important than the instantiation of form for its own sake. However, the instantiation of "use" should not be misconstrued as a simply pragmatic or functionalist narrative, but rather as against the simplistic and totalizing solipsistic internalization of architectural production. Use is about the performance of architecture: the double *entendre* of performance, both of utility and theatrical value/relevance.

Today, disciplinary formal games (unlike in the 80s and early 90s) need a purpose other than aesthetic experimentation in itself. The architectural discipline—the academy's legacy of beaux-arts formalism—has become so watered down and vague that it no longer provides a strong armature to work against or within. Without a broader system, the drive for form has been listless, lost in self-referential exercises, meaning less outside the field of architecture itself. Instead, architecture should *perform* rather than simply *form*; structurally, environmentally, programmatically, contextually, or in multiple formal arenas. Formal distortions need to have purpose or cultural relevance and cannot stand alone as games or algorithms. Within this new discourse, meaning can be constructed locally and relationally.

The discourse of architecture has been too bound up in the techniques of its own construction, not its cultural social situation. Of course technique is part of the cultural situation, but we've forgotten about everything else. The object of architectural has become so depoliticized and neutered that we think it's just a progression of different tribal ideologies. Ideology is personalized to the point where there is almost no discourse. Performance optimization is not a fundamental architectural determinant. Architecture is primarily a cultural socio-political form, not technological determinism. It's super vague, it's inclusive, relational, it's parametric, but it's far more complex than any of us could singularly map out within the computer and totally understand because it's out of our grasp. Not everything is easily quantifiable or all relationships are geometric and not all are to be coordinated into a smooth relationship. Traditionally the enemy of avant-garde art and architecture is the production of taste and quality, false expression of the culture. We are not against these *per se*, but operating without an a priori "style" means we are looking to define an alternate

systems. If anything an inclusive parametric process changes how we work, as well as our relationship to the 'office' itself. Parametric modeling is a discourse built upon techniques of either subdivision and/or aggregation (the perimeter is always arbitrary), but just as important are the office-laboratory, or workplace itself, as are the clients and users. The "apparatus" we use shifts and changes for each project. As Paolo Vitro describes in his essay *Grammar of the Multitude*, the office is not a single person, nor is it a "we." Our office is a multitude of individuals and ideologies; there is no inside and outside; no "us" or "them," inclusive of everything, excluding nothing. Everything can be internalized as a parameter. Our office itself is "parametric," a network of parameters connected to other offices and persons that try to remain as open as possible. The systems individuated opinions and persons that try to remain as open as possible. The systems' openness is perhaps a direct result of the lack of a dominant ideology or position, certain aspects of an "open work," to use Umberto Eco's term. It describes one facet of current production, encompassing multiple readings, and the lack of any singular narrative, without a narrative hierarchy, where we look for "fields of meaning," instead of linear threads of meaning. As a result of this fluid system, the relationships that engage successive projects can shift or expand, constantly adapting to changes in the field, as well as socio-culture at large.

If our office is both an enactor of and an allegory for parametric systems, then the projects created within them are perhaps not as significant for their own sake as designs, but rather what they indicate about the evolving, if somewhat disoriented, nature of the field today. As specific (parametric) techniques of production and formal experimentation reveal the fluid normative workings within and between architectural offices, they also suggest how, in their (current) (problematic, proliferative and imagistic nature, context and use can be embedded in ever-multiplying, self-referential, parametric projects. However rudimentary the ways in which our offices are simultaneously and (albeit often unconsciously) cooperatively working to broaden and complicate formal experimentation, in order to imbue our technological development and their resultant a socially grounded context, their very multiplicity and corresponding ambiguity can be extruded in such a way that the discipline of architecture itself, through the interaction between aforesaid "parametric" offices, possesses the potential to become a kind of ground-zero for the socio-political dimension currently missing from the current formalist trope of parametric modeling.

At the moment, we don't have any dominant prescriptive system, we consciously work within a very makeshift interdisciplinary practice engaging new media and methods of production, so parametric modeling truly helps us play by incorporating as many parameters as we can. Again, yes, the future is parametric, I have no doubt it will be, but technology won't fix all our problems; unfortunately, they're much deeper and much more human. Architecture can only be critical or difficult or meaningful or complex if it directly engages culture, if it becomes meaningful to a social cultural network. It can only persist if it is elusive, more adaptable, less absolutist... allowing for the capacity to become more inclusive, more adaptable, less absolutist... allowing for a new model that is not built upon the persistent dialectical constructions of form/function, but more inclusive more adaptable more socially relevant providing a provisional utopia, one that is here and now.

quality, one that is specific to its situation, one that establishes an alternate space for itself within its site. It doesn't have to express a generalized sense of culture, but the cultural variables that are at play within the specific situation. What is interesting to us is within the armature of each project, looking for new methods for the production of work, utilizing parametrics, but also establishing another mode of working in our office that isn't based upon traditional "top-down" hierarchical structures. The quality of the work depends on the depth of meaning generated by the specific circumstances/parameters of the cultural landscape it occupies; in this, the parametric can engage its full capacities.

Ultimately, what interests us about the parametric project is exactly what it excludes, the socio-political dimension of architecture. Parametrics' potential is to produce a hyperinclusive network of parameters and relationships—the more multivalent the object the more meaningful and complex it is. The more multivalent the object the more engaged it is in culture/market and the more elusive it is to being absorbed by it. At the very least, the narrative of "use" provides some sort of agency to form making, deriving meaning through the influence and production of formal contingencies—variable relationships from inside and outside the architectural object. Constructing use as the performance of architecture, however, is not about reconstituting a neo-neo-function-alism/formalism) of form follows function. Use is a narrative structure. Constructing narratives of utility provides an instrumental form, which could include pragmatic performance, the visceral, as well as the intellectual, discursive, without forsaking formalism by providing an instrumental form, which could include pragmatic performance, the visceral, as well as the intellectual, discursive, or meaningful. The potential for use is synthesizing multiple narratives of architecture, typology (especially typology), performance, material, relational participation/production within a given site rather than autonomous legibility of internal relationships. These cultural, social, formal narratives provide architectural value. Use renders form as something more than an isolated physical or aesthetic object; it provides the architectural object with both denotations and connotations which can resonant outside an internalized field of signification. Through narratives of use, meaning is intimate, at a small scale and in relation to the specificity of its situation.

How has all of this affected our design process? I'm not exactly sure. (Within parametric terms, typically, our projects are manifested through point fields that are easily manipulated through lines and their position on lines. Those lines are manipulated through surfaces, typically surface normals. Parameters are constructed, some relationships are formalized while others remain immutable, due to constraints arising from site, material or structure. There is a clear hierarchy of elements and technique. Recently, we have been able to change this operative system where lines are produced through points that are produced through lines, and surfaces are produced through points or lines; essentially the hierarchy can break down and through scripting and programming within a parametric environment, through self-reflexive systems, the process can produce a sort of feedback loop of parameters.) We script, utilize and play with software in our work, and we appreciate the level of control and precision it offers, along with the intensive potential to experiment within a highly controlled environment. It is not all we do, but it is important to establish inclusive organizational

"The dynamics of line and surface define the templates that create architecture and organisations. In the making of form it is not only shape that counts but the rules and interior logic by which such contours are derived. Probing these regimes is the research, understanding the results and putting them into practice is the work, and the AGU is the mix of architects, engineers and scientists that create designs, beyond mere style and fashion, to offer interest and beauty." - Cecil Balmond

The Advanced Geometry Unit at Arup is a multidisciplinary group of architects, engineers and scientists working together on the making of buildings, structures and environments. We came together in 2000 as a small group of people that shared common interests in the definition of a new practice. Architecture is either derivative of past models or pursuing sensation through experimentation, usually engaged in the trivial mimicking of software-lobed surfaces: we wanted to build from first principles and our own prescriptions of forms based on interior dynamics that grow their own logic.

The approach is to accept as irreducible the notion of complexity: a holistic view, one that is different from the traditional methods of drawing sections and plans and then extruding or patching them to make buildings. For the AGU a form is not only a building but can be viewed as master plan, structure or sculpture—any organisation that interrogates space in new ways. We carry out our own designs and are also in a commitment to collaborate with other architects and designers. The AGU is an investigation into a new aesthetic.

**AGU**  
 Advanced Geometry Unit at Arup  
 was funded by Cecil Balmond in 2000 as Arup's think tank addi-  
 tional to its researching complex structural geometry in support of many  
 architectural visions and solutions. AGU has collaborated with many  
 architects, scientists and engineers and realised a variety of remark-  
 able buildings like the Serpentine Pavilions with Topo, Daniel  
 Libeskind or Alvaro Siza, Centre Pompidou, Metz with Shigeru Ban,  
 and the CCTV New Headquarters, Beijing with OMA. [www.arup.com](http://www.arup.com)

## p.art® at Adams Kara Taylor

(parametric applied research team)

Structural and Civil Engineering Consultancy based in London whose driv-

ing force is the dialogue with the architect, other designers and the client.

A young professional team with a variety of backgrounds including architecture

structural analysis, computer science and 3D visualisation and animation, p.art

allows for the intellectual speculation of academics to extend into and redefine

the realm of engineering and architectural practice. [www.akt-uk.com](http://www.akt-uk.com)

p.art work with a diverse range of architects and designers each one employing a different approach to the creative process. At times they are part of a complex web of interacting development stimuli and aesthetic aspirations. At other times interacting sensitively with the spatial experience that an architect or designer is seeking, the complexity possibly not coming from the diverse range of design constraints that must be considered but from the rigorous application a geometrical rule set, material choice or specific design style which must be adhered to.

How can a structural engineering practice adapt its business systems and organisational procedures in such a way that the response to these diverse design requirements is a proactive and collaborative engagement with other designers rather than a passive mechanistic adherence to the traditional design process? The approach at AKT has many strands and, as with all complex systems within business and nature, the optimum performance is only achieved when each strand works in harmony and with fluidity. One of the organisational strands within AKT is p.art, the parametric applied research team.

The aim within p.art is to bring together designers from a variety of backgrounds such as architecture, structural analysis, computer science, forensic analysis, and 3D visualisation and animation. This array of cross disciplinary skills and training is then utilised to find and develop a toolkit of design approaches and methodologies which can be brought to bear on specific project challenges. Of course each project brings a unique set of design hurdles to overcome, the ongoing question with each project is how best to utilise and develop the toolkit of methodologies in order to customise the process to suit the particular project.

The work within p.art is aimed at developing the discipline of structural engineering, as it is currently perceived by many, towards a more pluralistic approach taking advantage of skills from a range of design disciplines. In the following articles we present some of the work currently being undertaken covering diverse aspects of the design process including:

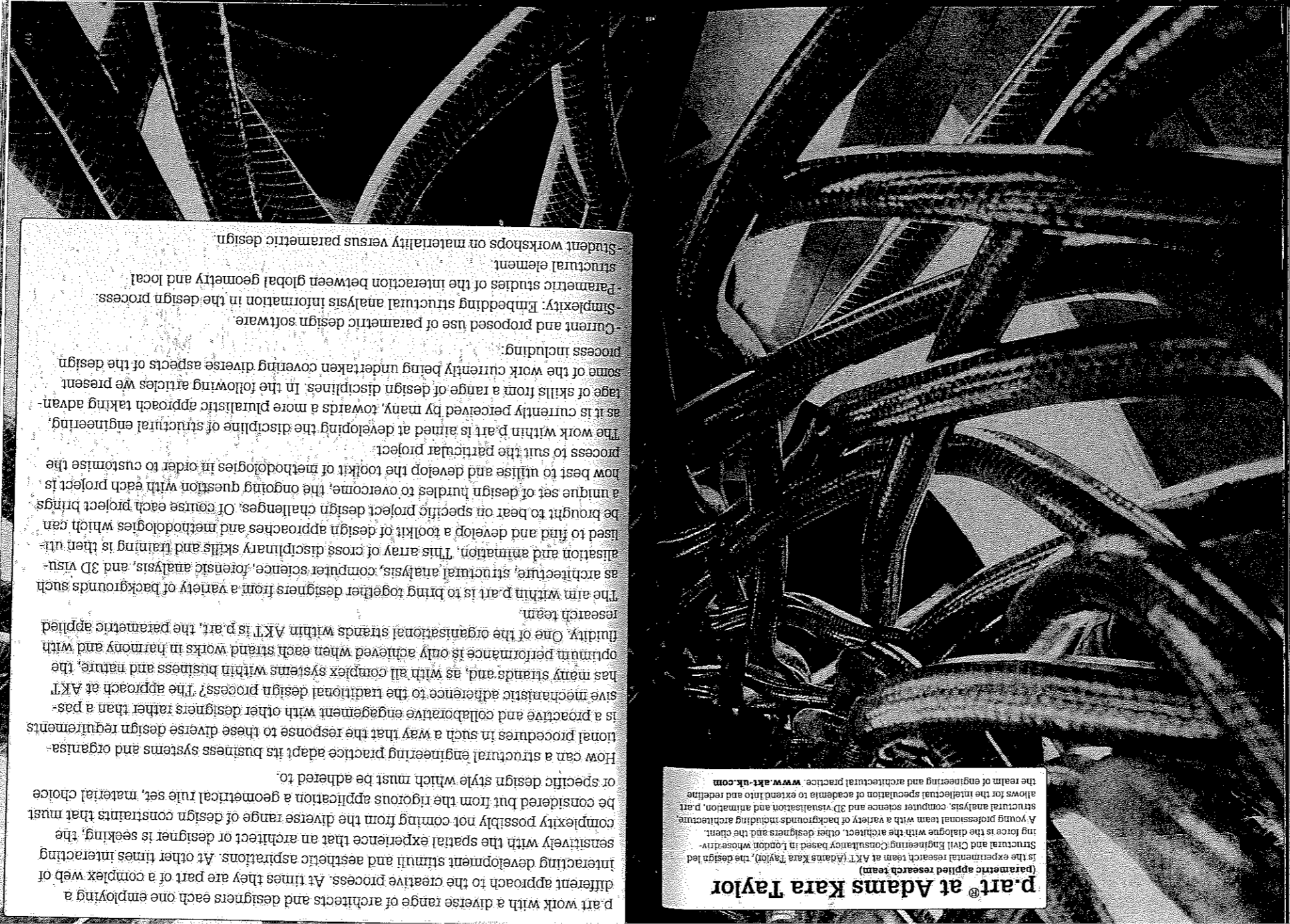
Current and proposed use of parametric design software

Simplicity: Embedding structural analysis information in the design process

Parametric studies of the interaction between global geometry and local

structural elements

Student workshops on materiality versus parametric design



## Open systems: approaching novel parametric domains

Marco Vannucci

Some of the most relevant shifts in contemporary architectural discourse and practice are intrinsically connected with evolution in computation techniques and software development.

The novelty in architectural design brought forward by new computational tools is often related to software packages or digital techniques developed in other design fields. Innovations in computational as well as manufacturing processes, in fact, experienced and developed by naval, aero, automotive and products industries have represented seminal undertakings for innovation in the construction industry and, moreover, for experimentation in architectural practice.

The introduction of parametric software packages in the world of architecture and structural engineering, despite being a fairly new paradigm, is already redefining the discipline from within.

Traditional CAD products create lines, arcs, circles and a great variety of geometrical objects; making design changes to a given geometry requires changing all appropriate components in order to make the drawing correct.

A new generation of parametric design systems establishes models defined by a collection of constrained relationship between objects. In other words it allows setting up parametric geometrical arrangements capable to build anticipated variations between objects.

A parameter is a variable to which other variables are related by means of parametric equations: design modification and creation of a family of component parts can be performed efficiently by setting up reconfigurable smart models capturing the underlying logic of the design.

The instrumentation of parametric setups into architectural practice is starting to shift the role of the architect in the design processes: from the design of specific shapes to the determination of those geometrical / algorithmic relationships describing the project and its components. The design shifts from drawing surfaces to setting up rules of interdependency—genotypes—leading to potential differentiation—phenotypes—!

The novelty represented by parametric tools in architectural culture hasn't found architects unprepared to conceptually understand its potential for contemporary practice: the responsiveness by which architects and advanced design firms gathered the resources of associative design has triggered a fast implementation of parametric tools in the software industry as well as an increasing curiosity to apply its potential in contemporary architectural design.

Nevertheless, despite the receptivity of some of the most interesting cutting-edge architectural practices, it is possible to trace certain tendencies concerning different approaches, some limitations and novel developing scenarios.

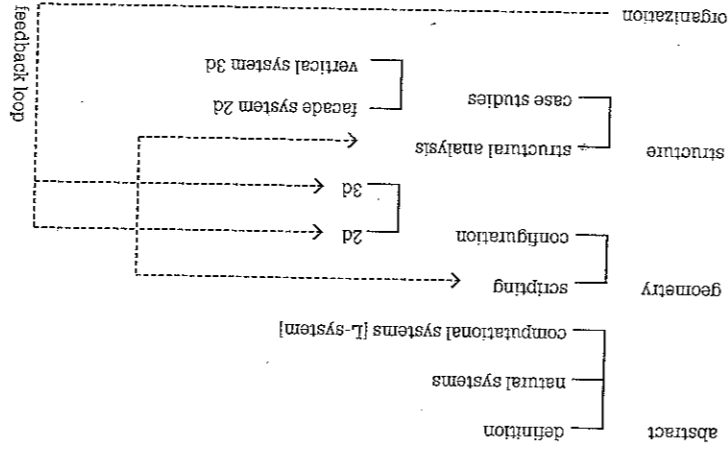
Architecture is ultimately characterized by the need for a coherent design logic between different elements forming a whole constituted by an interiority and an exteriority; quality and meaning are achieved through the rigorous determination of all those elements contributing to the interlacing between the different components and the building in its entirety: facades, detailing, proportions, symmetry, modularity just to name a few. Thus, parametric design is important for that: the possibility to establish intricate system of relations between different objects and their properties fusing the hierarchy between parts and whole.

"So far experimental architects have just jumped from top-down determination of parts to bottom-up determination of wholes," Greg Lynn<sup>1</sup>

What Lynn points out is the delay by which architects have employed parametric design in the development of bottom-up approaches where the determination of components has been prioritized over the design of the whole. This approach has just represented an extreme case. Nevertheless, reshaping the traditional dichotomy between the building and its parts, new digital parametric tools still leave behind some unexpressed potential for contemporary architecture, particularly in relation to the possibility to define highly modulated wholes together with the determination of differentiated components.

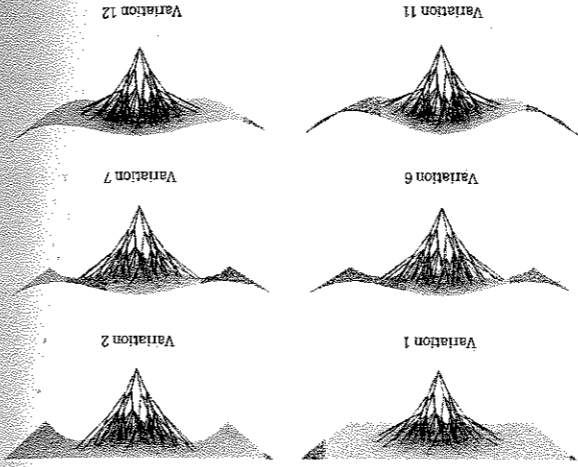
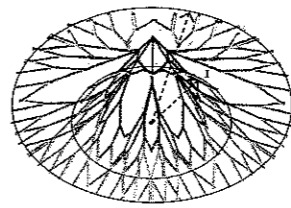
In contemporary construction industry, instead, parametric softwares are often employed in design processes of rationalization and post-rationalization where, given a certain project, the answer to specific problems is required to actualize the desired shape [problem-solving approach].

Branching system: the matrix shows parametric variation of the geometry



In this case the potential of computational tools is utilized for its higher degree of precision and speed to deliver tailored ad hoc solutions: the parametric modeling is driven by the need to engineer rational solutions in order to fulfill structural, geometrical or fabrication requirements. In this case, in fact, the potentials for a generative approach are set apart in favour of more pragmatic strategies. At the other end of the spectrum, by contrast, the proficiency of academic research to implement the generative potential of new computational tools is leading architectural experimentation towards unexplored territories where, more and more often, the figure of the (forthcoming) architect is contiguous to the one of the computer scientist. Thus, academia is quickly pushing the boundaries of parametric/algorithmic architecture towards the definition of novel paradigms, heading towards a higher level of complexity and sophistication marking an increasing disciplinary divergence between research and practice.

The part team sets its line of research at the intersection of these two worlds, searching for the definition of an integral approach to parametric design in the endeavor to bridge the gap between architectural design, structural engineering and evolutionary design strategies. The interdisciplinary structure of part and its heterogeneous research spectrum describe an open source design structure where the employment of parametric tools represents one of the most fertile lines of investigation. part is increasingly raising interest within the contemporary architectural and engineering realms due to its capacity to create an innovative interface between architectural research and structural engineering opening up opportunities rather than providing answers. part operates allowing collaboration between different disciplines and differing expertise in an attempt to create a common ground where it can be possible to formulate novel design strategies. part engages its research agenda through the employment of several different digital tools: among others, parametric software such



as Digital Project, Gehry Technology's 3D modeling package based on Catia, which it has been used since first the team was set up. The paradigmatic innovation of parametric design originates from its modus operandi: the intrinsic resilience to free-form sketching exercise of Digital Project, in fact, requires a sharper understanding of complex geometry and induces the designer to think through the system logic before even starting to draw a line. In this sense it is projecting desirable perspectives where architectural design is generated from a set of rules and the interdependent relationships between parts governing the manifold aspects of the design. The advent of parameterization increases the complexity of the design task in relation to the necessity to build up not only the model to be designed but also the conceptual structure that guides the parametric variations. From a design point of view it is possible to imagine the advent of design methods based on codified geometrical operations proliferating and interacting to achieve a higher level of complex order: the development of a specific design vocabulary based on parametrically codified instances prefigures a fully integrated design approach where complexity and differentiation emerge from the set-up of coherent and controlled operations.

In this sort of scenario the role of the architect and that of the engineer is contiguous and inform each other in a truly cooperative and generative holistic design process. So far, part's engagement with DP is twofold. In the first instance, in fact, part's use of DP has been mainly concerned with the study of complex geometry deploying feasible and buildable solutions: it has been deployed in a "problem solving" approach for specific ongoing projects whereby the mutable nature of the design required an adaptive model. The constant adaptation of the structural arrangement to the changing nature of the building envelope throughout the design process allows, among other things, the iterative computation of structural analysis models, almost in real time.

