

The model and its operative significance in architecture: objects driving evolution in design research

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Abstract: This paper draws upon the distinction between aesthetic and operative characteristics of models set for exploration in scientific and architectural research. Specifically, it weaves a link between Cache's concept of *Objectile* and architectural models appointed for studying design's inner logic also in reference to models describing biological functions. The outcome of this synergy is models that respond dynamically to variable data inputs and designated tasks. However, even when models are primarily applied as highly intellectual devices rather than ones being merely visual, still they cannot be detached from the formal idioms data is presented, compared and implemented with, set in reference to the graphic languages and the communication means by which content of any kind enters the architectural scene. As a response to this apparent incongruity, this paper delves into the operational role of models in the architectural making seen not as aesthetic objects, but rather as testimonial instances of a dynamic system in a continuum of recursive exploration and testing, further prompting to understand design as an experimental process undergoing phases of evolution, and so evincing architecture's profound affinities with science.

Keywords: Model; objectile; cybernetics; bio-structuralism.

1. Introduction: research models in science and in architecture

Research in science generally assumes applying experimental methods of high reliability in order to produce new knowledge or refine existing one, helping to find proper answers to fully identified problems. Research findings should be stable, useful and repeatable and also, as Glanville (2014) suggests, be consistent with what is commonly approved and stick back together within the larger structures. Models are companions to scientific research, corresponding with the different phases of the exploratory process. Typically, they are made as simplifications of reality, representing variables associated with particular data put under iterative testing, comparison and assessment. As such, models are suitable for tweaking of data through controlled operations, resulting in different outputs produced and reproduced at will.

The above description is pertinent to scientific research directly relating models with a consistent progression of actions, as it also shows affinities with the ways models are appointed for exploration in architectural design. In that case, models may refer to the various means assisting the process of making. They are essentially active, in the sense that they enact, as Picon (2010) notes, negotiation between subjects and objects involved in design such as the designer, the data, the software and the hardware. Architectural models also present their performative character through real-time feedback. Initially they are made to visualize the designer's intentions, as they are being enriched with more information that enters the working scene, so that the project evolves into more materialized phases gradually leaning towards a design proposition (Figure 1).

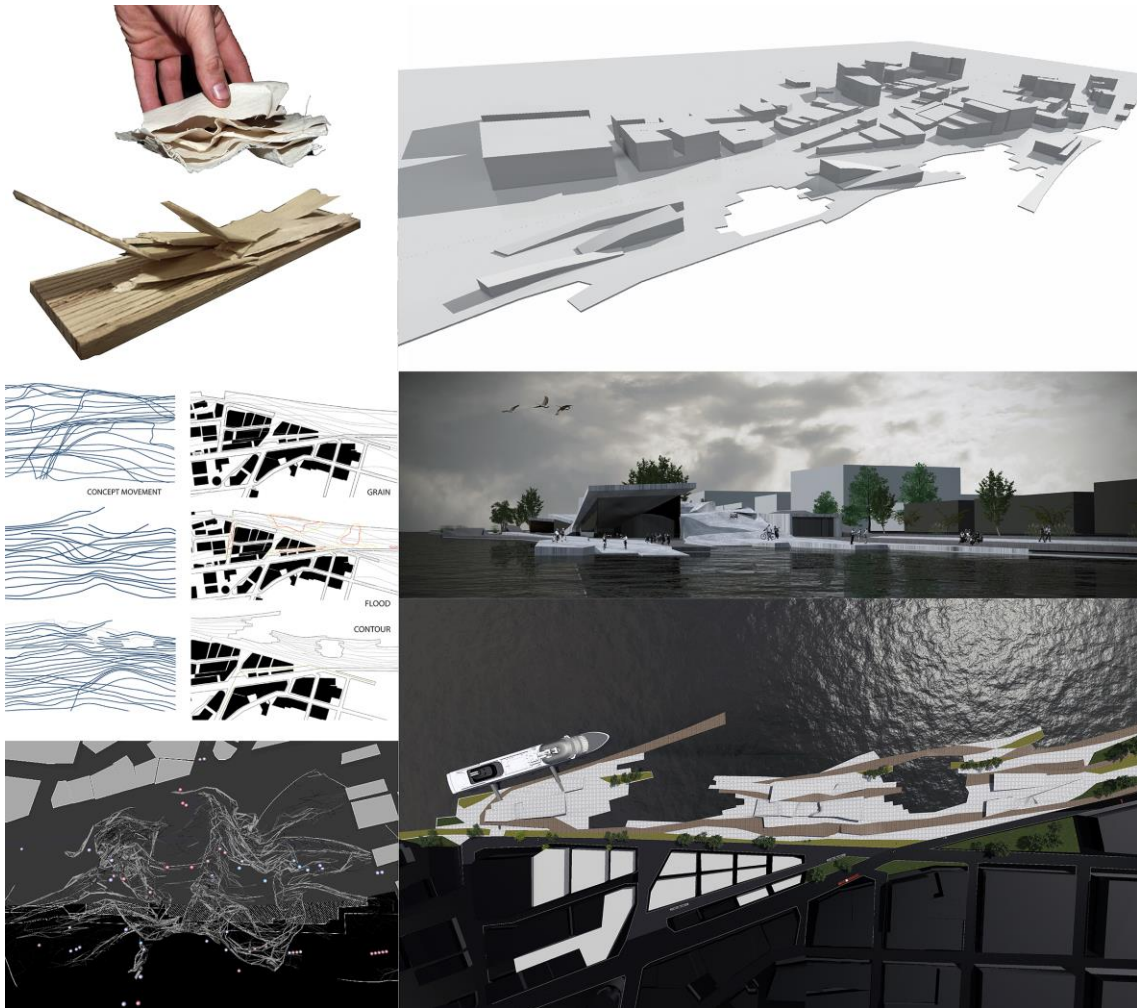


Figure 1: Models set to test stripes of land and implementation to a design proposal (source: C. Rowley, Y. Zavoleas, "Mutant body" master's architectural design studio, The University of Newcastle, 2014).

The kind of models discussed above is different to those produced at the end of the design process to illustrate a project upon completion. There is a clear distinction between models set for exploration to those presenting the aesthetics of the final outcome. This observation applies to models created with either analogue, or digital means. It is worth noting though that the embracing of advanced digital processes in architectural design has rendered the model an exploratory tool assisting progression and decision making, that is, closer to the ways it generally operates in scientific research, whereas various software commonly assisting architectural practice still assumes that the digital tools are mainly ones for documentation and communication across different areas of expertise and working platforms, not so much in relation to the creative phases. In effect, various analogue and digital platforms currently available support multifaceted approaches, favouring equally different ideologies about design research and practice. Apparently, there is a growing separation within the discipline of architecture in reference to the usage of models, the appointed tools and the modes of design, to the point that one is forced asking (Picon, 2010) whether architecture is an aesthetic or a performative discipline, and if in fact it is both, how the often opposite priorities that emerge may be compromised.

In view of the above, this paper outlines what is implicit in the notion of model being symbolic of an augmented view of the drawing and its operative significance in architecture. A response is crafted first, by comparing assumptions related to the aesthetics of architectural models especially since these have largely been influenced by the digital means; second, by focusing on the performative character of models used in design research and their structural analogies with ones describing behavioural functions. An updated notion of the architectural model is proposed as a dynamic intermediate in support of architectural design seen as an evolutionary process that leads to enduring outputs.

2. Models in the design process

2.1. Aesthetics vs. function

Models generally refer to approximations of original phenomena to assist calculations, analysis and predictions. Models omit all but the most essential data, being closely connected to the modes selected to represent that data. The notion of the model in architecture, apart from 3D representations, may also denote, as Glanville (2012) suggests, sketches, diagrams and other graphemes commonly classified under the notion of drawing (Figure 2). Architectural models made for experimentation are not primarily set to portray the geometries about design in a conventional manner, but as Rahim (2009) claims, to further design innovation and produce proliferating cultural effects. Especially with digital operations such as scripting and dynamic simulation it is possible to connect different sorts of data structurally and make them interact in ways that the output may not be appreciated visually, but instead be read in response to rule-based research scopes. Experimental processes related to the computer if applied systematically, may in fact help to envision updated definitions of the architectural model and, as Picon (2010) foresees, create new perspectives on the evolution of design. As such, architectural models are less means for delivering the aesthetics about a project, but ones where form occurs in the first place being the product of synergetic interaction assuming design as a field of (pseudo-) scientific research.

However tempting such a prospect might be, it does not eliminate reservations mainly expressed by traditionally trained practitioners and thinkers, who see in these models and the tools they associate with a lack of aesthetic control by the designer/computer operator, and along with it a conviction to surpass human creative intelligence by constantly promoting extremities, leading – often disappointingly – to meaningless creation of forms easily sorted as different versions of digital mannerism. The

challenge is even greater when these tools act in conjunction with intricate themes of scientific origin, often setting attractive methods for exploring and reproducing complex morphologies, but offering ambiguous outputs when they are eventually implemented to the built environment. For example, the uncritical embracing of references from biology into design has created concerns as to what kind of architecture is produced if organic patterns are automatically set to construct ones in architecture. Initially driven by an admiration towards nature and natural processes expressed by biomimicry and biophilia, models of biological origin are often appointed to suggest forms that present little or no relevance to biological objectives, let alone those establishing architecture as a reputable field of the human intellect. Awkwardness is even greater when the designer applies parametric routines in order to facilitate repetition, but, as Picon (2010) describes, hasn't fully integrated them in the process of conception to ally with his/her intuition. A result of this kind is described by Hensel (2009) as "parametric ornamentalism," evoking the morphological articulation of organic patterns such as sponges and algae adapted to form nothing more than mere decoration. Aside from personal preferences, still anyone may accept that the employment of external references, also set of tools and processes, is an ally to creativity, as much as it also raises the risk to impose their characteristics over the outcome in uncontrolled ways. The experimental attitude involved in discovering the proclivities of new modes of practice, unfolds ideally with an equal increasing of the designer's capacity to tame the related actions and more importantly to stay unbiased in assessing the result.

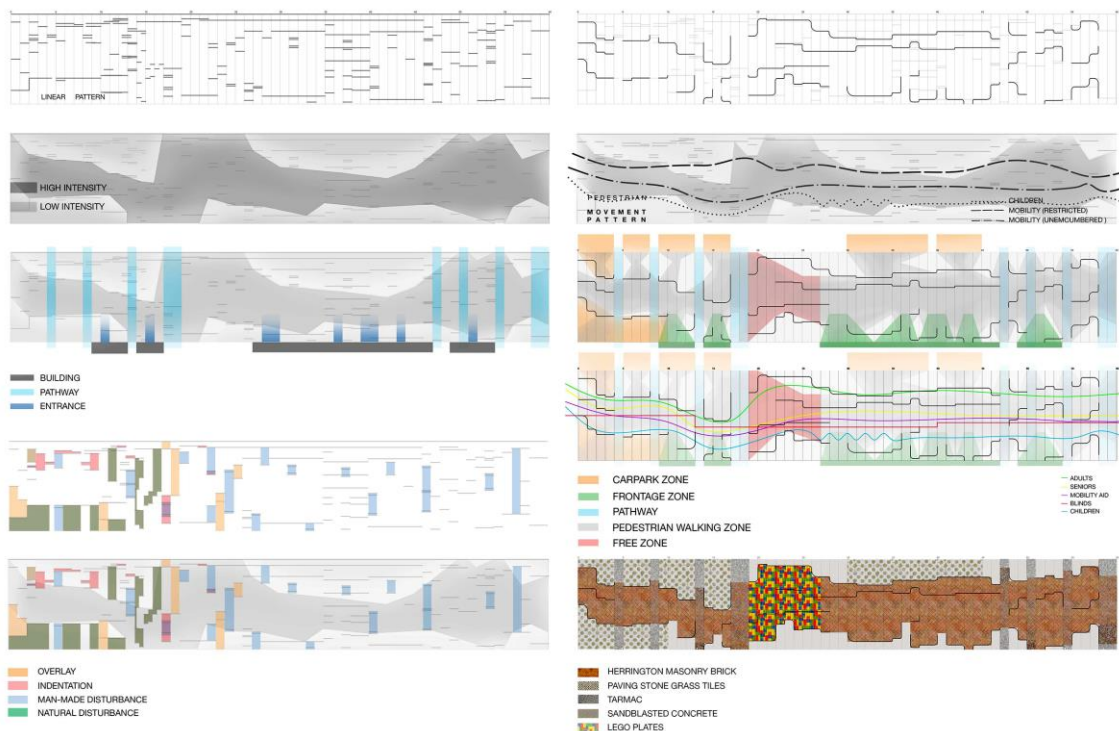


Figure 2: Analytical diagrams showing layers of data (source: C. Yuen Sim, M. Taylor, Y. Zavoleas, "Temporal topographies" master's architectural design studio, The University of Newcastle, 2014).

2.2. Dynamic views on form and object

That said, one brings formalism to mind, a persistent threat about architecture, overshadowing any creative movement to be reduced to yet another style. Formalism commonly infers treating references as fixities, whose aesthetic properties are copied into design in ways that visual similarities between input and output are preserved, but the produced forms are generally not consistent with the behavioural traits of the original. The result is viewed as a product of mimicry, a parody of what was meant to be authentic; or, as Kwinter (2008) puts it, a sloppy conflation of the notion of “form” to that of “object.” In response, Kwinter considers form as being inseparable of the mechanisms of its formation, hence yielding a dynamic connotation to it, one that retrieves the actions it sets under its objectified nature. Form should bring those mechanisms together also under a unifying scheme being always somewhat distant, as the object may be a variable manifestation. Kwinter further goes on to describe form as a set of algorithmic rules embedded into the object. As such, form is to its foundation and may only be the most dynamic, extendable expression of an algorithm holding its code of production onto objects as they come into beings, similar to those specified in computational biology.

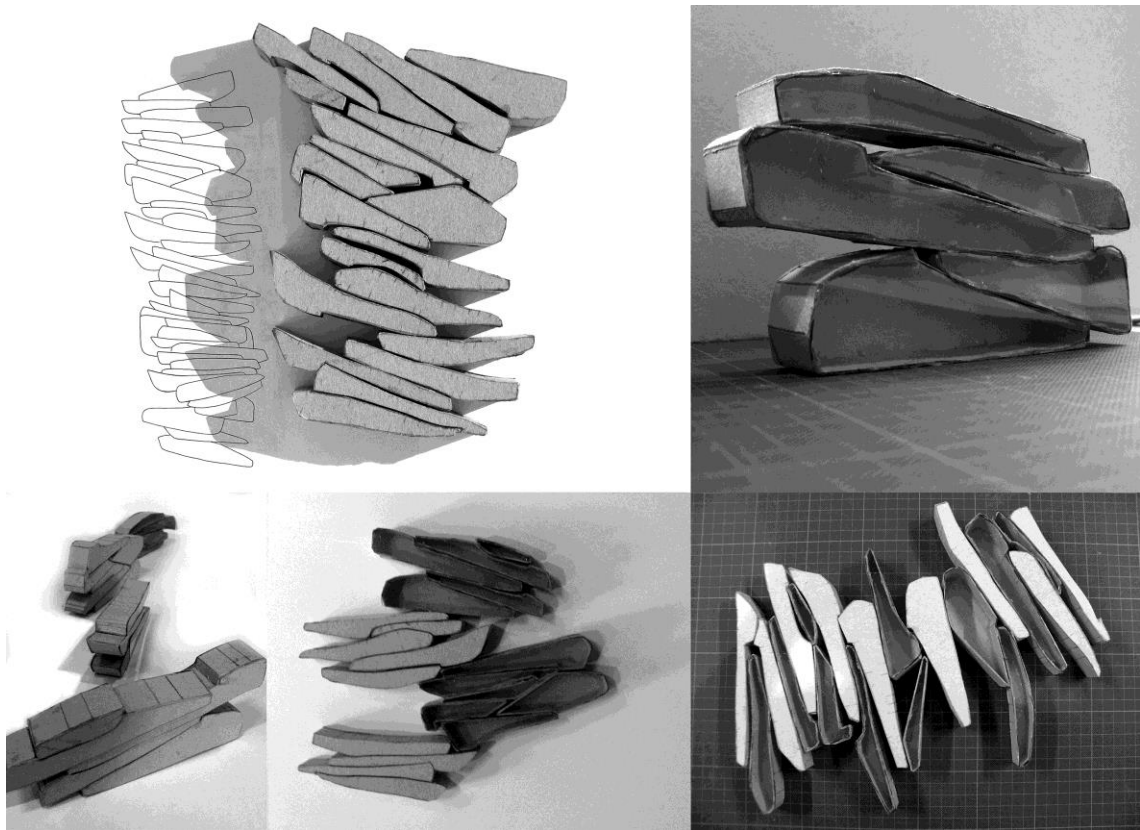


Figure 3: Topological variations of 3D pieces making a puzzle offering multiple outputs (source: C. Kourtoumi, Y. Zavoleas, K. Katsifarakis, “Design experimentations,” Technical University of Crete, 2005).

The problem is, however, that form may only be verified through an object. The discussion on form is incomplete if it does not include those resources involved in its genesis, which, as de Landa (2001) argues, are being immanent to matter itself, not transcendental. Aiming to disengage form from the properties that render it to the real world may respond at a philosophical level; still, on an actual setting, form and object go together. The answer to this oxymoron must be sought in the conception of the object on terms being equally dynamic to those used to describe form.

In alignment to this view, Cache (1995) identifies the object in a state of constant transformation and so he describes it with the concept of *Objectile*. As Cache (2013) denotes, the *Objectile* may be defined as a special kind of technological object, a dynamic topology rather than a static value wherein “fluctuation of the norm replaces the permanence of a law” (Figure 3). The *Objectile* is an aberration of what is considered as being standard and repetitive, from which harmony emerges as a singularity, not in reference to something universal. Cache’s definition follows a functional model constantly informed by a number of factors – actions, reactions and decisions – influencing the stages of an object’s life. Objects represent nothing more than a moment of densification in the folds of our behaviour that is itself fluctuating; they exist as variations of a “continuum” (Beaucé and Cache, 2007) based on extended flows and relations being essentially parametric.

Moreover, form and object share the same logic of control. For Cache (1995), that logic is a sort of a frame. Framing in this case does not refer to a physical frame or skeleton, but to a set of structural principles that condition the object in a state prior to its formal fixation, described as possibilities about images of flesh without bones, further associated with movement as a precondition to everything. Form is not a preset geometry applied onto matter, but the geometric output of structural constraints at the intersection of which the object is created (Beaucé and Cache, 2007). Experienced by the object’s material status, form resonates and expresses within itself the forces of its formation. The *Objectile* would demonstrate the range of negotiations among these forces, which, acting together, render the pair form/object a dynamic system (Figure 4).

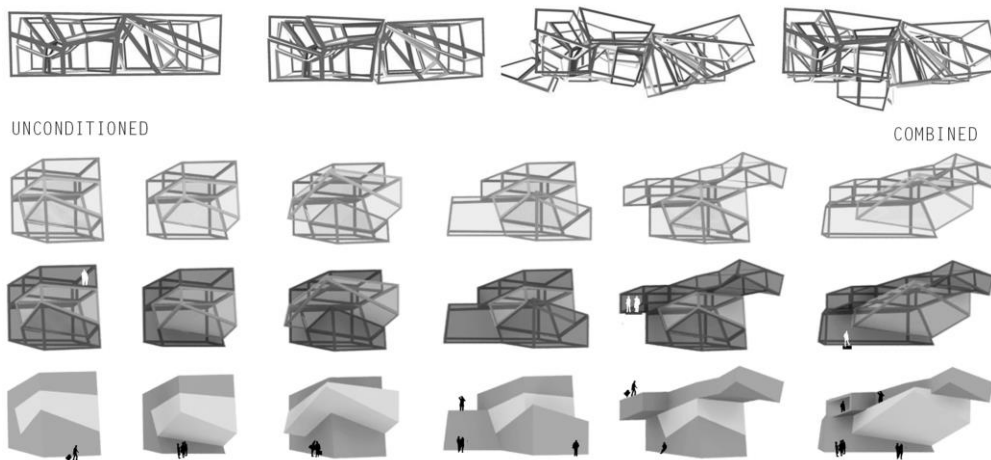


Figure 4: Progressive transformation of frame structures (source: L. Jones, T. Solman, Y. Zavoleas “Mutant body” master’s architectural design studio, The University of Newcastle, 2014).

A systemic definition of the pair form/object calls for the activation of the structural properties being mainly responsible for holding together everything that brought it into being. What appears as fixed in front of our eyes is in fact an open, mobile oscillating system, the palpable effect of computational interaction between internal rules and external pressures maintained in communicative tension together, setting, as Kwinter (2008) proposes, its behaviour as part of a broader ecology. Cache (1995 and 2013) further separates himself from a general understanding of the world as an accumulation of entities being distinct in space and time and so he proposes viewing them as systems interacting with one another, also ones that at any moment and no matter how complex they may be, they still signify parametric data and so they can be calculated. Data of any kind may entail social, legal and cultural factors that influence the system in a variety of ways. Every single bit, whether it is about basic information, a signal, a shape primitive, a curve, a surface, even an idea, is seen as a variable component, ideally summed up to a single formula, laying the foundation of non-standard, modes of production. In effect, the pair form/object refers to what de Landa (2005) identifies as a system mechanism reproducing and activating data under morphogenetic processes that extract multiplicities. The emerging variations refer back to the same system sharing the same code and rules, being also topologically similar; their seeming discrepancy responds to the same list of agents, which may produce alternatives as they are given different values.

3. System models

Systemic views of architecture call for assessing architectural models, those supporting the intermediate phases of exploration and also those illustrating the final design, separately from aesthetic criteria. Form neither has to come and impose itself from the outside (de Landa, 2005), nor has to be an expression of eccentricity. Emphasis is given on the model's operative significance, carrying the architect's thinking along the design process. What is suggested is a paradigm shift, one that involves turning architectural discourse, as Speaks (1995) suggests, to the more pliant, fluid, complex and heterogeneous forms of practice. Especially with the hybridization of the creative phases due to the appointment of digital technologies in representation and manufacture, the scope of design has shifted, Sheil (2012) remarks, from a largely pre-emptive act to an experimental process about form favouring the particular and the unique, under controlled modes of differentiation. The architect's methods should depart from modes of practice prompting aesthetic views upon the model and replace them by a keen interest in the model's aptitude in delivering nominated tasks. The idea is to assume the architectural model as well as the various outputs of the design process as active systems whose primary mission is to prompt negotiations among the design inputs by also supporting the necessary functions, in analogy to system theories speaking about the development and refinement of systems.

The view that architecture is a compilation of active systems has underpinned architectural discourse since the 1960s. Pask (1969) suggested that architecture is an operational research sharing the same philosophy with cybernetics in system management. Around the same period, Doxiadis (1963) stressed out that architects are first and foremost system designers. His working style gradually departed from traditional ones based on aesthetic assessment, also showing his inclination toward scientific modes of research in examining the dynamic connections among various data. Similar views resonate in the works of late-modern architects and particularly those of TEAM 10, who in clear opposition to prevailing ideas and modes of practice after Second World War, were devoted to studying organizing structures about physical space, often leaving the project intentionally unfinished, further claiming that the design is a proposition for handling energies in mutual exchange and a lifelong process that will certainly continue

after the project is delivered to its occupants. In effect, a building may not simply be viewed in isolation as a set of boundaries and articulated regions. Rather, it is a full-scale model in itself; that is, a system fabricated specifically to interact in real-time with other systems being its inhabitants and the environment, holding other systems locally into itself and being placed within larger systems, making, as Hight (2009) observes, a compound that is hard if not impossible to break apart. This complete model accommodates all kinds of data which are to be linked together as parametric inputs and outputs influencing the development of human settlements at large.

System-orientated thinking in architecture has raised a demand for dynamic models whose directed functionality designates certain behaviours. Dynamic models are nonrepresentational; they are in direct correspondence with the forces of their formation (Rahim, 2009). Models of this kind generally involve abstraction, often being in reduced scale, or in no scale. They leave things intentionally underspecified, tentative and even unpredictable as to how they will be materialized. They expose the options and questions being as important as the value in concluding, further encouraging, as Glanville (2012) has put it, dynamic uncertainty. They are better understood as structural templates connecting the design's constituent parameters and anticipating change in response to changes of their numeric values. As such, the dynamic model may hold those generative qualities that also act upon it to redefine and evolve it, in so doing fostering its continual reformation (Spyropoulos, 2014). Its beauty resides in its operational ability in relating the data about design, keeping them open as input parameters set dynamically to produce a variety of outputs. The model constantly adjusts eventually reaching equilibrium, a moment when design evolution terminates and the project finalizes.

4. Conclusion: design(-ing) structures of evolution

So far, this paper has stressed out the operative significance of architectural models in assisting the design process. Following their analogies with models in science, architectural models are suitable for identifying and exploring a project's inner logic, as opposed to sponsoring aesthetically-driven purposes. As it is argued, such a task is factually feasible by describing the functions by which form is produced; in other words, by turning the architectural model from an aesthetic object to a dynamic system activated to eventually suggest its aesthetics being consistent with its formative logic. This task is greatly supported by advanced computing. It may be claimed that digital models are naturally dynamic, a trait they have inherited from the digital medium. In fact, every object on the computer screen is an automatic representation of codified data and so it is a variable per se. Admittedly, digital model's variable character is often downgraded when the easiness by which data can be translated, modified and multiplied digitally without any of the frictions, or resistances commonly attributed to the material world is not taken into its full account. The undertaking proposed is to completely disengage the digital model from constraints associated with analogue materials and practices alike, especially the ones it suffers when it is appointed to merely respond to analogue-prescribed tasks; accordingly, as de Landa (2001) puts it, to take full advantage of the "digital matter" flowing inside computer simulations, being the basis of Computer Assisted Design (CAD). The contemporary designer, as an emerging type of digital craftsman immersed in the digital era, may invest his/her mastery on the digital model by challenging its limits to approximate behaviours and intuitive responses at micro and macro level also in real-time.

Taken down to its constitution, the digital model simulates data visually, as much as it presumes a structure being a set of specified rules holding data together. Structures support data and their shared functions as defined by the model system. In architectural design, data represent the variables influencing design, whereas functions involve manipulation of these variables also in reference to

schemes that set the general layout, all undergoing mutual compromises leading towards optimal solutions. Moreover, the digital model's description as a structural scheme underlines its analogies with biological models. The biological model portrays organisms as systems interacting with one another, the result being their interference. An organism's characteristics are seen as responses to its vital functions, and so they are given parametric significance. Variation is projected onto an organism's phenotype, being the outcome of interaction between its genotype on the one hand and data and energy exchanges between the organism and its outer environment on the other. Evolution becomes a question of generating and updating the genotype due to limitations that have emerged during exchanging among systems. Consequently, there are operative similarities between digital models in architecture and biological models as instances of the same structure adjusting to data tweaks (Figure 5); a compound process of adaptation and evolution that, according to Spuybroek (2009), offers variations of answers to design problems addressed under a research scope.

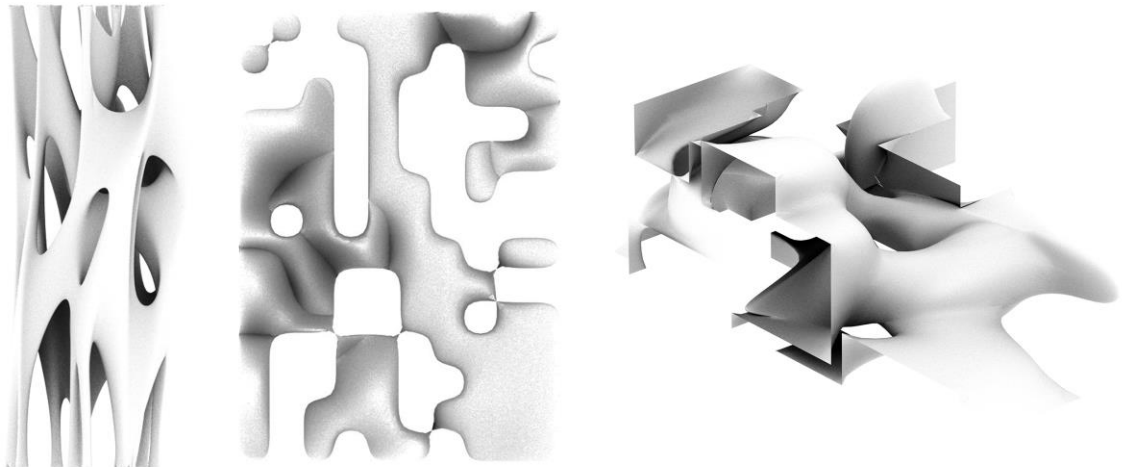


Figure 5: Structural models developed as derivatives of a. set of flows, b. polycentric mesh, c. skin (source: Y. Zavoileas, "Bio-structuralism" research project, The University of Newcastle, 2014).

As with biology, an evolutionary approach to architectural design presumes delving into the processes of setting a project's structure that holds variables and their functions together. As Kirschner (2009) suggests, whenever a structure changes, underneath that change is a process of how that structure has been generated. Structure is seen as the primary variable, a kind of bio-structure that adapts to its tasks, a hybrid that evolves in response to new inputs. Architectural design, therefore, seen as a research subject, involves recursive processes of unraveling about variables and structures making up a project and then reconfiguring them back together, and so offering a population of responses gradually leading to comparative selection of the fittest and of which aesthetics may only be the end-effect and a by-product; not the cerebral contrivance of an individual.

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