

# Possibility of critical practice in computational design: applications on boundaries between public and private space

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## **Biobibliographical record**

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Her main research interest revolves around:

- the idea of 'architecture as landscape'. She did write a book about: constructive experience of architectures that are open towards the landscape, like Álvaro Siza's swimming pool in Leça da Palmeira, entitled *Architecture as Landscape*, Paris: Petra, 2010;
- the notion of 'critical practice': interior architects, architects and urban planners that use the thinking tools of art and philosophy to underpin their practice. The objects of research range through different countries (e.g. France, Germany and Brazil) and across different areas (architecture, interior architecture, art, landscape).

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## **Abstract in French**

La conception par ordinateur permet de créer des surfaces transformatives complexes qui tendent à gommer les limites entre espaces de différents statuts. Cet article porte sur les possibilités de développer une pratique artistique et critique de la conception par ordinateur: permettant ainsi des événements dans le système en transformation, et donc de l' 'affect'. La possibilité de jouer ses les limites entre espaces aux différents statuts nécessite de maintenir les notions d'espace public et d'espace privé (les technologies et leurs capacités à connecter tout espace dans un même réseau économique tend à effacer ces différences) de manière à permettre un entrelacement créatif de ces derniers. La possibilité de transformer ces limites pose la

question de l'entité légitime à contrôler cette évolution. En maintenant une distance avec les extrêmes que sont la liberté totale tendant vers un soit-disant 'Bien ultime' d'un côté, et une liberté niée par une 'loi' excessive de l'autre côté, l'article présente des manières dont une communauté pourrait acquérir le contrôle de son environnement par ces nouvelles technologies, tant qu'une 'loi commune' de la vie publique est respectée. La manière dont les paramètres et algorithmes pourraient être définis afin de fonctionner selon ce modèle est utopique mais théoriquement faisable dans le futur selon les théories de l''émergence'. Le maintien de la possibilité d'événements et de singularités créatives dans le système permet de maintenir un espace pour la pensée critique en architecture, prenant en compte la mémoire et la volonté d'un futur meilleur.

### **Abstract in English**

Computational design technologies enable the shaping of complex transformative surfaces that tend to blur the limits between spaces of different statuses. This article focuses on the possibilities of developing artistic and critical practices of computational design: enabling 'event' in the evolving architectural system, thus creating 'affect'. The possibility to play on boundaries of places of different statuses necessitates maintaining the notions of public and private space (as technologies and their capabilities to connect all space in the same economic network tend to erase these differences) in order to enable creative intertwining. The possibility of transforming boundaries raises the question of what and who controls them. By keeping a distance between the extremes of total freedom reaching a so-called 'Ultimate Good' on one side and of restricted freedom through excessive 'law' on the other side, the article presents ways for communities to regain control of their environment through new technologies, as long as 'common law' of public life is respected. The way parameters and algorithms could be set to function in this model is utopian but theoretically feasible in the future according to theories of 'emergence'. The safeguarding of possibilities of events and creative singularities in the system keeps a space for critical thinking in architecture that takes into account memory and the will for a better future.

**Mots clef:** architecture/ computationnel/ limite/ publique/ critique

**Key words:** architecture/ computational/ limit/ public/ critical

# Blurred boundaries: aesthetic challenges of computational design

Antoine Picon describes in his book *Digital Culture in Architecture*<sup>1</sup> from 2010 how computational design blurred the limits between fields. Architecture shifted from ‘architectural design’ to ‘technology based architectures’. A first distinction can be made between ‘parametric design’, which is about using parameters to design things (if the parameters change, the results change), and ‘computational design’ that refers to the use of computers and a mathematical approach to the generation of geometries, objects and architecture. In both cases, the focus is on designed networks and processes instead of designed objects. As the outcome is a tangible architectural feature, the question of its quality is legitimate (even if the outcome is transformable). How can we safeguard possibilities of events and creative singularities in the system, that keep a space for critical thinking in architecture? In order to investigate this questions, the article focuses on boundaries between spaces. And, as the question of limits between public and private space is of key importance in architecture and urban planning in general, and as computational design technologies enable the shaping of complex transformative surfaces that tend to blur the limits between spaces, the article focuses on boundaries between public and private space. Do computationally designed boundaries create a loss of distinction between public and private space? What do they enable in this area that was not possible before?

## Blurred boundaries or new structural paradigm?

The whole field of computational architecture evolves constantly, like a ‘shifting landscape’. According to Matthias Hank Haeusler, director of the CODE program at UNSW Sydney, “computational design practices became linked with architecture as emerging modes of practice considering new technologies during the 90’s. Architecture has bifurcated, mutated, transformed, and totally abandoned into ‘architectures’”<sup>2</sup>. Antoine Picon and Frédéric

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<sup>1</sup> Antoine Picon, *Digital Culture in Architecture: an Introduction for the Design Profession*, Basel, Birkhäuser, 2010.

<sup>2</sup> Interview with Hank Haeusler, head of Computational design course, UNSW Sydney, April 2017.

Migayrou<sup>3</sup> describe the fundamental blurring of limits as the philosophical background of this development. Paradoxically, Edmund Husserl and Gilles Deleuze are key theoreticians that can enlighten us on the aesthetics of computationally designed forms. Husserl is the father of phenomenology, a field that inspired an architecture based on sensations, and that differentiates itself totally from the computational architecture field. With computational design, the opposition between phenomenology and analytical philosophy does not stand anymore. Technology becomes so intertwined with forms and matter at the smaller scale, in their evolution in time and in their representation, that classical oppositions fail to embrace the challenge of these new tools<sup>4</sup>. The first stages of computational design are based on rational systems that are inherited from the history of techniques, but in an extremely complex and dematerialised way today: the digital dialectic between script (code, genotype) and parametric variations or algorithmic formula<sup>5</sup> (phenotypical adaptations) are part of a complex system of space and time variations of forms. It can be linked to concepts from the past, especially from the baroque era, but again in an extremely complex way today. Malcolm McCullough<sup>6</sup> defines a shift of paradigm with the passage from software scripting and coding to the creations and direct manipulation on blobs, when digital designers stopped being coders. He calls it the 'Direct Manipulation Boom', and it happened in the 1990s. This is a shift from the age of information to the age of the digital according to Nicholas Negroponte<sup>7</sup>. Even if coding and scripting come back again, this shift created a revolution in architecture. Parametricism (in opposition to parametric thinking before) connotes the arrival of a 'global style', while thinking informed by multivalent parameters was nothing new to practice and theory. Patrick Schumacher positions himself in the new era of parametricism<sup>8</sup> that produces a new style, while

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<sup>3</sup> Migayrou, Frédéric, "The Order of the Non-Standard: Towards a Critical Structuralism," Rivka & Robert Oxman (eds.), *Theories of the Digital in Architecture*, London, Routledge, 2014, pp. 17-34.

<sup>4</sup> Pablo Lorenzo-Eiroa, "Form:in:form on the relationship between digital signifiers and formal autonomy", (Pablo Lorenzo-Eiroa; Aaron Sprecher ed.), *Architecture in formation: on the nature of Information in digital architecture*, London, Taylor & Francis, 2013, pp. 11-21.

See especially the paragraph: "A New Structuralism as a Continuity from Post-Structuralism"

<sup>5</sup> Meredith Michael et al (eds.), *From Control to Design: Parametric/Algorithmic Architecture*, Barcelona, Actar, 2008.

<sup>6</sup> Malcolm McCullough, « Scripting » (2006), Mario Carpo (dir.), *Digital Turn in Architecture 1992-2012*, Chichester, Wiley, 2013, p. 182.

<sup>7</sup> Nicholas Negroponte, *Being digital*, New York, Alfred A. Knopf, 1995.

"For instance, to what extend is the contemporary digital tidal wave different from what happened before? In his 1995 essay, being digital, Nicholas Negroponte, the founder of the MIT Media Lab, opposed the age of information to the digital era. According to him, the first was about anonymous mass consumption, whereas the second gave precedence to individual preference." Antoine Picon, *Digital Culture in Architecture: an Introduction for the Design Profession*, Basel, Birkhäuser, 2010, p. 9.

<sup>8</sup> William Mitchell, "A New Agenda for Computer-Aided Design", Achim Menges (ed.), *Computational Design Thinking*, London, Wiley, 2011, pp. 86-93.

other practices like Foreign Office Architects used these tools by keeping a critical positioning in their practice.<sup>9</sup> Other examples of ‘complex surfaces’ that could be studied for their aesthetic qualities include TU Delft’s project *Hyperbody*, using ‘spider finger’ joints; Paul Loh and David Leggett’s (Power to Make) *Articulated timber ground* from 2014, with a group of students from Melbourne university; Prof. A. Menges and S. Ahlquist’s *Deep Surface Membrane Morphologies* studio at the university of Stuttgart; Emmi Keskisarja, Pekka Tynkkynen, Kristof Crolla and Sebastien Delagrange’s *Dragon Skin Pavilion* from 2012. Some examples are parametric surfaces, but this article focusses theoretically on computationally designed boundaries, that have higher chances to challenge aesthetics and enhance critical thinking than pure parametric design (even if parameters or algorithms are involved in computationally designed boundaries mentioned in the article).

Complex surfaces replace traditional plain walls. “The digital turn in architecture and design has freed surface from the ‘body’ of a built object to a new landscape of possibilities.”<sup>10</sup> Forms are replaced by ‘patterns’, and the way surfaces become complex creates a shift towards the notion of ‘hypersurface’, as multiple parameters or algorithms implied mimic the possibilities of a n-dimensional space, projected or interpreted or represented in our 3-dimensional space. Complex joining and panelling systems can be developed. One main aim is to get curvature, and the complexity of the structure enables the integration of electronic devices in the facades themselves<sup>11</sup> to create a media façade as a ‘productive zone’ for the interfacing between architecture and city and human beings. The mode of production of these hypersurfaces is a radical change. There is a shift from the fabrication of modern walls, that can be considered as standardized for ideological or technological purposes, to nonstandard surfaces that open up a wide range of possibilities and versions based on a set of parameters or algorithms.

“Both the terms Nonstandard and Versioning do not relate to forms but to a mode of production. These modes of production generate series of different objects. They have revolutionized our understanding of serialization, and the very notion of reproducibility in which we have lived for five centuries of mechanical culture.”<sup>12</sup>

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Neil Leach, “Parametrics Explained”, Neil Leach, Philip F. Yuan (eds.), *Scripting the Future*, Shanghai, Tongji UP, 2012.

<sup>9</sup> Interview with Hank Haeusler, head of Computational design course, UNSW Sydney, April 2017.

<sup>10</sup> Interview with Hank Haeusler, head of Computational design course, UNSW Sydney, April 2017.

<sup>10</sup> William Mitchell, “A New Agenda for Computer-Aided Design”, Achim Menges (ed.), *Computational Design Thinking*, London, Wiley, 2011, pp. 86-93.

Neil Leach, “Parametrics Explained”, Neil Leach, Philip F. Yuan (eds.), *Scripting the Future*, Shanghai, Tongji UP, 2012.

<sup>11</sup> Hank Haeusler, *Chromatophoric Architecture: Designing for 3D Media Facades*, Berlin, Jovis, 2010.

<sup>12</sup> Interview with Hank Haeusler, head of Computational design course, UNSW Sydney, April 2017.

The fundamental shift is between the consideration of a wide range of versions of the system and ‘versioning’<sup>13</sup>, when this is extended to the extreme of a continuous evolution of form. Hypersurfaces enable dynamic surfaces that are in interaction with the context, especially humans. The system is controlled from the outside usually, but the dynamics mimic self-organized bodies as we can find them in nature. Systems and processes could accommodate ever-quickenening continuously-changing contexts. This relates to ‘dynamic tectonics’ according to the *Handbook of Interior Design*’s definition of versioning, but the question is then: is it still about tectonics? What is the remaining structure of this system? According to Antoine Picon<sup>14</sup>, we lose the tectonics with the shift from the age of information to the age of the digital.

“Despite this general trend, one may still wonder whether the present crisis of tectonic corresponds to a definitive change or to a temporary weakening that will lead to its redefinition. Some theorists and practitioners, from Neil Leach to Cecil Balmond, are persuaded that new tectonic guidelines will eventually replace the traditional ones. For Leach, ‘swarm tectonics’ will emerge from a better understanding of dynamic systems, while Balmond is calling for the abandon of the Cartesian frame of thought that has curbed structural ingenuity for centuries”.<sup>15</sup>

Instead of relying on a fixed structure, we shift to complex continuously dynamic systems, and instead of a law, we shift to variations of the norm. For Frédéric Migayrou, our current situation, when the object positions itself in a continuum through variation, sees the fluctuation of the norm replace the permanence of the law.<sup>16</sup>

“This norm, always in the process of being defined and always deferred, is transcribed into objects fluctuating on the variable curves of the new industrial series... There are no longer pre-established functions requiring a form, we have only the occasional functions of fluctuating forms.”<sup>17</sup>

To develop the reflection in this article, it was important to mention this shift to a change of paradigm and its implications at different levels. The challenges raised by hypersurfaces do raise fundamental questions about ways to consider boundaries, and especially boundaries between spaces of different statuses. Before defining a new paradigm for ‘structure’ and

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<sup>13</sup> « Versioning », Jo Ann Asher Thompson, Nancy Blossom (eds.), *The Handbook of Interior Design*, London, Wiley, 2015, p. 22.

<sup>14</sup> Antoine Picon, *Digital Culture in Architecture: an Introduction for the Design Profession*, Basel, Birkhäuser, 2010, pp. 9-10.

<sup>15</sup> Antoine Picon, *Digital Culture in Architecture: an Introduction for the Design Profession*, Basel, Birkhäuser, 2010, p. 11.

Neil Leach, “Swarm tectonics”, Neil Leach, David Turnbull, Chris Williams (eds.), *Digital tectonics*, London, Wiley-Academy, 2004, pp. 70-77

Cecil Balmond, *Informal*, Munich, Prestel, 2002.

<sup>16</sup> Frédéric Migayrou, “The Order of the Non-Standard: Towards a Critical Structuralism”, Rivka & Robert Oxman (eds), *Theories of the Digital in Architecture*, London, Routledge, 2014, p. 22.

<sup>17</sup> Frédéric Migayrou, “The Order of the Non-Standard: Towards a Critical Structuralism”, Rivka & Robert Oxman (eds), *Theories of the Digital in Architecture*, London, Routledge, 2014, p. 22.

Bernard Cache, *Terre meuble*, Orléans, HYX, 1997, p. 68.

‘tectonics’ in the era of the digital, the old definition of ‘structure’ in the context of complex systems of the age of information is still our landmark in this text. A ‘structure’ is still part of a clear architectural statement at a large scale. Topological transformations of the ‘structure’ in space and time are not yet deployed in our everyday environments, and are only laboratory prototypes for the moment<sup>18</sup>.

## Technological innovation is not architectural innovation

Technological innovation can create new kinds of shapes and thus bodily sensations, but there might be a difference between producing new bodily sensations and creating innovative architecture that creates affect, linked with concept (as will be defined in relation to Mehdi Belhaj Kacem’s theory of affect). In what cases does the artistic potential associated with kinesthetic sensations create affect and enable critical thinking? An example of a highly technological project is Mark Goulthorpe(dECOi)’s *Hyposurface* from 2003. He uses triangular shapes that are animated through a mechanical system creating moving ‘waves’ at the surface, in an interaction process with the persons who approach it. This example is at the junction between parametric design and computational design. According to Goulthorpe, “*HypoSurface* is the World’s first display system where the screen surface physically moves. Information and form are linked to give a radical new media technology: an info-form device.” This surface moves, and we can witness on his website’s video how the surface surprises people, and has a real impact on them. The system enables infinite possibilities. Each iteration of the experience provides another slightly different pattern on the surface. The openness of the system questions the possibility of an aesthetic value of an iteration, or of the system as a whole. It establishes the question to which there might not be an easy answer. But there is a difference between the two projects made by Mark Goulthorpe that shows how open moving structures are challenging an aesthetic point of view. One of dECOi’s few built projects, the *Glaphyros* apartment in Paris, completed in 2003, features an 8-by-6-foot aluminium screen whose form is based on a mathematically generated algorithm of three intersecting waves. The fixed surface evokes the movement of a liquid, and has a specific impact on the bodies who would pass next to it. This materialisation of a ‘frozen moment’ in time is linked to classical ideas in aesthetics<sup>19</sup>. It plays with the perception of gravity, as the surface is set vertically. The complexity of the wave design creates an always slightly different bodily sensation, but in a

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<sup>18</sup> Interview with Hank Haeusler, head of Computational design course, UNSW Sydney, April 2017.

<sup>19</sup> Jacques Rancière, *Aisthesis, Scènes du régime esthétique de l'art*, Paris, Galilée, 2011.

specific and chosen way (by the designer). With *Hyposurface*, these classical aesthetic criteria vanish. To develop new aesthetic landmarks for computational design, it is important to first make a distinction between sensation, especially bodily sensation in architecture, and real affect that would be linked with concept. The boundary is blurred, and theories like Gilles Deleuze's are major tools to define the difference or make the junction between sensation and concept. The aesthetic theory that will serve as a landmark in this article is Mehdi Belhaj Kacem's theory of affect<sup>20</sup>, linked with concept. Kacem's theory of affect is also a theory of event, and truth, and real presence. His theory could be summarised as follows: on the base of Alain Badiou's philosophy, he defines affect based on the 'virtual' as gap between presentation and representation, or what fails in the forcing of representation into presentation<sup>21</sup>. Affect is "the identity of this infinity". Kacem considers the event as the real of a disintegrated representation. There is a negative aspect of any relation, and this aspect is inherited from Hegel's notion of the 'Negative' as well as the negative of any relationship in Lacan's (the real of pleasure proves it). Void is always integral to things, and the site of the event (or 'eventual site') is always 'at the border-of-the-void'.

The knowledge developed by cognitive sciences about the sensory impact of geometries on our bodies still displays today a gap with philosophy, and especially with what could be considered as affect in Kacem's definition. But with a project like Mark Goulthorpe's *Hyposurface*, as we don't have clear aesthetic reference to make a judgement, cognitive sciences could be helpful to understand the impact of this surface on the body. Cognitive scientist Alain Berthoz shows how the forms of our living environment have an impact on how we move. Movement is inherent to forms, and in particular to geometrical forms. He defines as 'sense of movement'<sup>22</sup> this sensitive impact of forms on our bodies. It relates to the representation of virtual movement of our body in space as well as real movement induced by forms. Berthoz also found, as described in his book *La décision*<sup>23</sup>, that the sense of movement arises from the perception of form: drawing a triangle in space with the arm is connected to the same brain zone as seeing a triangle. The platonic structures Berthoz considers are not isomorphic to the bodily structure, nor are they representations of the body, but rather they are perceived as a schema of possible

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<sup>20</sup> Mehdi Belhaj Kacem, *L'affect*, Auch, Tristram, 2007.

<sup>21</sup> In French: « virtuel comme écart fondateur de la présentation et de la représentation »  
« ce qui choisit du forçage de la représentation dans la présentation ».  
Mehdi Belhaj Kacem, *L'affect*, Auch, Tristram, 2007, p. 179.

<sup>22</sup> Alain Berthoz, *Le sens du mouvement*, Paris, Odile Jacob, 1997.

<sup>23</sup> Alain Berthoz, *La décision*, Paris, Odile Jacob, 2003, p. 316.

actions.<sup>24</sup> There are numerous examples of experimentations made by the avant-gardes on this play between geometrical forms and body image, that can be called kinetics. Bodily reference systems frame these links<sup>25</sup>. Philosopher and architect Rudolf Steiner (1861-1925) and his circle of acquaintances represent the utopia of the avant-gardes (and also their esotericism). In the Wagnerian inheritance of the concept of *Gesamtkunstwerk*, they developed experiments in dance, in particular on the relationship between platonic structure and the movement of the body. Steiner named this research "eurythm". It inspired later Rudolf Laban for his dance theories and annotation technique. In regard to the number of experiments on the theme of movement in connection to triangular structures, my research has explored the fact that a triangulated surface was favourable to the "sense of movement". Triangular forms have a link with our perception processes, in particular with mental image constitution processes, in relation to our systems of bodily perception<sup>26</sup> (proved in research on rats, and there is strong hypothesis that it is valid for humans). Triangulation has become a standard computer modeling tool because of its convenience for calculation, but it also corresponds to our types of geometrical mental images, that existed before all types of representations, including computational design. Triangular surfaces are useful to model forms, and numerous computational design projects use the geometrical capacities of triangles. Research in cognitive science about the isomorphism of structure between body and geometry (through 'empathy' according to Berthoz) is ongoing.

As with these examples from the past, development of complex geometries through new technologies could create affect and enable concept in the future, thus enabling innovation in the field of architecture. Berthoz's research remains outside of any aesthetic reflection but the philosophy of Deleuze and Guattari is for example a theoretical stepping stone towards aesthetics. For Deleuze and Guattari, "If there is a primitive "geometry" (proto-geometry), it's an operating geometry where figures are never separable from affections, as lines from their

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<sup>24</sup> Alain Berthoz, *Le sens du mouvement*, Paris, Odile Jacob, 1997, p. 247.

<sup>25</sup> Alain Berthoz, *Idem*, p. 246.

<sup>26</sup> At the date of publication of the article, the scientific proof had been made on rats, and the application to human was a plausible hypothesis.

Laurence Kimmel, "Le terminal portuaire de Yokohama par Foreign Office Architects à la lumière des sciences cognitives - rappels historiques sur la danse et le lien à la structure triangulée chez Rudolf Steiner et Rudolf Laban" [The ferry terminal of Yokohama by Foreign Office Architects, in relation to cognitive sciences - historical remarks on dance and its link to triangular structure in Rudolf Steiner and Rudolf Laban's works], Xavier Bonnaud, Chris Younes (ed.), *Architecture Perception Urbain*, Gollion, InFolio, 2014.

becoming, segments from segmentation"<sup>27</sup>. They see "abstract machines"<sup>28</sup> as "expressiveness-movement"<sup>29</sup>. The complex machine is a "line of musicality, of pictoriality, of landscapeity, of faceity, of consciousness, passion".<sup>30</sup> Territory is "expressiveness of the rhythm".<sup>31</sup> Some geometrical or topological experiments from avant-garde figures that transferred scientific knowledge or research into the arts are blurring this difference between simple bodily sensation and real affect linked to arts and aesthetics. The applications of the Möbius strip (discovery from 1858) for example are numerous, and it still inspires artists and architects today. It enables 'shortcuts' between two sides of a surface. There is a coexistence between a topological experiment and the concept of reversing the inside and outside. Another example is less well known but is worth mentioning because of its dynamic aspect: Paul Schatz's '*Umstülpung*' [fold-over] model. It couldn't be easily applied in architecture, as it would reverse floors and walls and ceiling. Sculptor and mathematician Paul Schatz (1898-1979), who settled down in the Dornach Goetheanum in 1927, invented structures in movement inspired by (or giving inspiration to) Rudolf Steiner's theories. Certain experiments by Schatz on the link between shape and movement led to discoveries, presented as useful today, as Paul Schatz's oloid. His *Umstülpung* [fold-over] model is a reversible structure where inside becomes outside, a little bit like a reversed sock. It challenges our concepts of architectural links between inside and outside, and has been mainly presented as a curiosity until today. But there is something conceptually important in the field of statuses of spaces (inside and outside) in relation to our bodily apprehension, that is worth mentioning. Computational design methods could enhance, complexify and adapt these ideas to future projects.

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<sup>27</sup> This geometry is in opposition with the State's geometry (from the Roman Empire, in reference to Paul Virilio). Gilles Deleuze, Félix Guattari, *Capitalisme et schizophrénie 2 – Mille plateaux*, Paris, Les éditions de Minuit, 1980, p. 258.

<sup>28</sup> Gilles Deleuze, Félix Guattari, *Idem*, p. 636.

<sup>29</sup> In the chapter « La géologie de la morale » [genealogy of moral], they also use a name linked with the idea of movement: « danse muette » [a mute dance].

Gilles Deleuze, Félix Guattari, *Idem*, p. 89.

<sup>30</sup> Gilles Deleuze, Félix Guattari, *Idem*, p. 226.

<sup>31</sup> In French : « Il [le territoire] est essentiellement marqué, par des « indices », et ces indices sont empruntés à des composantes de tous les milieux : des matériaux, des produits organiques, des états de membrane ou de peau, des sources d'énergie, des condensés perception-action. Précisément, il y a territoire dès que des composantes de milieux cessent d'être directionnelles pour devenir dimensionnelles, quand elles cessent d'être fonctionnelles pour devenir expressives. Il y a territoire dès qu'il y a expressivité du rythme. C'est l'émergence de matières d'expression (qualités) qui va définir le territoire. »

Gilles Deleuze, Félix Guattari, *Idem*, pp. 386-387

# The challenge to preserve critical thinking

The boundary that has been defined between cognitive science and aesthetics (even if the challenge of innovative thinking is to cross this boundary) is blurred by computational design. By focussing on process, tools, and their performative aspect, in a development that can relate to natural processes, we tend to be disconnected from cultural and critical aspects. The positioning in this paper is that computational design needs to be discussed and considered in a critical way. This critical positioning is clearly inherited from the past, and criticality tends to be erased in the digital era. Manfredo Tafuri studied this shift of critical thinking and critical practice in numerous essays, such as his 1974 essay “L’architecture dans le boudoir: the language of criticism and the criticism of language”<sup>32</sup>. The passage from modernism to post-modernism raised similar questions. According to Antoine Picon,

“Tafuri early on perceived the importance of this turn and devoted an entire chapter of his 1973 book *Architecture and Utopia* to it. Contrary to cybernetic-oriented designers who generally attributed a natural origin to patterns, Tafuri saw computer-manipulated formal systems as ‘artificial languages’ preparing “capital’s complete domination over the universe of development”<sup>33</sup><sup>34</sup>. There are “dangers present in digitally-produced architecture with the temptation to focus on the satisfaction of the senses and the fulfillment of programs dictated by global capitalism without ever questioning their limitations. This allegedly realistic attitude, sometimes characterized as ‘post-critical’, has led many designers to relinquish political consciousness in order to fully embrace the conditions of their time. But can architecture live only in the present, oblivious of the past and indifferent to the promises of a different future? Can design survive deprived of memory and without the ambition to make the world a truly different place? The most pressing challenge awaiting digital architecture perhaps has to do with the need to overcome this attitude. The extended implications of sustainability already force designers to think in political and social terms again. Perhaps the time has come to reinvent memory and utopia, these forsaken architectural ideals.”<sup>35</sup>

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<sup>32</sup> Manfredo Tafuri, “L’architecture dans le boudoir: the language of criticism and the criticism of language”, Michael Hays (ed.), *Architecture Theory Since 1968*, Cambridge, London, MIT Press, 2000.

<sup>33</sup> Manfredo tafuri, *Architecture and Utopia: Design and capitalist development*, Cambridge, MIT Press, 1976, p. 152.

Tafuri’s analysis of the growing importance taken by ‘artificial languages’ in architecture was initially published in a 1969 issue of the journal *Contropiano*.

<sup>34</sup> Antoine Picon, *Digital Culture in Architecture: an Introduction for the Design Profession*, Basel, Birkhäuser, 2010, p. 46.

<sup>35</sup> Antoine Picon, *Idem*, p. 14.

An example shows the difficulty of the question: Through their radical autonomy<sup>36</sup> from the spatial and temporal context, some computer designed forms disengage extremely from this context, but this criticality doesn't have the constructive aspect of real criticality as defined by Theodor Adorno or by Georg Lukács. By contrast, the global style for urban planning of Patrick Schumacher seems to be non-critical, because all the context is shown transformed by the same tools and it creates a continuous landscape.

When engaging with the context in a chosen way, which can be well thought, and when picking the adequate choice of parameters and algorithms, computational architecture can be critical. The contradictions between the submission to a global system as opposed to singular choices are in continuity with contradictions in architecture's past, but more exacerbated because of the heightened level of complexity of computational tools. Antoine Picon stresses these remaining contradictions:

“In a world dominated by capitalism, the only way for architecture to escape the role of legitimization that was assigned to it by ruling powers was to be reflexive and critical. By the same token there was an implicit link between the computational and the critical perspectives. Such a link was not without contradictions, for the computational dimension in architecture pointed both at a purely performative attitude, like the one envisaged by Lyotard, and to its critical counterpart for which performance mattered less than reflexivity. How was one to reconcile these two seemingly irreconcilable objectives? Contemporary digital architecture is still confronted with this question”<sup>37</sup>.

So, even with the horizon of a computer resolved urbanism, there are in real projects still remaining contradictions that create these critical aspects.

## The example of New-territories's (ex R&Sie) work

New-territories is a French architectural practice which used to be called R&Sie. Francois Roche, Stephanie Lavaux and Jean Navarro are the primary architects, and the team varies depending on the project. Their work is mainly theoretical and has remained on paper, or on the computer only. Still, a few projects have been realised such as the *I'm lost in Paris* project in 2008. They had a retrospective called *eILe Pr\_FAIRE la FICTION* at Frac Centre in Orléans from 10/11/2016 to 26/03/2017. From the projects spanning from 1993 until 2050(sic)

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<sup>36</sup> Antoine Picon about autonomy and criticality:

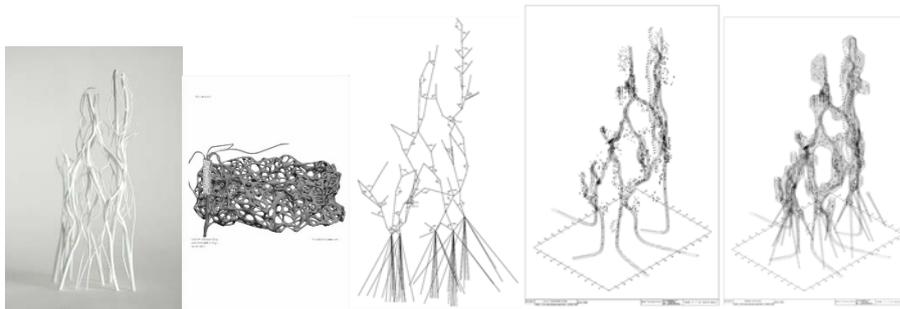
“A feature many of these researches and experiments shared was the emphasis put on the autonomy of the architectural discipline. Formalism met on that ground with the provocative experiments of radical architecture. In the eyes of many of its major proponents, from Italy to the United States, autonomy went with an ideal of criticality. »

Antoine Picon, *Digital Culture in Architecture: an Introduction for the Design Profession*, Basel, Birkhäuser, 2010, p. 47.

<sup>37</sup> Antoine Picon, *Idem*, p. 47.

presented during the exhibition, I've selected two projects that present a defined structure or structural development at the large scale. This large scale structural development is combined or closely intertwined with small scale forms that seem to be natural expansions of matter. The first project is called *I've heard about*, from 2006-2009, 2012. The team is Francois Roche, Stephanie Lavaux, Jean Navarro and Benoit Durandin. The second project is called MMYST, developed in 2015. Before analysing the first project, the manifesto of the architects is described as follows:

Fig. 1: New-territories, *I've heard about*, 2008



© New-territories

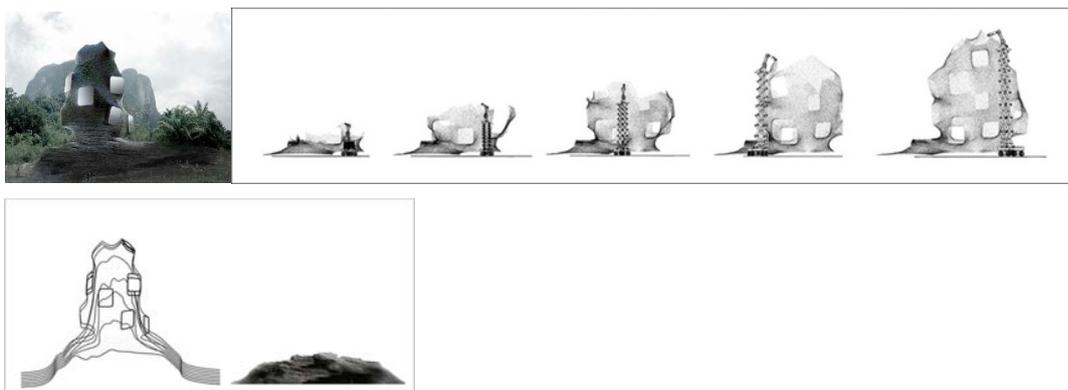
“I’ve heard about something that builds up only through multiple, heterogeneous and contradictory scenarios, something that rejects even the idea of a possible prediction about its form of growth or future typology. Something shapeless grafted onto existing tissue, something that needs no vanishing point to justify itself but instead welcomes a quivering existence immersed in a real-time vibratory state, here and now. Tangled, intertwined, it seems to be a city, or rather a fragment of a city. Its inhabitants are immunized because they are both vectors and protectors of this complexity. The multiplicity of its interwoven experiences and forms is matched by the apparent simplicity of its mechanisms. The urban form no longer depends on the arbitrary decisions or control over its emergence exercised by a few, but rather the ensemble of its individual contingencies. It simultaneously subsumes premises, consequences and the ensemble of induced perturbations, in a ceaseless interaction. Its laws are consubstantial with the place itself, with no work of memory. Many different stimuli have contributed to the emergence of *I've heard about*, and they are continually reloaded. Its existence is inextricably linked to the end of the grand narratives, the objective recognition of climatic changes, a suspicion of all morality (even ecological), to the vibration of social phenomena and the urgent need to renew the democratic mechanisms. [...] Made of invaginations and knotted geometries, life forms are embedded within it. Its growth is artificial and synthetic, owing nothing to chaos and the formlessness of nature. It is based on very real processes that generate the raw materials and operating modes of its evolution. The public sphere is everywhere, like a pulsating organism driven by postulates that are mutually contradictory and nonetheless true [...]”.

The whole text must be read on their website, as some cuts have been necessary for this article. The phenomena are induced by the ensemble of heterogenous individual contingencies, that

can be contradictory. The growth is, according to the authors, not aligned with nature's formlessness. The principle of growth is thus similar. The way a bifurcation is defined in the structure is thus linked to the idea of emergence. We witness the nature-like phenomena of emergence in an artificial system. The question is then: would such an emergence rise if, as the authors state, no law or moral applies anymore to this community? The public sphere is everywhere, and thus nowhere. Public space and private space vanish, and of course their boundaries. So how can a membrane like the one we see on the renderings emerge? As an artistic-like architecture manifesto, it is a valuable project because it raises these questions. Unlike a formless project that wouldn't have any aesthetic value, this project shows formal characteristics, evolving in time, that give it an aesthetic value. And this appreciation of the project is possible only in a Kantian perspective, that stays wide spread in aesthetic theory, on the base of a law. As there is law as the background of aesthetic judgment, it is highly probable that there is a law that serves as the background for the aesthetic development of this project by its authors. This law is maybe redefined implicitly in this manifesto. It seems that fluctuating norms (according to the functioning of the community) would coexist with a law that enabled aesthetic choices, especially in terms of structure and membranes.

The second project that shares this characteristic of clear structuring dynamics is called *MMYST*, developed in 2015 by Francois Roche, Vongsawat Wongkijjalerd, and Benjamin Ennemoser.

Fig. 2: New Territories, *MMYST*, 2015



© New-territories

*MMYST* is “An hybrid architecture (half for human and half for specific birds) on a tropical Land for only 10 years, corresponding to the time of the Pledges. As a backer, you can treat yourself to a stay in this architecture from one single night to a week per year during 10 years. This experimental ‘ecosophical’ and ‘anthrosophical’ lava emergence will be yours within this sharing, including the benefits of the breeding (bird nest soup). To make it possible, we involve architecture advanced technologies (for design and fabrication) with Robotics and Computation.

This experimental 'breeding-resort' with Swiftlets & Dwellers twisted together (a Human Shelter & an Artificial Bird Cave intertwined) is located in Krabi, middle of Thailand (see map pictures below)."

Again, the whole text must be read on their website. This project expresses explicitly a link between new technologies (parametric architecture and its application through robotics) and nature. In this case, animals are involved (birds), and thus a continuous link is created by the authors between human, animal and vegetal realms. Similar reflections from the first project can be applied to this project: there are aesthetics choices for the structure. They are nevertheless less important than for the first one. The whole shape would relate more to a *mimesis* of nature (the hill behind). Windows are quite classical. Natural processes have precedence over creative phenomena that could occur from the functioning of the group of humans and birds. The space where aesthetic choice occurs (even through new mechanisms of production and evolution of shapes) is vanishing in the practice of New-territories's.

## Mimesis of nature and disappearance of affect

When the development of computational design follows a linear and determined system of evolution or growth, it tends to merge with natural processes. The opposite would be a system based on chaotic functioning. With a computational system functioning on a strict law, or its opposite of endless possibilities through the absence of any law, boundaries tend to disappear between human and nature. Homogeneity through repetition and the systematic tends to prevail. The consequence is that boundaries between places of different statuses, as defined by cultural and political functioning, and aesthetic value, are also disappearing. Thus, if we consider the requirements of psychoanalysis, the disappearance of boundaries in human society is a threat to human values. In the case of architecture, it is a threat to the expression of human freedom in an artistic expression that creates affect. Mehdi Belhaj Kacem analyses in his book *Affect*<sup>38</sup> how two sets of pathologies are related to the absence of limits, in two different ways: masochism and sadism. He describes the disappearance of affect in a system governed by law (sadism) and in a system governed by the absence of any law (masochism). By contrast, the possibility of affect and aesthetic judgement in architecture means that there is a distance set with these two extremes. Affect can't exist in the case of an absence of law that is masochism. Pleasure is not reachable, but instead, an 'Ultimate Good' is aimed to be reached. It is linked to the idea of virtual as 'Universal Relation' or 'Metaphysics of the Relation' (when any point in time and space has the same quality). Desire is considered as inconsistent, diffuse and

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<sup>38</sup> Mehdi Belhaj Kacem, *L'affect*, Auch, Tristram, 2007.

infinite. The event is impossible. On the other side, that relates to law and superego<sup>39</sup> that is sadism, sexual pleasure is repeated, but the repetition shows that the event is impossible. The event stays as horizon. The real is inaccessible, as is the real of the 'thing'.

Freed from law, and referring to Alain Badiou's 'matheme' as a necessary background concept, the possibility of affect is the possibility of an event and is thus presence itself. Mehdi Belhaj Kacem links it to considerations on anxiety and loss as main affect. The loss of loss is thus absence of affect. Far from 'ultimate Good' and Law, the true affect can arise. Against the disappearance of aesthetics value in art and architecture, and against the disappearance of boundaries between public and private space, architecture is considered as the site of the event (or 'eventual site'), 'at the border-of-the-void'. When architecture is excessively produced and controlled by technology, it loses its real presence and its aesthetic quality.

## Preserving affect in preserving different statuses of space

Even if there are limits of territories with different functions in the animal realm, spaces of different statuses, public space and private space are a human cultural construction. Keeping these differences is a guarantee of living human culture and the creativity of a society, against any tendency for homogenisation. The boundaries between spaces of different statuses can be mainly functional, but can easily have poetic characteristics. In architecture, the limits between inside and outside are a considered place of creative expression, linked to affect and aesthetic value. In the history of architecture, there are links between the culture of the society and the links between inside and outside, public space and private space. The Art Nouveau style represents a key period of blurring the limits between inside and outside. New technologies of information are blurring the limits of the public and the private in our everyday life and in the way the society and politics work. According to Beatriz Colomina, 'modernity' is actually the publicity of the private. Modern architecture renegotiates the traditional relationship between public and private in a way that profoundly alters the experience of space. In her book *Privacy and publicity*<sup>40</sup>, Colomina tracks this shift through the modern incarnations of the archive, the city, fashion, war, sexuality, advertising, the window, and the museum, finally concentrating on the domestic interior that constructs the modern subject. Innovations have followed these redefinitions of the fields of the public and the private. We must accept contemporary changes

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<sup>39</sup> Mehdi Belhaj Kacem, *Idem*, p. 184.

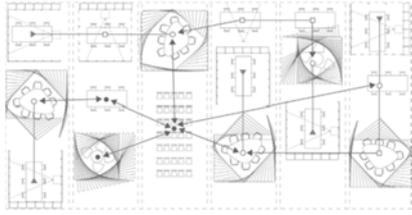
<sup>40</sup> Beatriz Colomina, *Privacy and publicity – Modern architecture as mass media*, Cambridge, London, The MIT Press, 1994.

brought by new technologies and new relations between public and private, but an excessive erasure of boundaries would be pathological for the functioning of our societies according to psychoanalysts. Ever-changing boundaries can enhance freedom, but an amoral freedom. Keeping the limits of private life enables each citizen to enjoy their liberty, when it respects the boundaries and limits set and discussed by society. According to French philosopher Jacques Rancière, the debate of these limits defines contemporary political life. Each person should be able to discuss these boundaries and be able to play with them and act on them. New digital technologies enable designs of an unprecedented level of complexity, and through parametric methods and their technological realisation, an interaction with data coming from a person, a group of persons, or broader context. The virtue of these technologies is an adaptation to changing needs, especially in the types of action and interaction we have with others in space. Without stopping the innovation processes around the plasticity of shapes of walls, and maybe also floors and ceilings, through parameters and algorithms, it is necessary to think and control the design of these near future or utopian possibilities. The knowledge and experiences around permanence and adaptability of partitioning is the historical background of these innovations. The status of spaces and ways to maintain privacy (for example of an office place in an open plan project) have been researched extensively. We know how spatial characteristics affect human behaviour. A smart design of long term adequate partitioning has been the main aim of architecture so far. Even if there was a primary and a secondary structure that could evolve in a lapse of a few months or years, and even if there was a wall or furniture piece that could expand and retract according to the needs, the plasticity enabled by new technologies is now unprecedented. The transformations of partitioning in laboratory prototypes enabled now in a short period of time (seconds) are new characteristics that must be taken into account. For example, Omar Khan's project *Design Innovation Garage*, Buffalo, NY<sup>41</sup> is a design innovation centre modelled on open source concepts, using multiple communications options between black boxes including secure information networks, projections, visual reflections, opacities and transparencies, occupant conversations, overhearing and glancing.

Fig. 3: Omar Khan, *Design Innovation Garage*, Buffalo, NY

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<sup>41</sup> Omar Khan, "Black Boxes: glimpses at an autopoietic architecture", Pablo Lorenzo-Eiroa, Aaron Sprecher (eds.), *Architecture in formation: on the nature of Information in digital architecture*, London, Taylor & Francis, 2013, pp. 124-129.



© Omar Khan

Another tendency has also to be considered, according to Richard Sennett, capitalist society enhances the desire of protection of persons and families behind sealed boundaries of private place. He studied how, at the scale of the city, the intense and ever-changing transformations of society created a collection of enclosed family units, and with the decline of family values a disparate and conflictual collection of individuals. The city becomes a mosaic of individuals or micro-communities, and public life and public space (as Jürgen Habermas made the link between these two concepts) no longer exist. The result in terms of living environment is its neutral and sterile characteristics<sup>42</sup>. The rising speed of transportation makes this crisis of space even more acute. In a constructive positioning, Sennett develops concepts that can be guidelines for new working organisations under capitalism, such as ‘concentration without centralisation’. On the basis of the concept of a working unit without centralised decision-maker, designers could propose new flexible boundaries of workplaces for example.

On the basis of these two paradoxical movements, that are the publicity of the private (mostly developed through social media) and the withdrawal of the private self in a protection process, the architectural discipline needs to reflect on fluctuating boundaries, in order to create adequate flexible proposals for the future.

But the creative play on limits between public and private can happen only if we maintain these two ends of the spectrum. Maintaining public space is especially challenging, because it is a collective expression and thus political. Creativity and events enabled in public space are expressions of a society’s culture. If public space is overcontrolled, because of its functional aspect of circulation of a crowd, or because of its economic value, we lose this collective creative aspect, and the possibility of an ‘event’. Control can be heightened easily through the use of electronic based logistics, stimulated if not caused by the increasing ability to use them. Security and efficiency can be managed at a distance through cameras. But public space is a space where there is not a private person controlling space, either a present physical person nor

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<sup>42</sup> Richard Sennett, *The Conscience of the Eye: The Design and Social Life of Cities*, New York, Norton, 1992.

a distant person behind a screen. The public institution (State, city council) ‘owns’ the territory, but the public as a ‘we’ auto-regulates itself in this space<sup>43</sup> in respect of common law. Repression can occur just when common law is not respected. Public space can be the space of expression of personal desires and affects, that can be shared by a group and then lead to common expressions of desires and affects (cultural events, demonstrations, etc.)<sup>44</sup>. If some rules are excessive, then the ‘we’ is too much under the control of the institution, that needs to be personified as the ruler. For example, if a part of public space is set in discontinuity of the main public space, and thus under the visual control of a private office building or a private residence, then it loses its public status. The challenge to keep public space protected from the influence of the private sector, and from the influence of an institution that would act like a private manager, is important.

From the opposite perspective, but in keeping the same logic of different gradients of statuses of space, it is necessary to keep the other end of the spectrum: private space. Private space is a place of freedom from the control of the society, and the primary place of expression of affects. There is a tendency to see private space disappear, because personal behaviours and affects can be used as economic value. Through the presence of technology in interiors, data can be collected on our behaviours in private space. Of course, *Facebook* is a symbol of the way we share affects and behaviours with the public. The autoregulation of private space relies on a different set of dynamics, linked to a small community of persons or a person on his/her own who autoregulates his/herself on her own, and these dynamics can’t occur properly if they are under the gaze of the public sphere. The requirement to maintain the two ends of the public/private spectrum are a guarantee that the gradients between spaces of different statuses will remain.

## Possibility of collective creativity

On the combined bases of:

- the possibilities of computational technologies to take into account a considerable amount of input data and parameters, and

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<sup>43</sup> Jacques Rancière, « Dix Thèses Sur La Politique », *Aux bords du politique*, Paris, Gallimard, 1998.

<sup>44</sup> Hannah Arendt, *The human condition*, Chicago, University of Chicago Press, 1958.

Frédéric Lordon, *La société des affects – Pour un structuralisme des passions*, Paris, Seuil, 2013.

- the key sociological aspect of boundaries between public and private space, and
- the political needs of community run practices in architecture and urban planning,

computational design could appear as both a threat and an unprecedented tool to use for collective practice. As critical thinking in architecture is discussed in this article, the article itself can be seen as a critique of innovation possibilities in collective practice based on computational design tools. There is no doubt that creative architectural design could be developed using computational tools. The artistic value would be developed by the author. But what computational tools enable, and that creates a shift from traditional practice, is the input by multiple participants. Is the addition of individual input capable of collective creativity?

The scale of community, small or big, is especially interesting to investigate in terms of transfers or sharing of power and decision making. Through the multiplicity of parameters and algorithms, power can be shared at different levels: between the ruler and a community, or between a community and an individual person<sup>45</sup>. The use by a community of persons, with the tensions inherent to the functioning of this community, could have as consequence the emergence of a creative configuration of the system. As the technological environment tends to mimic natural processes, collective creativity could emerge on the model of ‘emergence’ in the animal realm (Swarm Systems, Ant Colony, Termites Cathedrals, Slime-Mold Aggregation).

“Emergence is a concept that appears in the literature of many disciplines, and is strongly correlated to evolutionary biology, artificial intelligence, complexity theory, cybernetics and general systems theory. It is a word that is increasingly common in architectural discourse, where too often it is used to conjure complexity but without the attendant concepts and mathematical instruments of science. In the simplest commonly used definition, emergence is said to be the properties of a system that cannot be deduced from its components, something more than the sum of its parts.”

The theory of emergence posits that sometimes nature ‘jumps’ from one state to another in sudden and unpredictable ways, which modern science can neither anticipate nor account for.<sup>46</sup> In architecture until today, we could represent it symbolically in architectural forms more than witness it as a real phenomenon. Charles Jencks<sup>47</sup> states that we can just have a representation of emergence.

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<sup>45</sup> Christopher Hight, Chris Perry, “Introduction to Collective Intelligence”, *Design AD*, September– October 2006.

<sup>46</sup> Mario Carpo, “Introduction Twenty Years of Digital Design”, *Digital Turn in Architecture 1992-2012*, Chichester, Wiley, 2013, p. 11.

<sup>47</sup> Charles Jencks, « Landform Architecture: Emergent in the Nineties », *New Science = New Architecture*, *AD Profile 129, AD 67*, September– October 1997, pp. 15– 31.

“In short, they do not pursue formlessness but emergent form, the matter emerging from matter. The intention may be the desire to get closer to the reality behind nature, the generative qualities behind both living and dead matter, that is, once again, the cosmogenic process which complexity theory has recently tried to explain. Representing emergence and creativity per se cannot be done, but it can be presented by an architecture that is as fresh and unlikely as one finds here.”

It is an utopian idea to imagine the emergence of singular events in architecture, but if René Thom is not contradicted, it is theoretically feasible with the level of complexity achieved by computational tools.

“René Thom affirmed an adequate relationship between mathematics and nature, a dynamic understanding of morphogenesis, where non-standard analysis was the tool, through the integration of infinite in the numbers to define the singularization of a form or a motive. The singularity, conceived as a bifurcation along the progression of an algorithm, opened the way to a full description of the physical world, to the full discretisation of reality. This qualitative science of interaction between attractors that define relations between differential varieties which was descriptive of physical manifestation became a tool of simulation applied in physics or in biology and extensively to ecological systems. Here again one finds the schematism of the continuous, which René Thom uses as a tool for interpreting mutations of life, those of embryogenesis, translating them geometrically as ‘saliency’ or ‘pregnancy’, a return to the relationship of the objectile and the subjectile, demonstrative of the movement to ‘singularization’ and ‘individuation’<sup>48</sup>.”<sup>49</sup>

If this evolution is possible in nature, the hypothesis is that with the level of data and complexity enabled by computers, it is also possible in artificial objects. If it is possible today to demonstrate in laboratory experiences, then it could be possible in the future to display creative events in the functioning of computationally design panels. If it stays at a theoretical level, then the possibility of architecture and living environments based on the theory of emergence enabling creative collective practice is utopian.

If and when it is possible, it is necessary to set a frame to this practice, in terms of rules or a priori concepts. Mehdi Belhaj Kacem defines Alain Badiou’s ‘matheme’ as a priori principle for the existence of affects. Jacques Rancière mentions ‘common law’ as a priori principle for the existence of events in public space. Without being conservative by setting up strict laws (which as we saw wouldn’t enable affect in architecture), these background *a priori* principles are a guarantee of the possibility of creative practice. The fluctuation of norms of a

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<sup>48</sup> René Thom, « Saillance et prégnance », *Esquisse d’une sémiophysique*, Paris, InterEditions, 1988, pp. 16-34.

<sup>49</sup> Frédéric Migayrou, “The Order of the Non-Standard: Towards a Critical Structuralism,” Rivka & Robert Oxman (eds.), *Theories of the Digital in Architecture*, London, Routledge, 2014, p. 19.

computational architecture could function efficiently on this basis, as a second layer of parameters and algorithms that would have effects at the scale of a community.

## A model: measured ‘common law’ as possibility of affect, superimposed with local fluctuating norms

On the functional level of a society or community of people, computational design could enable an adaptation of boundaries to a changing context and to changing needs. Instead of becoming obsolete, boundaries between spaces of different statuses could be adaptable in time. Forms vary, and parameters ensure a variability that is coherent with the aspirations of the society (especially in regard to permeability of boundaries between public and private space). Through the modelling of social norms into a multiple and finite number of parameters (manageable and controllable by a community), the system can integrate tensions inherent to the functioning of the community. If we consider the statuses of places, the tensions in computational systems can relate to tensions inherent to public space in the definition given by Jacques Rancière<sup>50</sup>. These tensions in computational systems (in relation to the political aspect of the above-mentioned tensions inherent to the functioning of the community) could find an expression in materialised architectural features that create affect and concept. The fluctuation of the norm that replaces the law could enable a dynamic of architectural features that would be in dialogue with dynamics and tensions of public space. The at first threatening-looking aspect of the loss of law can actually serve at the scale of the community even better the cause defended by Rancière. Fluctuating boundaries, in a measured way, could propose an adequate response to the political question of the statuses of places. Because the question of public space is a political question, as is political the question of private space and of the transitions between public and private space, computational design can reactivate these debates. Computational tools can for example bring innovation into the conception of short-circuits between public and private space. The use of smart phones and social media are the wide-spread examples and symbols of this tendency to merge public and private life. If the extremes of radical autonomy of a computational system from the context or radical continuity with the context don’t prevail and are kept at a distance, there are possibilities for computational design to develop new adequate functional and aesthetic architectural projects. These new thinking tools would enable the definition of new objective qualities (after the disappearance of classical objects for prevalence

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<sup>50</sup> Jacques Rancière, *La Haine de la démocratie*, Paris, La Fabrique, 2005.

of surfaces and patterns), and a new resolution of tensions between objective qualities through momentary optima, materialized in innovative configuration of computational systems. The way the gradients between spaces of different statuses remain and evolve through time creates the conditions for a wide range of experimentations. Computationally designed architectural elements could be an important factor of the redefinition or reinvention of boundaries between public and private space. Criticized (usually adequately) for creating either an architecture that is totally in continuity with the context, or on the other side a totally autonomous object, computational design can be a tool that would enable subtle site-specific approaches. By choosing precise suitable parameters and algorithms, specificity could be explored in an unprecedented way. It would allow control to be maintained at the scale of a community and not let the ruler control the totality of a vast territory. The relative autonomy of the scale of the community can be maintained without creating a radically closed system. Architecture would be thus in a relative interaction with the context, like a plant in its environment, as the link with natural processes would create this possibility. The new negotiation of boundaries of space should be discussed and accepted by the group, on the long term (to match structuring effects of habits) or in a short timeframe<sup>51</sup>. The plasticity of boundaries raises also ethical questions about who can act and how can one act on these transformations and control them. Parameters related to the 'common law' of public space, and the 'common law' for private space could be a frame for the possibility of events and creativity. Defining fixed parameters or algorithms that would define 'common law' is of course a utopian project, but a draft of this 'common law' that would be translated into a parameters and modelling is foreseeable. The possibility of events due to a 'light control' of the system through common law could coexist with functioning and control of the system at the scale of the community. If a community is controlling the system, this collective intelligence would make this structure evolve in time. In the best case, through the phenomena of emergence described by René Thom, and appropriated by designers like New territories (ex R&Sie), collective creative events could happen in the architectural framework. A singularity as event would happen at one point, and then disappear again, before the next one arises. Thus, an adaptation of the building to accidents and catastrophes can be imagined, either on its surfaces, or maybe even at the larger scale of the structure (auto-fixing structure after an earthquake, or a movable structure that would occupy

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<sup>51</sup> These transformations question our capabilities of adaptation, as a person and as a group or community. Let us not forget that habits have structuring effects that are important for individuals and groups. Richard Sennett, *The corrosion of character – The personal consequences of work in the new capitalism*, New York, W. W. Norton & Company, 1998.

a more habitable place). The buildings and inhabitations would gain a relative autonomy from the control of the market. Through this relative autonomy of the system in space and time, politics could be in the making on a continuous basis.

The possibilities of computer calculation to set up a system that could achieve artistic collective action is still in debate today. Meanwhile, these possibilities of calculation enable a draft of this model (collective input and control at the scale of the community, relative autonomy from outside on the base of respect of 'common law'). The utopian aspect of the theory of emergence applied to the artificial world of architecture displays real potentialities for the future, even if collective artistic creation *per se* is not achieved. Antoine Picon summons us not to forget memory and utopia if we want to build a better place for the future. Today, considering the capabilities of calculation of computers in a way that tends to this utopia could effectively create these better places of political community practice. 'Law' and 'ultimate Good' wouldn't set the rule over our living environment. The collective body would be able to evolve in an environment that enhances events, affects and singular evolutions in time. It is a challenge for the architectural profession to develop constructive and progressive critical thinking on computational design.

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