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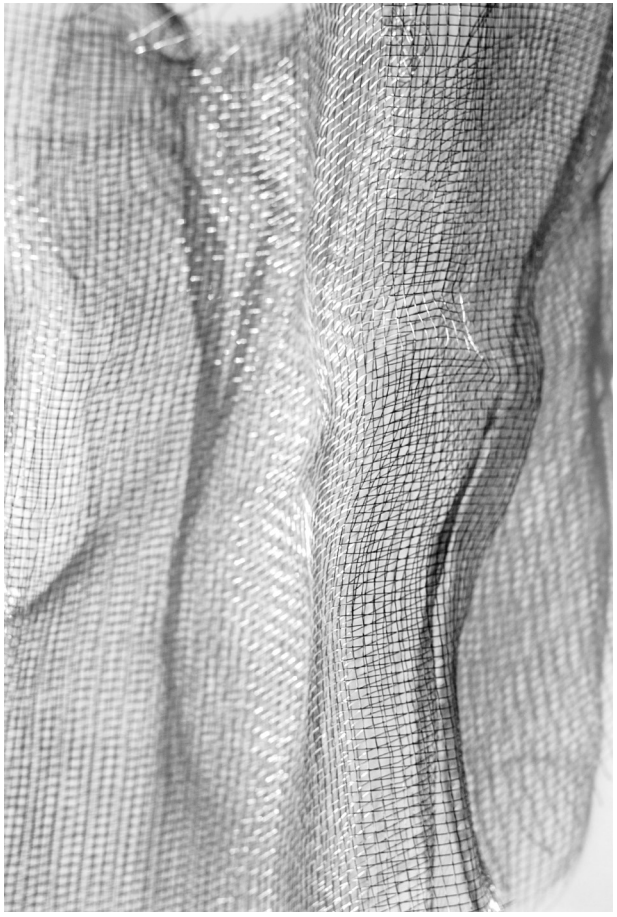
Design-Disegno.

Geometry, measure and algorhytm for architecture and the city.
Curated by Matteo Fraschini.



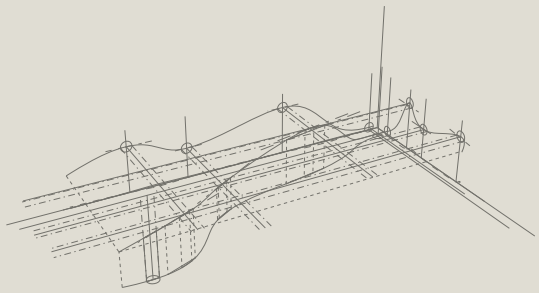
The initial mesh: manual/tactile modification process towards the definition of a diagrammatic sketch.

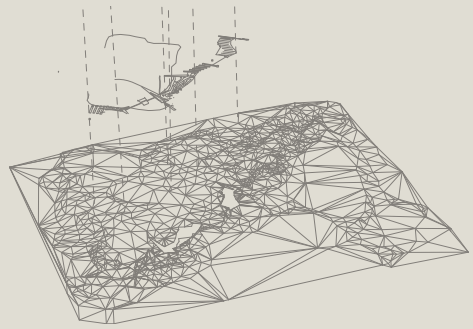
Presentation.

Ernesto d'Alfonso

I see Matteo Fraschini now as he was then: young and carefree, working with his student, Matteo Graziani, on a metal mesh manipulated and moulded according to the sketch, a wise compression of the three dimensions on a flat surface.
Thus, the young teacher, already a professional architect, tested with his pupil, an expertise later displayed in the projects for Segovia and New York. He placed in his student's hands the mature result of the work just created, in a constant and careful application of the design tools. Therefore, it comes as no surprise for me to see this book bringing today to its completion a process that began at that time, was honed during Fraschini's PhD Thesis and continued in his most recent South African years with new students. For them, in this book, Fraschini perfected the study of the architectural tools that he has developed, based on specific theoretical and historical preconditions, for his teaching activity.
On my part, I would like to take this opportunity, as a witness of his journey, to say something about what connects him to the School of Milan, of which I became, in fifty years of work, a representative. I clearly see Matteo Fraschini taking over the baton in the relay race between generations. A baton that he will carry on in his South African journey at the University of Cape Town with a new generation of students that will demand from him new original contributions pointing towards directions currently unknown.
I remember myself when, at the same age he is now, I was studying the instruments of an architect, which were based on technical drawing for the architectural design: Borromini's tables for the Opus Architectonicum. For me, Monge's descriptive geometry as well as Futurism found an ancestor in that book.
The projectivity, created by Alberti on the basis of Brunelleschi's mirror discovery, found in the Opus Architectonicum a systematic application into design. On the other hand, the Milanese artists of the beginning of the last century, the Futurists, could find a pioneer precisely in the matter modelled by the construction. I will not go further into the concept.
If, at the time, the topic was the planar surface and the geometry that directs it, today, it is the computer screen and the program behind it.
As reference I had Bramante and Leonardo, who were inspired by Alberti and Brunelleschi and followed by Palladio (and then Descartes). It was not a matter of resurrecting the past, but rather of the future finding a 'language' (to use a trendy metaphor) to display the data of an imagination freed from arbitrary acts.
Even though Palladio has been the master of post-medieval architecture, the four books of architecture could not have been written without Alberti. However, I also know that Palladio's legacy is founded on Bramante's Tempietto in the cloister of San Pietro in Montorio, just as I know that, without Leonardo, an evolution of the Platonic concept of the Idea into a visually based modern science would have never occurred.
Therefore, today, as an architect from the Politecnico, I claim a scientific dimension in the making of art, especially in architecture. I think about an art that knows the technique, its tools and machines; I think about the power of all the tools that have been crafted working together with the designing mind in order to orient world phenomena toward the definition of inhabited spaces.
Fraschini went further. Starting from a centre of urgency of his own, the theme he tackled has been the tectonic of architecture. He deepened this topic, having clear

in his mind the issue of architectural and urban design in the digital era. In this context, the main tool could no longer be the technical drawing. Instead, it was rather the relationship between a sketch, a digital diagram, the sheet of mouldable mesh, intended to explore a ground surface or a roof. It was the analytical and infinitesimal geometry employed to control the digital design software. The two-dimensional figures could then be operated 'three-dimensionally', as they are automatically projected on the surface of the computer screen. This book represents the first effort to gather the results of more than a decade of research in order to provide young students with access to the tools of architectural design on an urban scale. It offers the lens of parametric digital design to deepen and refine a morpho-typological approach. Furthermore, it provides landscape urbanism with innovative and original contributions for the definition of a method that can discipline the design of the ground not only on its surface, but also in the strata involved in human construction. I will not go beyond the scope of a preface. I would simply like to describe the path travelled by Fraschini from his Master thesis to his PhD, up to today and of the novelty of the theoretical and practical approach he developed, as originally as I just described.
Authors he admired in the late nineties, and in particular the work of Rem Koolhaas, Peter Eisenman and Frank Gehry, clearly inspired his theoretical and historical studies. From each, he drew specific questions to ask himself as a designer. I will summarise them as follows:How to describe the constructive three-dimensionality and/or the spatiality that is modelled by means of architectural drawings? In this question, the substantial two-dimensionality of technical drawing and of the flat projection, laid out on a computer's screen, represents a challenge for the designer that is aware of the real three-dimensionality of what he designs to be inhabited and used.
Along this path lays the crucial question about the limits of the design tools in relation to the knowledge applied in the construction process; it is a knowledge where the transparency of the visual, which stops at the surface, is inadequate.





In a **design** process, the drawing (Italian: **disegno**) of an object or a space is the act of representing that thing with the idea of knowing and modifying it, and it is an essential moment.
It is an operation that requires a synthesis capable of projecting and confronting on a two-dimensional surface - physical or virtual - the complexity of the world with an idea of form.
The concept of **measure** and measurement is therefore, for the designer, the instrument that makes it possible to make an object, architecture or an urban fact representable, abstract, knowable and therefore designable. Similarly, for the user of that space, the measurement will help to memorise, map and place him in relation to it.
Mathematics and geometry have played a fundamental role in enabling this knowability. The machine of the two mirrors invented by Brunelleschi opened up the definition of the rules of perspective and performed the compression of a three-dimensional world regulated by numbers, on a two-dimensional surface. He defined a bijective (one-to-one) relationship between the drawn and the real world. This operation reinforced the distinct role of the tactile and the visual dimension - the stage and the scene - and permitted to describe and graphically think of **infinity and the infinitesimal.**
Towards the end of the last century, F. O. Gehry created his **"machine"**, a digital tool to "see and know" what he had manually modelled in his cardboard models
Mathematics as the tool that structures forms and urban spaces, making them recognisable, for centuries has organized this "invisible framework" through discrete measures, proportions and modules. Now the complexity of urban spaces can be better understood using the concept of "**modality of variation**". This new framework suggests the study of **algorithms** capable of interpreting this dynamic modification process.
These themes are addressed from a technical point of view, understood as the necessary knowledge to imagine and make an idea designable.

This book is a reflection that, with the benefit of practical examples, proposes to reason on the relationship between an **idea** and its representation, between a **sketch**, analogical and digital **models**, and on the "mental" tools which manage this relationship.
It is furthermore a reflection on the theoretical and practical implications of the concept of fold, or better, on the **act of folding**, as a concrete and tangible capture of the infinitesimal that directs a tectonic possibility. To do this, to try and control the infinitesimal as a measure that gives structure to contemporary design, both at the architectural and the urban scale, a delving into mathematics as the algorithm that manages the machine, was necessary.
This publication is based on the doctoral dissertation in Urban and Architectural Design presented at the Politecnico of Milan and on the research and teaching activities developed by the author in that school and, subsequently, at the University of Cape Town.

Matteo Fraschini is a senior lecturer at the School of Architecture Planning and Geomatics of the University of Cape Town where he teaches in the Masters of Urban Design and of Architecture. His teaching and research activity is centred on architectural and urban design methods in relationship with the different scales of the contemporary city. He is an architect and holds a Ph.D in Architectural and Urban Design (2007). He has been a contract professor at Politecnico of Milan where he taught design and theory of architecture and where he organized several seminars and workshops with international Universities. Besides the research and teaching activity he has been working as an independent architect, developing designs at different scales, He has been awarded and mentioned in international design competitions, and has founded, in collaboration with others, the web magazine Arc2città with the aim to stimulate the debate around the most relevant issues of contemporary design.

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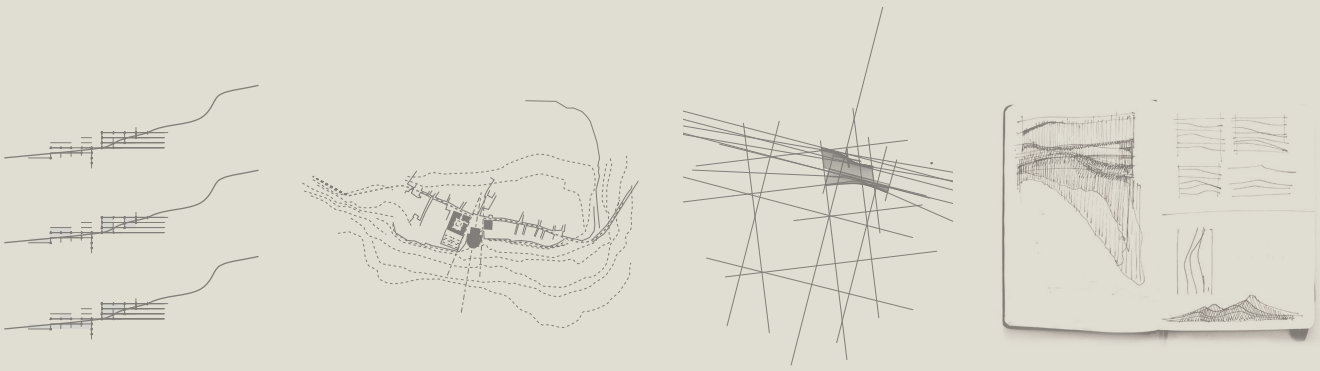
This question triggers the next: How could architectural design as a discipline overcome this gap and what constitutes the going beyond of the traditional designing instrumentation?
In this question, a speculation on the Cubist transparency post Le Corbusier and Terragni as a dilemma on the 'canonical' in relation to the Zeitgeist of Modernity has played a crucial role to link the Palladian legacy to the discoveries of the contemporary age. In conclusion, a third question arises, more intrinsically connected to the ontology of architecture, that opposes transparency and tectonics as conditions of existence. A design thinking implies the overlapping of steps that are completely abstract with moments where perception, memory and imagination are activated according to different modalities. How can this dialogue be clarified, displayed and shared as an operative process?
I believe that this third question is the synthesis to which the others converge. Therefore the very core of this study is the innovative relationship between the sheet of paper, where the sketch is traced, and the metal mesh, modelled by hand into folds, curves and cuts. An infinitesimal geometry translates these modelling actions into three-dimensional forms, such as the ground or the roof-scape, to create the footprint/scenario in which natural or artificial inhabiting phenomena will take place. To conclude, I find it very interesting to conceive the analytic geometry as a moulding, and therefore tactile, experience, translating the modelling process of the mind into something concrete. At the same time, the idea of looking at the manipulation of the metal mesh as a starting point for an abstraction process operated by means of analytic geometry is worthy of attention. In my opinion, the tactile side of analytical geometry and the abstraction reached starting from the metal moulded mesh, are necessary implications of the coexistence of the abstract and the concrete in the digital parametric design. The reference to contemporary authors and old masters is essential to grasp the novelty of the questions and of the answers within the Zeitgeist of our own contemporary age. Similarly the reference to the design projects is a useful testing exercise for a public assessment.

Ernesto D'alfonso has been full professor at the Polytechnic of Milan where he has been the director of the Ph.D School of Architectural and Urban Design for several years.
He convened and co-founded the ARC journal as a dialogue space for the Italian Ph.D Schools in architecture and urban design disciplines. He published several texts, amongst others, L'architettonica commedia secondo Claude Nicolas Ledoux, and Architettura, and, more recently, Il tipo, Itinerario teorico and L'antico, il Moderno e il Classico for the Quaderni di Arcduecitta' series.
He is the founder and the director of the web magazine Arcduecitta' that promotes and aims to facilitate a critical debate on contemporary architectural and urban design conditions.



Matteo Fraschini

DesignDisegno
Geometry, measure and algorithm for architecture and the city

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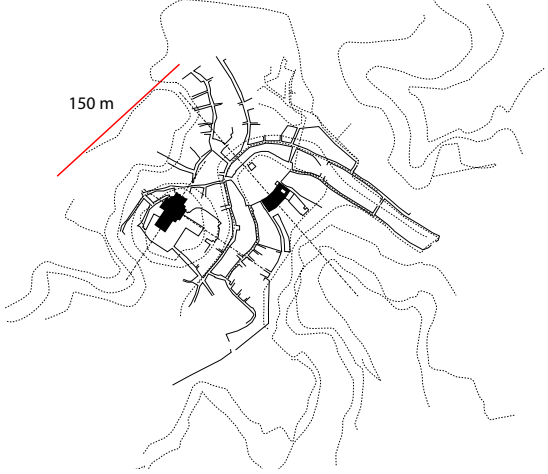
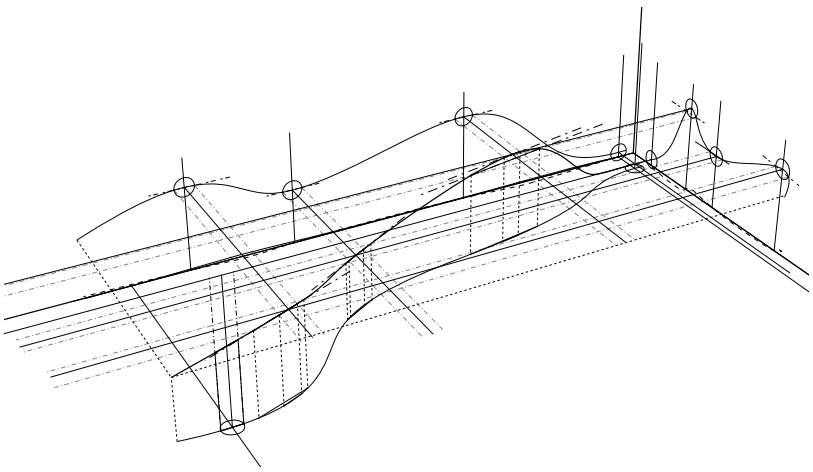
Abstract



The book. Shortly.

Matteo Fraschini

In a design process, the drawing (disegno) of an object or a space is the act of representing that thing with the idea of knowing and modifying it, and it is surely an essential moment.
It is an operation that requires a synthesis capable of projecting and confronting on a two-dimensional surface - physical or virtual - the complexity of the world with an idea of form.
The concept of measure and measurement is therefore, for the designer, the instrument that makes it possible to make an object, architecture or a urban fact representable, abstract, knowable and therefore designable. Similarly, for the user of that space, the measurement will help to memorise, map and place him in relation to it.



Projection of a three-dimensional curve and of its "meaningful" points into three planar surfaces.

Mathematics and geometry, particularly in Western architectural culture, have played a fundamental role in enabling this knowability. The machine of the two mirrors invented by Brunelleschi opened up the definition of the rules of perspective and performed the compression of a three-dimensional world regulated by numbers, on a two-dimensional surface. Thus, it allowed the definition of a bijective (one-to-one) relationship between the drawn and the real world. This operation reinforced the distinct role of the tactile and the visual dimension - the stage and the scene - and permitted to describe and graphically think of infinity and the infinitesimal.
Towards the end of the last century, Frank O. Gehry created his machine to "see and know" what he had manually modelled. He developed a digital tool that would help to study and refine, on a screen, the folds made on his cardboard models.
Mathematics as the element that structures (not always explicitly) the form, making it recognisable, for centuries has organised this invisible framework through discrete measures, proportions and modules. Now, the complexity of the contemporary built space, and not only of its most iconic architectures, seems to require a leap in the quality of the instruments that allow its readability and modifiability.
In the past, space was read and organised on the juxtaposition between the city and the countryside and on their peculiar measures. In the reality of urbanity today, the thresholds between the different parts that form it are rather describable as blurred surfaces readable through the concept of continuity and varying intensities. In this new dimension, the ground, as a thick modified and modifiable surface, maintains an essential role to organise a possible readability of a space that otherwise struggles to find its references.
These themes are addressed from a technical point of view, understood as the necessary knowledge to imagine and make an idea designable. Technique (téchne) therefore, must confront with the digital instrumentations where mathematics and measures are inflected as algorithm and modality of variation.
This book is a reflection that, with the benefit of practical examples, proposes to reason on the relationship between an idea and its representation, between a sketch, analogical and digital models, and on the "mental" tools which manage this relationship.
It is furthermore a reflection on the theoretical and practical implications of the concept of fold, or better, on the act of folding, as a concrete and tangible capture of the infinitesimal that directs a tectonic possibility. To do this, to try and control the infinitesimal as a measure that gives structure to contemporary design, a delving into mathematics as the algorithm that manages the machine, was necessary.
This publication is based on the doctoral dissertation in Urban and Architectural Design presented at the Politecnico of Milan and on the research and teaching activities developed by the author in that school and, subsequently, at the University of Cape Town.

1
Introduction: measures and scales of the contemporary city.

The introduction frames some key concepts based on the Doctoral thesis, that will be discussed and developed throughout the book. The chapter highlights the relationship between representation (drawing) and idea where the act of representing is considered an essential and necessary abstracting step to understand and modify (1) the form. The process of selection of formal characters finds in geometry and, therefore in mathematics, an important tool to make the form legible and therefore, communicable. In this framework the concept of infinity and infinitesimal are introduced as abstract but representable mental concepts; for this reason the invention of perspective and the Renaissance revolution have a fundamental role for architecture and its design processes: the representation of the infinite on a plane, the distinction between view/section and plan, between visual and tactile, between stage and scene. The concept of measurement, of a discrete module, becomes essential for managing this relationship and for defining a mathematical "bijective" relationship between 2D and 3D.

These concepts have been elaborated in the framework of a "homogeneous, abstract, infinite and mathematical" (2) conception of space. From these premises, today, the relationship between architecture and city is approached considering the contemporary space, which is often described rather as discontinuous and "fragmented". The notion of continuity and discontinuity are addressed by recovering the tactile dimension and therefore of modification processes where the infinitesimal becomes the conceptual tool that allows their readability. Infinitesimal is proposed as a key capable of reading the process of modification - the act of folding. This manner of reading the tactile operation permits to combine architectural design processes with the urban and territorial development in terms of modification of the ground to which architecture reacts.

2
The Renaissance: measuring and touching the infinite on a plane.

The second chapter looks at the Renaissance through the keywords outlined in the introduction with the intent to gain a stimulus and a lesson for contemporary design and its processes. The book by Francoise Choay Espacement (3) is employed to help define the concept of physical settlement in relation to the cultural, social and philosophical context that generated it. This text guides in reading and understanding the concept of scale jump that characterized the European city (and not only), from the Middle Ages to the metropolis of flows.
In the Renaissance, in its abstract, homogeneous, infinite and mathematical space, as defined by Panofsky, it is possible to read some paradigmatic elements that are still current for the contemporary city and for its design. The comparison between Siena (Middle Ages) and Pienza (Renaissance), highlights the different way in which urban fabrics and monuments relate to the territory and offers the opportunity for some subsequent reflections.
In the urban transformations of Pienza takes shape the idea of "fracture", of discontinuity between the landmark and basic buildings but also the distinction between city and landscape. They are perceivable as disjointed elements: the ground/stage and the view, ideally projected on a virtual plane-window. This distinction between plan and section is seen through the reading that Arnheim proposes in The Dynamics of Architectural Form4.

The invention of the Brunelleschi's machine and the definition of perspective as both an empirical and ideal-conceptual act (Alberti) uses the module (measure) to tie the horizontal dimension with the vertical one. The module is the key that decodes the relationship between three-dimensional space and its planar projections. Perspective is the machine that projects a 3D space on a window/screen making it readable, decodable and therefore measurable (5).
The Baroque operates a tactile but still conceptual and mental "simulation" of modification processes on pure and legible forms. Compression, dilatation, deformation, hybridization are the conceptual operations that combine primitive forms (square and circle). It is evident the shift of attention between the immutable figures and the processes of modification that begin to acquire primary importance. Through the modification, in the tension between primitive and modified/hybridized figure, it is possible to understand and "decode" forms. Urban Baroque transformations are based on these assumptions, on an ideal, abstract, measurement of the territory (scene); even in the genetic mutation of Paris operated by Hausmann, the scale jump that will lead to the industrial metropolis will be managed through perspective axes that frame Landmark/monuments designed as new types for the space of contact of a new society. In Manhattan (6), the Cartesian grid clashes with the ground and with the trace of the ancient route (Broadway) that follows the topography marking the intervals that define the measures of the metropolitan dimension.

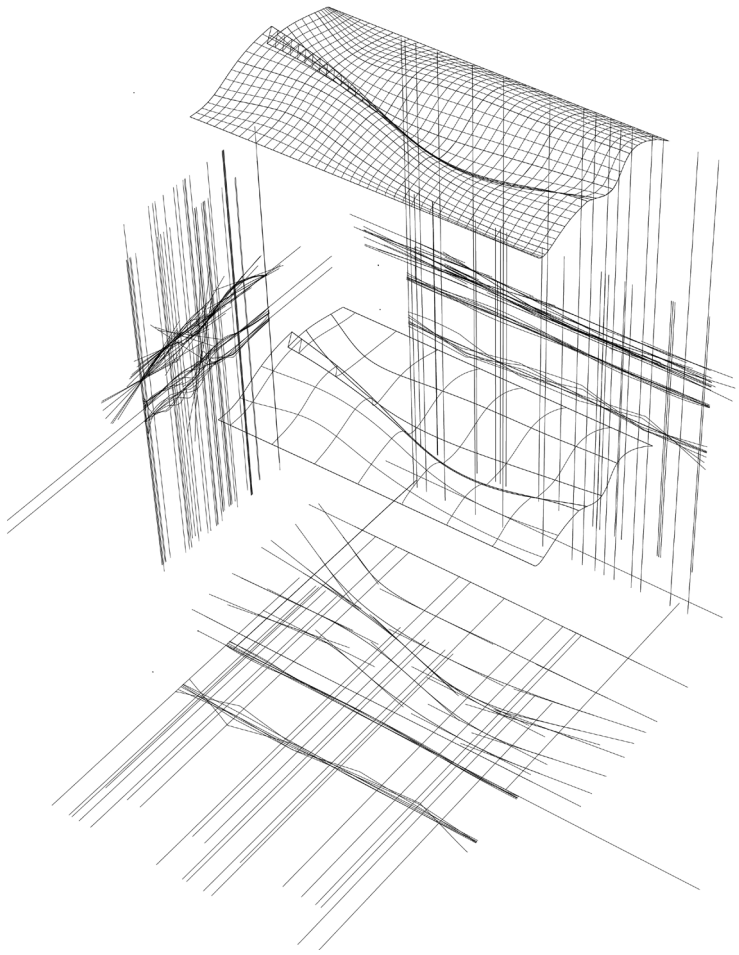
3
Readability and designability of the contemporary environment.

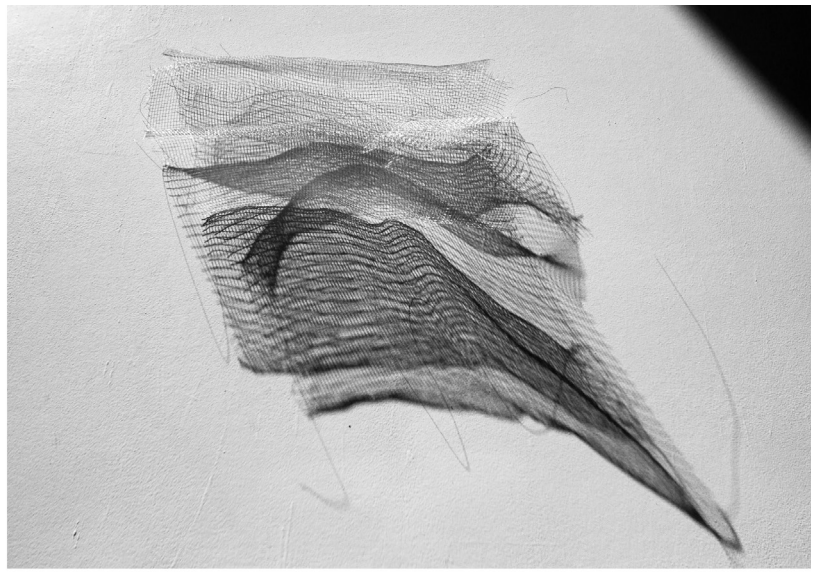
The chapter starts with the definition of a possible relationship between geometry, architecture and the city in the contemporary context characterized by the overlapping and coexistence of networks, urban fabrics and landscapes. The question addressed concerns the transition from an idea of homogeneous to heterogeneous space with specific regard to its readability (7).
The scale jump of the contemporary metropolis configures an overlap of structures still based on a perspective space and/or Cartesian grid with heterogeneous elements and patterns marked by different measures and characters. The territory and its scale acquire a fundamental role and the idea of modification combines typological and morphological aspects to ones related to the landscape dimension.
The reading of Gregotti (8) and Caniggia (9) is useful for linking the concept of typology, understood as the study of a decodable construction process with that

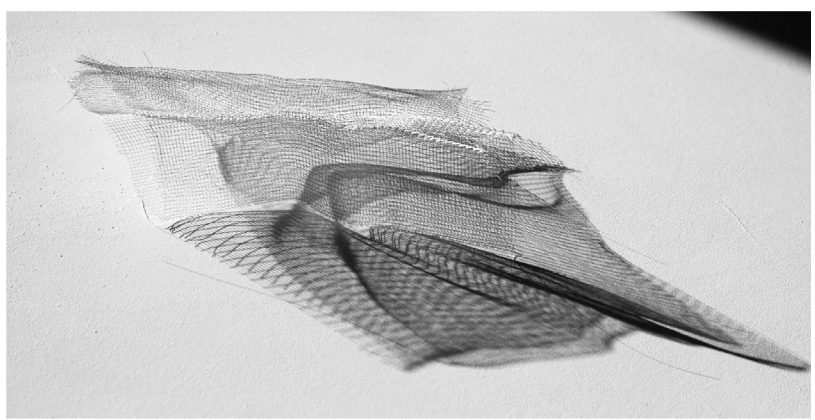
of the territory. But if we compare the measures related to the territory with those of the city, we note that they are not only of different sizes but they belong to different orders or groups.
We can, in fact, describe the measures relating to the city using discrete quantities in relation to each other, while when we refer to the territory it is useful to introduce quantities that refer to the concept of different intensity and infinitesimal variations. If in the Renaissance the codification of the measures of architecture, of its typologies and of the urban space could be based on the relationships of discrete measures, in the context of a heterogeneous space it seems necessary to update the instruments and the "machines" that can compare measures of different orders.
From this point of view, the artistic experimentations that, since the end of the 19th century, aimed at questioning the hierarchical spatial system defined by the rules of perspective, offer a useful hint for further reflections. Colin Rowe (10) highlights a mathematical continuity between Renaissance and Modern Movement, freeing the latter from a too direct bond to the relationship between form and function. However, he also defines a connection between the "painted" cubism and the architecture of transparency and the "coexistence" of overlapping window planes. The reflection approaches the relationship between tectonics and transparency starting from the work of Rem Koolhaas towards the search for different hierarchies that allow the readability of a "heterogeneous" space where the recovery of the (artificial) ground becomes essential.
What are, from a design angle, the "other hierarchies" and what are the techniques that help us manage them? What are the elements that make them readable and how are they combined? Gestalt offers help in defining some categories related to the concept of dynamism, of structural skeleton(11) and of equilibrium (balance) which, however, appears to be rather directly linked to Albertian harmony.
Stan Allen, shifting the focus from object to the field (12), whose recognizability may not be linked to closed geometries but to open systems (see the flock of birds) highlights the importance of algebra in spite of geometry in reading and interpretation of these systems. The chapter concludes with a reflection on the work of Boccioni and Kandisky (13) and his attempt to codify a shared formal grammar based on point, line and surface.

4
A method: touching the infinitesimal.
The considerations developed in the previous chapter extend the attention to the idea of process and, to the concept of dynamism always framed from a design perspective. In this sense, geometry is seen as a tool to describe the form and the mathematics that manages it is connected to the idea of code that permits its readability.
Deleuze (14), commenting on Pollock's work, highlights an idea of art as production, where the process of making acquires an expressive value and particular importance. He focuses on the translation/rotation of the pictorial plane, from vertical to horizontal. The "stepped on" plane is the surface, the "window" on which he projects his "world". It, therefore, acquires a tactile connotation where transparency becomes something that has to deal with the ground. The design by "layers", a conceptual extension of the Collage, using perhaps for the first time a metaphor derived from the digital world, fits into this context. In the early works of Koolhaas and Tschumi, the design by layer occurs as a compression/overlay into an essentially abstract horizontal plane of geometric structures that organize "unexpected scenes". Peter Eisenman develops a research aimed at giving three-dimensional thickness to the horizontal plane; he interprets the Layer as a trace, as an absence/void left by a metaphorical operation on the ground. This study is carried out in relation to the need to manage spatial complexities that overcome the line-to-point binomial by combining different figures, types, and processes. In the City of Culture of Santiago de Compostela (15) he reinterprets and hybridises figures and measures that refer to different spheres acquiring a particular role in the composition: the symbol, the historical city, the territory. In his diagrams, with the intent of moving to an architecture from figures/ground to ground/ground, he combines discrete measures and continuous entities; the typological research is therefore compared to the landscape characterized by continuous quantities and variations in intensity. What are the tools with which the relationships of these "inhomogeneous" entities can be controlled? Patrik Schumacher opposes to the concept of type the binomial genotype/phenotype (16), recalling from a parametric design lens the idea of code that instructs different manifestations adapted to specific physical/conceptual surroundings. What has been said poses a question concerning the landscape as a continuous inhabiting process that develops over time modifying it.
The design experiences discussed so far refer to conceptual operations such as vibration, overlap, hybridization: they are operations on forms that occur metaphorically in a conceptual and "virtual" realm. Gehry's work (17) is therefore analysed in an almost instrumental way: he poses the problem of the relationship between manual physical operation of manipulation of matter and its digital translation. The fold (18) in this sense is not just an image, a concept, but encloses and decodes in a digital space the memory of the act of folding. Such act, that in the physical model gives rigidity to an otherwise labile material, instructs the design development orienting its typological and technological characterizations.
How is it possible, how can we make this act a "code" that guides digital processes? How is it possible to describe the different intensities of topological surfaces in order to make them recognizable? To answer these questions, the concept of infinitesimal, of existing infinitesimally small quantities, becomes an essential concept. The second part of the chapter, therefore, proposes the use of analytical geometry, used through parametric tools that read and translate manual operations - curving, bending and cutting - in the digital space. These algorithms are tested on practical exercises with the idea of structuring a design process that starts from the sketch, from the model and reaches a digital elaboration that maintains the (reasoned) memory of the tactile manual operation as a feature that guides the technological and typological progress. The exercises propose a reading of complex shapes through curves that can be mathematically codified, projected onto a plane and therefore become legible on the screen.

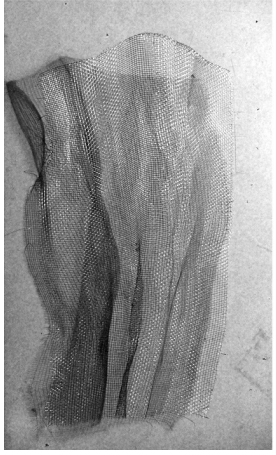
5
Conclusions: possible applications of a method in the contemporary space.
The conclusions of this path aim to expose the results of the study by proposing possible research developments with particular attention to the relationship between architecture and city, between the urban and the territorial scale. The method described in the previous chapter can, therefore, be developed on a larger scale: it would permit the regaining of the tactile dimension of the ground and of its anthropic modifications as codes within an algorithm that connects each other. It can be used to combine the signs that characterize the built environment at different scales by comparing the "local" measures with a larger, global dimension. It is therefore presented as a possible instrument capable of combining and hybridizing the topographical characters de-termined

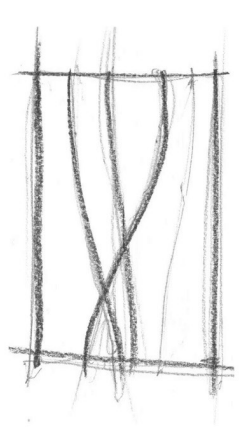






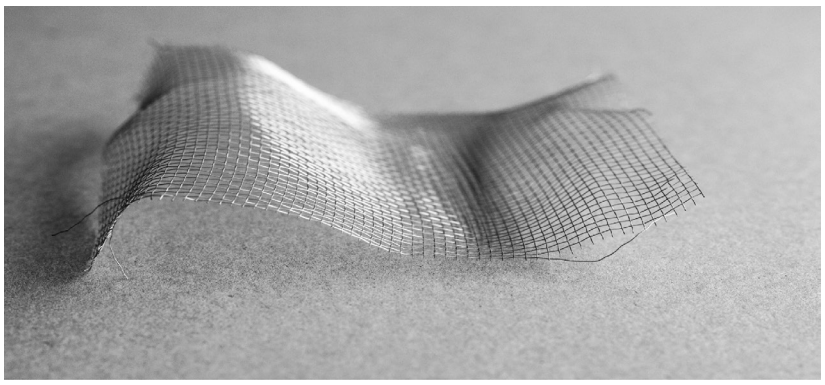
by natural agents, with anthropic transformations and with more abstract and mental visions characteristic of urban design. The possibility of developing this method appears to be particularly relevant when one looks at the rapid growth of contemporary metropolises where different actors, often “informal or spontaneous”(19), contribute to give shape to a built territory whose legibility is often difficult to decipher.
The identification of urban structures that link the different scales but find a clear reference in the natural characteristics of the ground can indicate a path towards sustainable development.
The research could be implemented with the parametric decoding of local typological characters as a mirror of a cultural way of living and modifying the ground.
Therefore, studies are approached to identify strategies for describing the territory and its characteristics in such a way that they can be parametrically decoded. In this manner, it is possible to extract the infinitesimal variation of intensities as a continuous mapping that establishes an “action-reaction” relationship between the local specificities and a larger framework.
The “codified” typological study can be used as an agent for modifying the ground and its sections in relation to specific “areas”. Digital-parametric design tools are therefore used in this context as a contemporary “machine” capable of making formal complexities that characterize the archi-tecture and the city making them readable and therefore modifiable. As once perspective, they bound a three-dimensional space with its projection-compression on a two-dimensional surface through the decoding of specific measures that can make it legible and therefore designable.
The appendix proposes an interesting design experiment developed as a Master thesis by Devin du Plessis in the School of Architecture, Planning and Geomatics of the University of Cape Town.

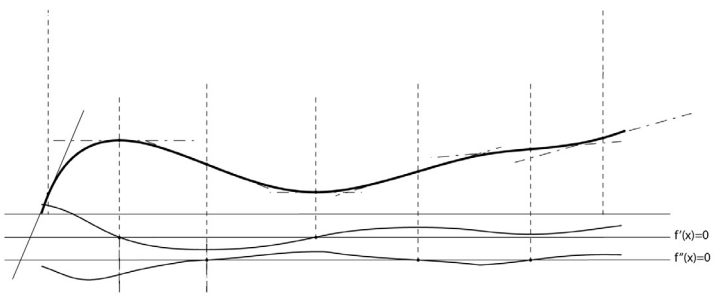


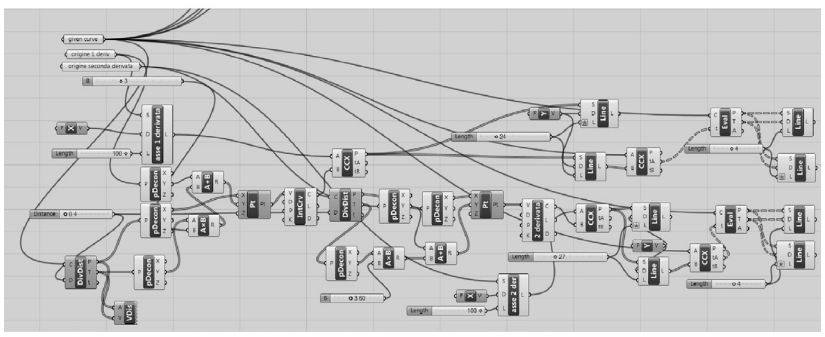


Della Nuova Società. Venice: Marsilio, 1979.
10 Rowe, Colin. *The Mathematics of the Ideal Villa, and Other Essays*. Cambridge, Mass.: MIT Press, 1976.
11 Arnheim, Rudolf. *Art and Visual Perception. A Psychology of the Creative Eye*. Berkeley and Los Angeles: University of California Press, 1974.
12 Allen, Stan. “From Object to Field.” AD, no. 67, *Architecture after Geometry* (1997): 24-31.
13 Kandinsky, Wassily. *Point and Line to Plane: Contribution to the Analysis of the Pictorial Elements.* Translated by Howard Dearstyne and Howard Dearstyne. New York: Solomon R. Guggenheim Foundation, 1947. Originally published as Punkt und Linie zu Fläche, 1926
14 Deleuze, Gilles. “The Diagram.” In *Francis Bacon: The Logic of Sensation,* 99-110. London: Continuum, 2001.
15 Eisenman, Peter. *Written into the Void: Selected Writings, 1990-2004*. New Haven: Yale University Press, 2007.
16 Schumacher, Patrik. “Parametricism as Style - Parametricist Manifesto (Presented and Discussed at the Dark Side Club1 , 11th Architecture Biennale, Venice 2008).” Accessed Dec., 8 2017. www.patrikschumacher.com/Texts/Parametricism%20as%20Style.htm.
17 cfr. Lindsey, Bruce. *Digital Gehry: Material Resistance/Digital Construction.* IT Revolution in Architecture. Basel: Birkhäuser, 2001; Sorkin, Michael. “Frozen Light.” In *Gehry Talks: Architecture + Process*, edited by Mildred S. Friedman and Michael Sorkin, New York: Universe Publishing, 2002; Dal Co, Francesco, Kurt W. Forster, and Arnold Soutter. *Frank O. Gehry: The Complete Works*. Milan: Electa Architecture, 2003.
18 Carpo, Mario. “Ten Years of Folding.” Architectural Design 63, no. 3/4 March/April *Folding in Architecture* (2004).
19 Gouverneur, David. *Planning and Design for Future Informal Settlements: Shaping the Self-Constructed City*. Abingdon: Routledge, Taylor & Francis Group, 2015.

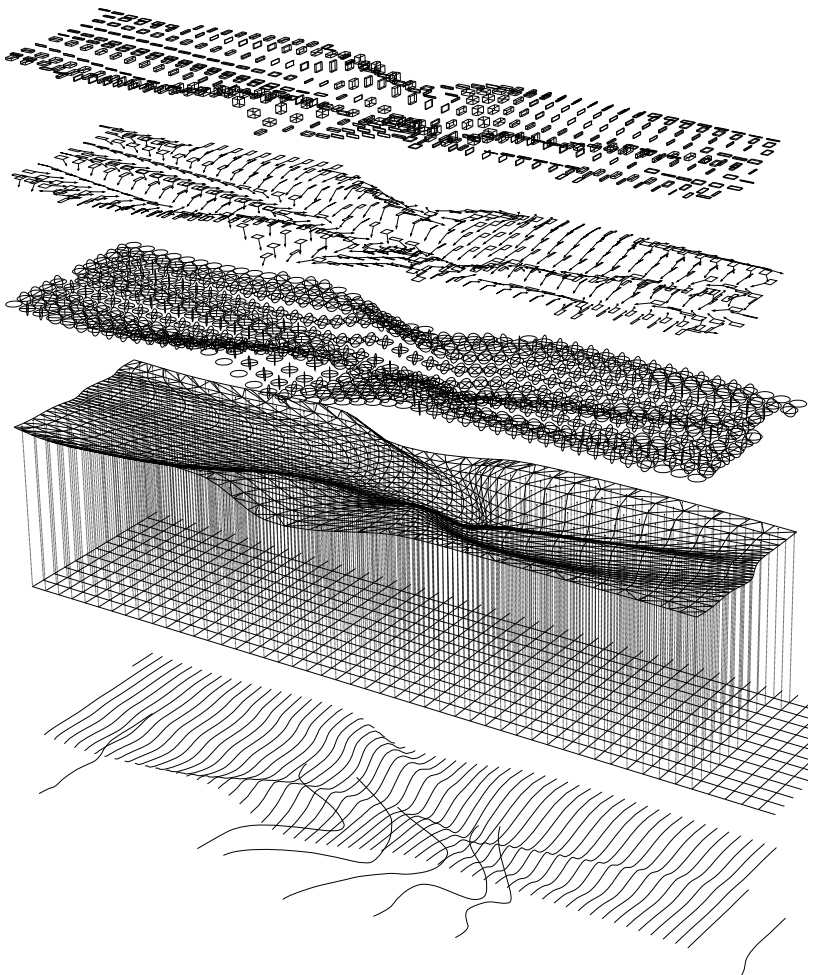
below
Possible geometrical interpretation and parametric analysis of the curvature of a “master” section of a folded aluminium wire mesh. The main section extracted from the mesh in terms of a sketch-curve is drawn and then analysed parametrically by means of its first and second derivatives that highlight meaningful points when they intersect their 0 horizontal axis.

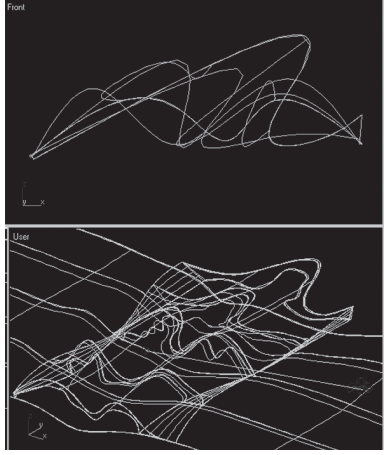




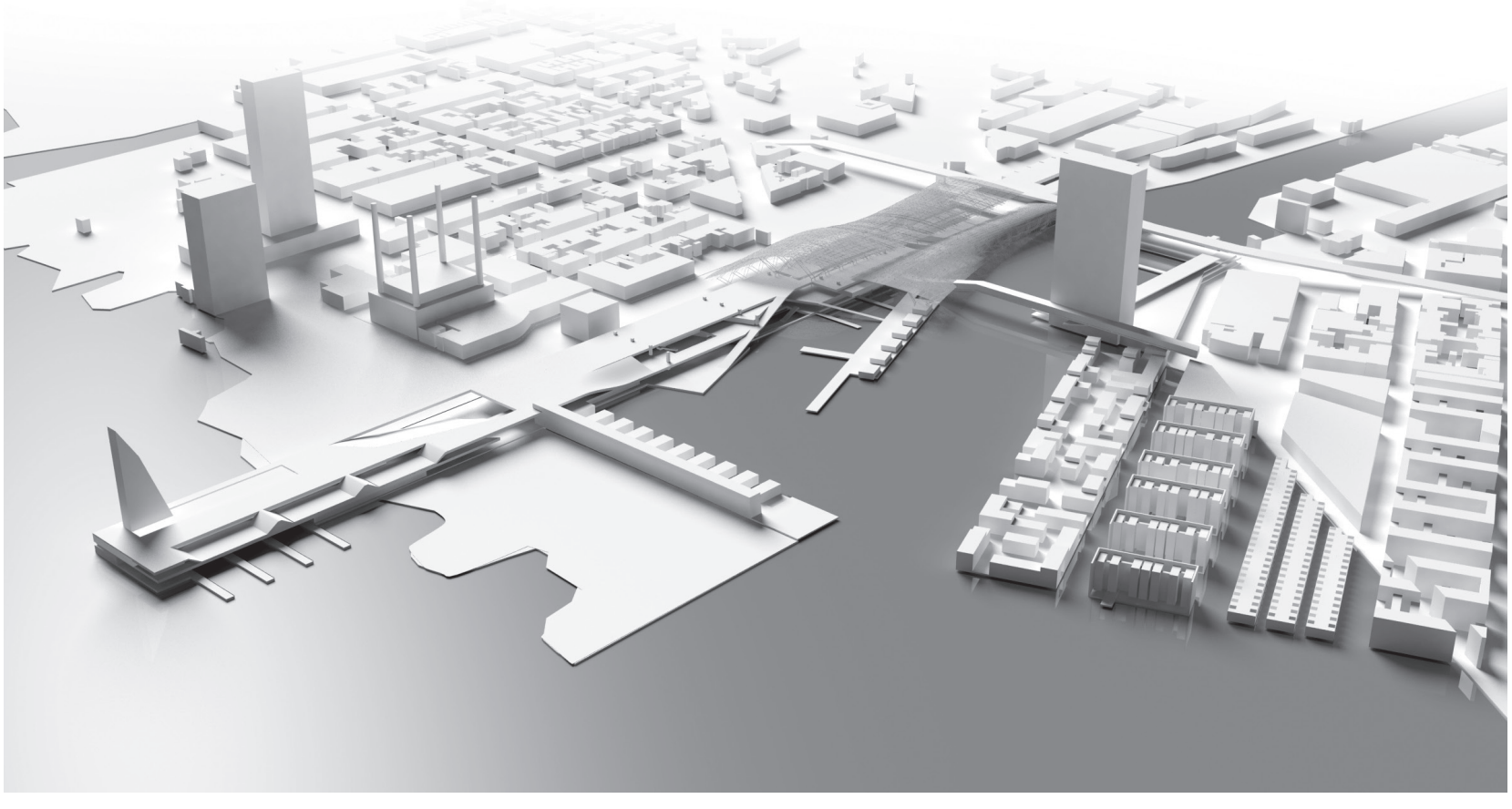


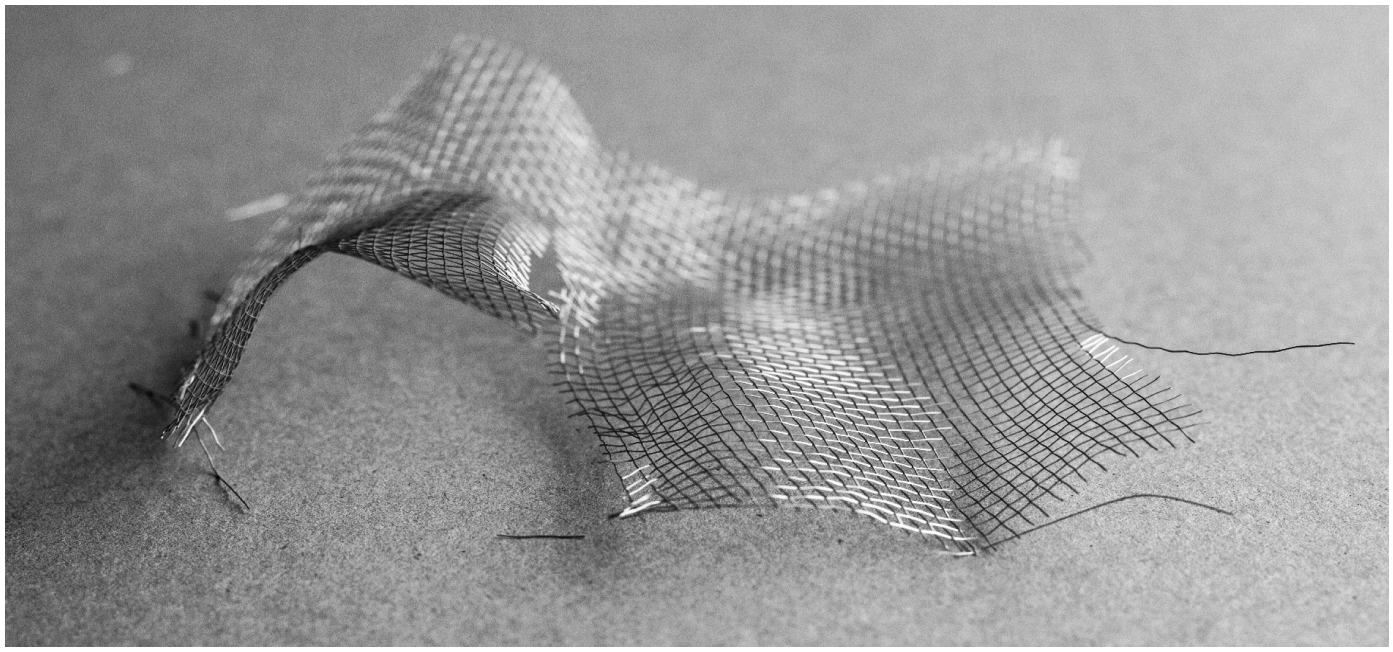
below
Parametric experiments between the grid and the fold. A regular grid has been overlaid on a complex surface; the points that define the grid have been projected to “touch” and meet the actual “z” coordinate, and to individuate the corresponding point on the surface. These points have been evaluated in terms of the numeric value of the local vertical and horizontal tangents. These values have been used to modify the scale and the rotation of a primitive box as local reaction, modification and adaptation of a “footprint” in relation to the infinitesimal local value of inclination.





Below: The grid in Manhattan represents a superimposition of an abstract geometry on an articulated geography; it is readable as a trace in its clashes with Broadway and as a void in Central Park, while in the other districts of New York the same structure appears more fragmented or rather more carefully adapted to geographical characters. In this specific case, the meeting point between Brooklyn and Queens sees different grids oriented in relationship to the coastline, marking a discontinuity where the artificial canal interrupts the ground continuity. The design proposal confronts the urban measures with the geographical dimension where the water represents the nodal element. From this standpoint, the project reinterprets the different dimensions of the two waterfronts - the more intimate and internal one on the canal and the more wide and open one on the East River. The project aimed to reactivate, as a set of interlaced public spaces, a threshold surface that during the industrial development became an essential factor for the productive sector, and that had almost excluded different uses. The meeting/ clash between the two grids is absorbed by a series of curves that adopt the different alignments as asymptotes and define the profile of a landmark that represents the local complexity of the place at a large scale.





Architectural writing

Ernesto d'Alfonso

1st Part.

The text by prof. Fraschini deals about architecture as writing. Building, in fact for architecture (as a symbolic form) is, first of all this: a "foundation" that can be considered "inscription" on the ground, according to the analogical metaphor with the inscription of letters on the stone, earthenware or parchment.

To this work of inscription, nature, which obviously pre-exists the inscription / foundation, essentially concurs as ground and character of a site. The ancient term substance could be used to understand this mutual contribution.

Today the term is obsolete due to the idea of an actual identity of the below and the above space. In fact, they are both non-inert but dynamic due to an internal energy that subatomic physics can see active everywhere and that is independent of the somatic states of tectonics or transparency.
For the human experience of living, substance and transparency are two essential states of nature for the existence of the living, mineral, vegetable, animal world. Nor can they be removed.

Therefore, without denying the existence of phenomena inaccessible to human capacities (which we will therefore call ultra-human) we will say that substance and transparency are existential and unavoidable notions in relation to the world in which man lives. Nor does the reality of ultra-human phenomena have the power to remove or alter them.

I would add, however, that the products that "control" ultra-human phenomena are available to everyone. The telephone is proof of this: today it is a real computer that we have in our hands, we use it on every occasion and it works through the control of electro-telematic phenomena.

Finally, technology makes the most remote phenomena accessible to the somatic and "natural" experience of men. It is an evidence that what we discover (through sophisticated tools) about the invisible and intangible reality of the world belongs to nature. Therefore substance and transparency maintain a full validity for the somatic existence. From a somatic point of view the world for man and man for the world have not changed condition.

There is no thought without a body; there is no body without a world that feeds it while supporting it. So I go back to the concept of inhabiting and constructing. If I consider these terms in the field of architecture as a symbolic form (and beyond the natural condition of existence), I verify that they cannot be assimilated to language.

And yet if we consider the sign system which, as De Saussure says, qualifies every communication of thought, we use metaphors drawn from verbal language such as reading and writing.

If I can't reject the metaphor, I'll talk first about reading and then writing. It's about reading things. Not words. For architecture the built work, the "artifact" is the text to be read. Reading, therefore, coincides with perceiving the context while exploring the site (which is exemplary for the whole world habitable by men). But perceiving is not reading; perceiving is not even just seeing. Before using my eyes and to be able to use them, I must have learned to feel my body as an actor.

Indeed, to see the world as a sequence of views, I must have learned to feel the body, especially as it moves.
I must have learned to stand and walk. Otherwise, I cannot discern the thing between things, direct the step towards it, take it in my hands, observe it closely and work on it. Nature provides the site and the two circumstances: the next and the remote one.

The way of bringing together in an integrated system the site -ground- and the circumstances is a "fact", an "artifact".This applies both to the wooden totem or the stone menhir; it is valid for this archetypal sign, for the supporting or founding base on the ground and for the elevation that intercepts the horizon/skyline.

The relationship between base, elevation and the intercepted - immeasurably distant - horizon / skyline is between opposed conditions.
The balance of this element is achieved through a work of foundation and elevation. However, it refers to an invisible phenomenon: the interior of the ground and the interior of the elevated element.

The relationship between the ground and the element is interpreted by the mind as an interplay of reciprocal forces: weight and reactive support.
Once the pole or stele is raised, it appears as a thing between things and is exposed to vision.

But vision does not see the space between but the surface of things.
The eye sees these surfaces until it stops on the line that defines the boundary between the undefined transparency of the sky and the ground.The invisible is therefore characterized by different modes. The first is below the surface of the ground on which things stand; it concerns the relationship between weight and support. The second is above the ground and concerns the relationship between the eye and the surface of things.

I talked about the totem, but antiquity produced more abstract and complex syntheses: the Greek temple, the Roman Basilica / Nymphaeum. I will highlight how elevation, in each cases, replaces the totem and will underline the extreme difference between the two syntheses. The first is an extreme evolution of the wisdom of the Stone Age.The second is an extreme evolution of the knowledge of the earth. It is the science of the transition from liquid to solid material of specific soils.

The Greek one has in the exposition the fulcrum of the systematic composition/ arrangement of the structure. The modeling of the surface exposed to the sun is what matters. Statically speaking, the support counts.

In the Roman one instead, the fulcrum of the composition is the internal change of state, from liquid to solid. The relationship with the context, with the skyline / horizon is not as important. It is rather the relationship between those who

inhabit and the walls that define that closed space. The problem, therefore, was to make holes for the light to enter not only on the vertical walls, but also from the roof. The Pantheon is the most evident example of the specificity of Roman architecture: the dome is conceived as cantilevered arched beam that protrudes from the walls and leaves an hole above. This void is intentional, not necessary. An arc imposted on the edges of the wall could have been continuous and close the dome without affecting the static. This is the case of many circular Nymphaea . The hole brings light inside. The Renaissance dome will replace that void with the “roof lantern”, which, as the word itself says, concludes the shelter with an hollow construction to illuminate the space below.
Therefore, in the classical age three construction organization systems have been defined. They constitute three structures of synthetic organization of the space and time somatic construction.

The three a-priori terms, integrated into a space-time-framework are intuited as adaequatio rei et intellectus, - between mind and somatic experience were:
- the wooden totem or the stone menhir,
- the Greek canon of the exhibition,
- the arched wall structure, which is followed by the vaulted wall and by the rib vault/dome. The latter is taken to the extreme, in Hagia Sophia, and defines the relationship between the internal complexity and light from above.

The latter is the admired and studied structure throughout the Middle Ages.
Perhaps each of these is a paradigmatic system that implies and revolutionizes the previous one.

The geometric-mathematical redefinition of figures and shapes: point, line, surface, volume. It constitutes the first conscious and intentional epistemological revolution in the system of sign structuring: the birth of design.
It is of primary importance to emphasize that drawing (disegno) is an extreme abstraction that translate forms into measured geometries or algorithms. Matteo explains it properly in chapter nr. 4.

As such it is an essential step to abstract the “substance”. In fact, instead of world and nature that refer to matter, the key-word used to describe the reality of the world is space (therefore ideal). And space is a geometric-mathematical algorithm. Science. And science will use this space paradigm as the basis for the equations of celestial mechanics that describe the planetary motion and any “spaceship” that is shot in the sky and orbits around planets.

Obviously for Matteo the spatial algorithm is framed according to architectural design where, digital modeling and design tools play a fundamental role.
His arguments, therefore, fit into at least two paradigms that structure architecture as a symbolic form: the invention of design and the management of the most sophisticated algorithms that describe NURBS curves.

This does not mean that previous scientific achievements can be neglected. Only, they are no longer exhaustive, they are worth upstream and together.
Going back to drawing (disegno), which is not writing of words two aspects must be reported:
- the sheet is not a material entity, It’s conceptual, it can be described by the algorithm $\infty = 0$. The matter remains as the surface that receives the signs.
- the marks on the surface are signs in the depth and each sign indicates a trajectory that can be enunciated in an equation.

The “reading” of the design, for the architectural discipline, is not just “perceiving” understood as “seeing”, but circonspicere, (looking at something while walking around it). Each point is before or after the previous and the next, as the step while I walk turning and aiming my head and torso.
The drawing cannot be read only in relation to the vision. Without tactility, seeing has no somaticity. In other words, in architecture, tactility is privileged over vision.

This fact counts in the design that seems to have lost interest in tactility. It is rather a problem of Ghestalt psychology. For the infinitesimal calculus that “measures” the trajectories in space, the algorithm is necessary because it is artificial, abstract and mental.

The issue is not to demonstrate the artificiality of perspective, which is an obviousness. The problem is not even to remove the intellectual synthesis that elaborates in equations the functions of space and time. Perhaps nature does not need men to exist, perhaps. Men need to elaborate mental notions of nature and verify them. They need to build the notions of space and time as an inextricable synergy.
Men cannot exist without doing. Backwards there is only self-extinction which is one of the extreme evils of modernity. The algorithm that gives form to an equation allows you to touch the form at any point and to define alignments or modeling curves.
What Panofsky says, that perspective is a symbolic form, is true. What needs to be added is that once the notion is conceived and the technique elaborated, it cannot be neglected.
Calling into question perception and tactility, what emerges is the substance of construction that is irreducible to vision (and to hearing).
Then the writing, for the architect, concerns the rules of construction, so that his work can be explored and inhabited. These rules are many and varied. The architect needs Multas et varias artes for his synthesis. Vitruvius names and summarizes them in the six categories of ex quibus rebus architectura constet.
The first pair of rules concerns balance. It concerns the way in which the body is held together to stand erect on a point (the Leonardo’s circle).
Around this point the body is set to orient itself towards opposite directions (the Leonardo’s square).
The second pair concerns measure, modular proportions of parts with respect to the whole and rhythm in the sequence. The third concerns the anthropological-social state, the ownership of places with respect to a convenient and recognized “habitus”.
These rules are rethought by Alberti as a new grammar and syntax (concinnitas di numerus, finitio, conlocatio) once the drawing was invented.
On this subject, which is the main theme of Fraschini’s book, I said what I wanted to say.

2nd Part.
What has changed in the relationship between citizens and the world? How does this new relationship motivate the mutation of contemporary architectural design with regard to the past? The central problem, today, is about time.

If the field of action is extended to the whole world, the integration of the sequence into coexistence cannot be described and confined to a material field that is infinite and infinitesimal. What matters now is time.

If the traditional classical problem was the contradiction between coexistence and succession, the current one is between simultaneity and diachrony in a telematics context. We are in fact in simultaneous communication with anyone, near or far; the physical encounter, however, requires the diachrony of journeys made with different speed vehicles.

In this context the current concept of urban scale is framed. Given this fact, each site is in a communication / location relationship with many other sites, depending on the type of digital infrastructure that reciprocally connects the different sites. This fact makes of each “neighborhood” a “multi-scalar” site.
The site preliminarily belongs to different scales fields of action that include the somatic one.

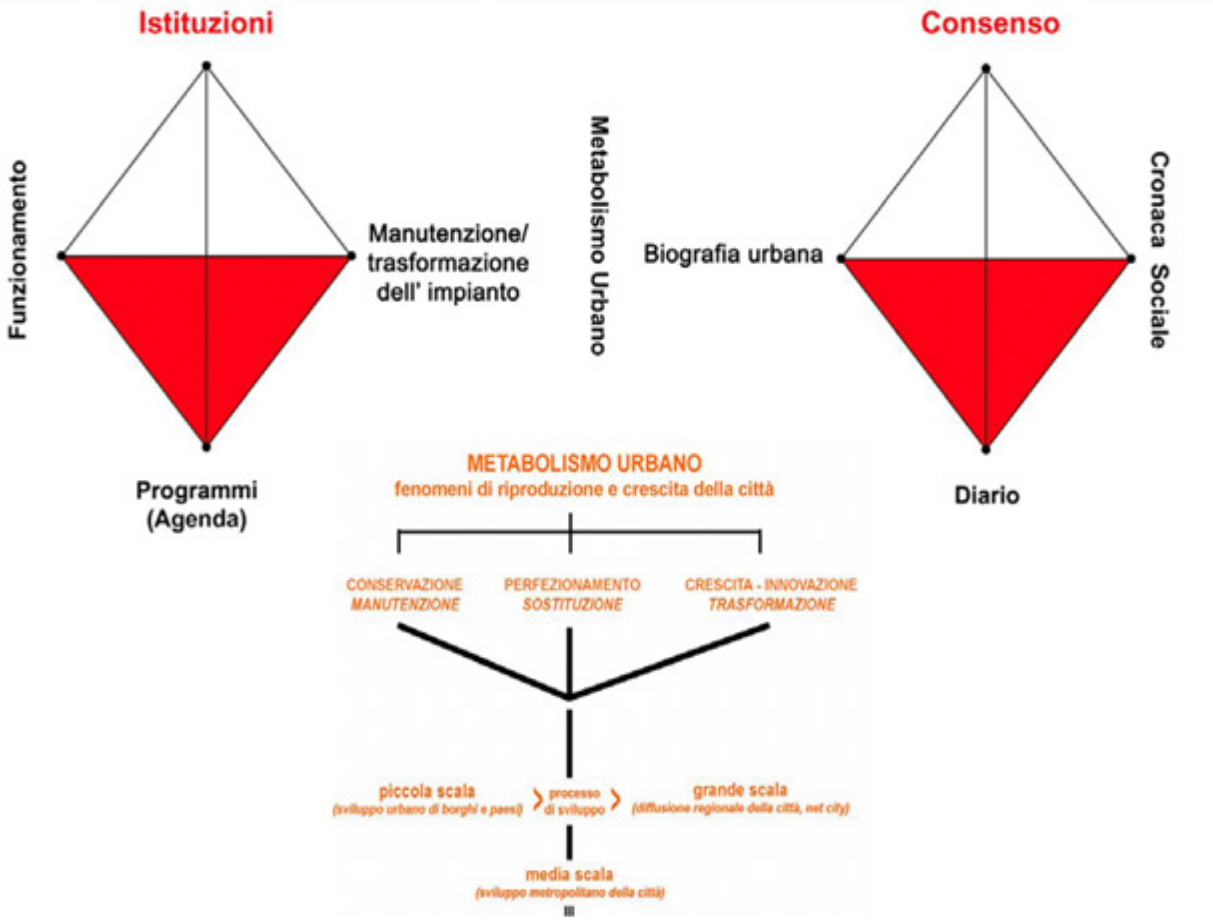
At the same time, it belongs to comprehensive global fields of action thanks to smartphones that in addition to connecting distant people also function as real computers.

The fact that we are somatically rooted in a “here and now”, but in communication with any site, means that we can be “here and now” everywhere else.
This fact is perceived by anyone (living both in the city and in the countryside) in relation to himself and to the particular desire to act in the topographical / geographical time-space.

The perception of oneself in the world and of the geographical world for the self has therefore changed:
1. In the “unprejudiced” use of the “inner self” and of the body.
2. In the new way of conceiving geography and planning its exploration.
3. In the spectacularization of everyday life.
4. In the unprecedented confrontation between different lifestyles and knowledge / communication.

These changes in self-perception can be conceived in a particular type of city.
The urban space is equipped to be simultaneously and continuously in contact, through the Web, with all the sites where a screen is on. Therefore the device in front of which we are sitting is in telematic proximity with every other connected device. A real distance corresponds to this cancellation of the space-time distance. The two screens can be contiguous or extremely far one each other.

Therefore the metric or spatial measure has not lost its value. However, the concept of distance is no longer limited to the walking pace but there is a multitude of



"vehicular prostheses" with different speeds: roads, rails, oceans, air.
Depending on the medium and the conditions of the network on which we move, the same distance is traveled in a longer or shorter time.
The distance, therefore, is measured rather in hours, minutes, seconds, and not in meters and kilometers.

The concept of temporal equivalence between different distances in relation to different vehicular prostheses is a consequence of this change. Memory and imagination must interpenetrate to control this fact.

The "intensified" virtual presence overlaps with the "here and now" one. Daily time is "spectacular", while the virtual presence is distributed in a multitude of equally virtual places. The particular synergy between memory and imagination gives us an experience of geography quite different from that of the past.
If then proximity was the essential condition for the construction of the mental map, today it is no longer so.

This does not mean that the world has lost the character of continuity, but that this character has become relative to the somatic experience of the fields of action. The whole earth thus becomes the place for a "virtual meeting" in real time that allows a programmable personal exploration.

This fact determines a radical mutation of the relationship between the inner self and the self that imagines the action. The new relationship between the existential "self" that guides action, the localized room and the globality of the world, is the epochal revolution of modernity. It is obvious that the structure and management of the city's spatial organization must change.

This relationship can then be summarized as that between human biography and urban biography. As an architect, this geographical dimension is the most important theme of globalization in relation to the local context that still builds "practicable fields to inhabit". It calls for a reflection on the theme "building-living". Beyond Heidegger's theses.

The nocturnal satellite photography of Europe, exposes the constellations of lights as a concentration of urban settlements: each point condenses thousands, hundreds of thousands, millions of devices working on the same network. It is the peculiar feature of the real-time telematic network: each device is immediately connected with all the others in a single city. Everyone can instantly communicate without intermediation with everyone. This determines the absolute primacy of cities.

Every bright spot (settlement) can give rise to a flow of people to any other bright spot / settlement. However, these flows can occur if there are multiple intercontinental transport networks: air, high-speed railways, highways, sea and, in the future, satellite. The global intercontinental transport network connects directly to the more local one: subways, trams and buses (BRT).

Telematic networks ensure a real-time audio and video connection anywhere in the world. But people move using vehicles. They are urban prostheses that preserve the human body while traveling at a specific speed-time standard from one station to another.

Metropolitan space is therefore concretely practiced only in the situationist way described in Naked City, by Guy Deborde. Local maps are disjoint (also from a somatic point of view) and reconnected through transport networks that measure their temporal distance.

In the "Between" the scale 1: 1 is not cancelled; this space is rather equipped with infrastructures characterized by different standard speeds. From this concept derives that of equivalent temporal proximity. In this scenario, three types of approach can be considered on a metropolitan territory:

- The small scale, that of the residence and the neighborhood. It is difficult to plan in a rigid way and is often described as sprawl.
- The large scale, that of the material and immaterial networks. They are organized and planned rigidly by public administrations.
- Station nodes between networks. They therefore have the role of "urban condensers of functions". They have a multi-scale character due the large amount of people that use the networks and converge to the pole of intersection. They are typologies in continuous evolution and with a variable complexity of functions.

These require to be studied from the point of view of the functional program and of the distributive, compositional and formal configuration. Their image must be able to impress itself in the imaginative memory of the users that could choose it as a node of their temporal programs.

The marking of a territory and its reasons, therefore, change radically. In a sense, the existing marking of places becomes obsolete. This is true in particular for the ancient intercontinental lines where the terrestrial paths were in direct relation to the sea routes.

This system described an intercontinental continuity.
Take for example the line / route Istanbul, Ravenna, Milan. In the latter was the junction that led on one side towards Paris and London and on the other towards the Rhine valley.

This type of lines interfered and collaborated with topographical characters and

the river basin system. They - at the 1: 1 scale - constituted the main lines for the construction of the mental map. They were first used for the migration of peoples, later for communications and exchanges.

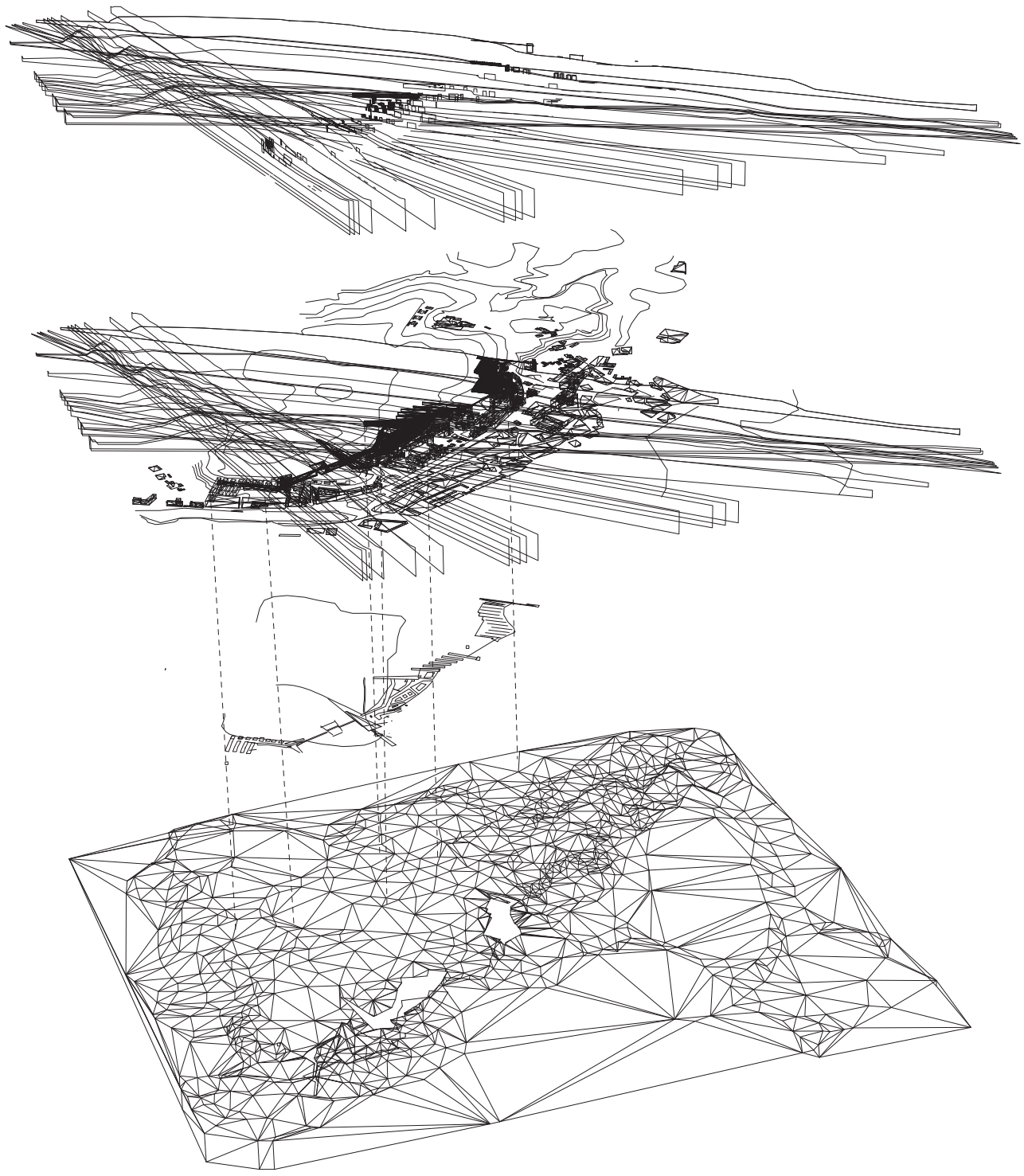
More recently these lines have connected specific productions of the different regions. It seems that the online / air transport relationship determines the greatest push to transform territorial marks.

The traditional local territorial mark in scale 1: 1 was determined by the following factors: position, body orientation and direction of travel related to the configuration of river basins. This marks have not lost value. The more the global scale grows, the more the 1: 1 scale becomes important. The two scales are intertwined: it is possible to look at the first from the point of view of the second and vice versa.

We still live in a local context. The term “global “ indicates only the multiple proximity that each place can define with distant places. (fig. 5) Therefore the “spatial” measures expressed in meters or Kilometers, although not disappeared, have less concrete meaning in the new concept of proximity. And they are involved in temporal measures.

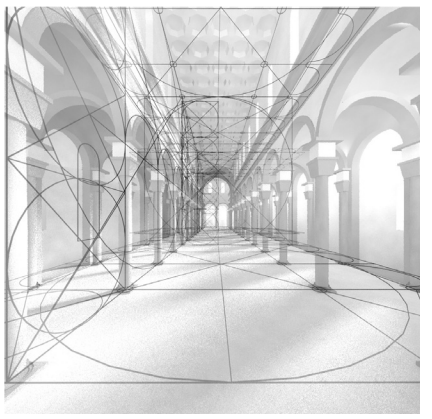
From a local “here/now”, the temporal/spatial relationship is measured with all the other “here/now” of the globality which are constituted by as many local contexts. This also applies to those contexts that have no history whatsoever.
It is therefore obvious that any local point is a virtual relationship with globality. This relationship acquires a somatic (and not only virtual) characterization only in the poles of the multi-scale and multi-network stations.

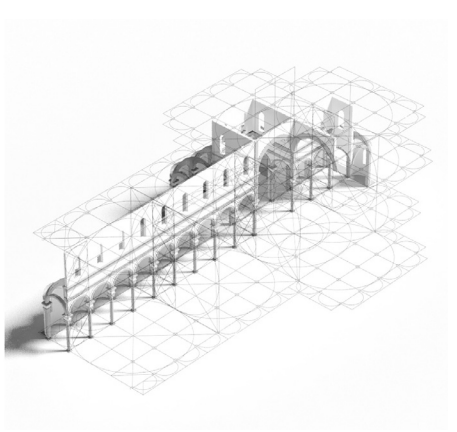
These are the points to be studied to understand the concrete space-time complexity of modernity. Again I said what I had to do. I stress the fact that the book by prof. Matteo Fraschini is aimed at design and therefore at the theoretical-practical study of this problem in the concrete cases that can be met. Like the one in Capetown of the district-six.



The book focuses on contemporary design techniques framed in a theoretical background. It does not have a historical approach and yet it begins with the Renaissance. Why this choice?

There are many hints that the Renaissance offers to the contemporary world: for this reason, it's intriguing. Perhaps because it defines the modern image of the architect, between the foreman who wants to go beyond a material problem and a person of "culture" who wants to get his hands dirty. Perhaps also because it develops an artistic process based on abstract formal rules that derive from a theory of space which is disconnected from material production.
Through these rules the personal sensitivity of an artist becomes a design and therefore communicable. The book deals with the importance of drawing as a design tool, of the relationship between space and its projection on a two-dimensional surface. This operation cannot just be a mechanical translation between the three-dimensional world and a flat surface.
The Renaissance allows architects and architectural scholars to reflect on the "nature" of the world. This reflection is not necessarily connected to a specific temporal / historical location. It allows to put in the ideal communication the technique of a knowledge - between 300 and 400 - with the classical one introducing a science of space that dialogues with the contemporary world.
For this reason, in the construction of the book, the relationship between space and form is particularly important. Because on it is based the design-





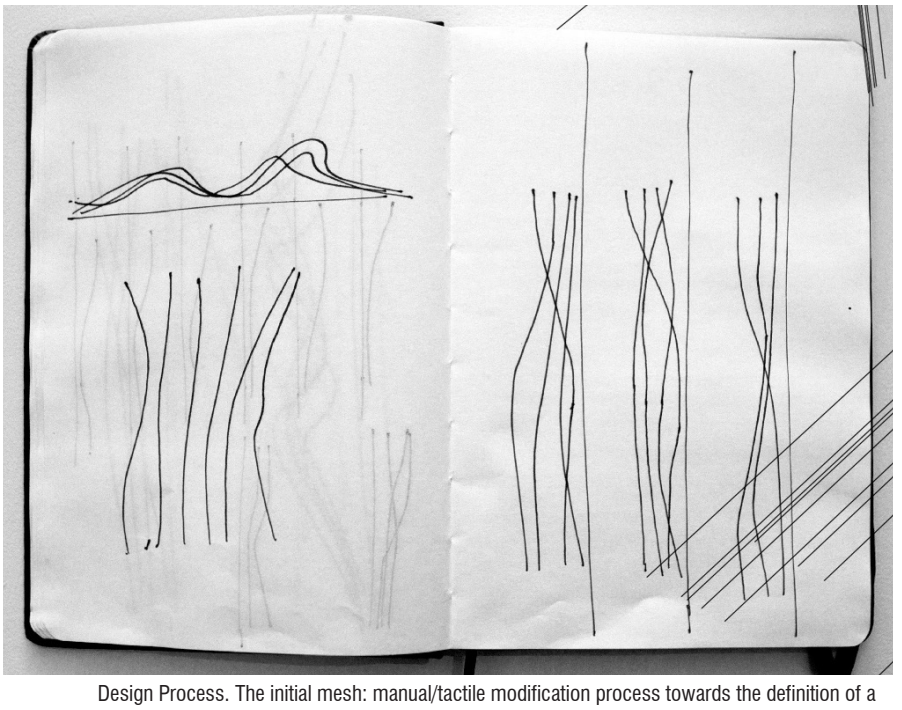
disegno that is the condition of representation/rojection of three-dimensional shapes, on a two-dimensional surface.
When Brunelleschi builds his "machine to see", the system of mirrors that project on a flat surface the Florence Baptistery, he has essentially a practical problem.
He is not a painter. His purpose is not to represent a three-dimensional space on a surface. It is rather to verify the constancy of the deformation and to extract the real measure from what it sees in "perspective". Mirrors are rather the means. The end is to measure a space to understand it, make it editable and therefore designable. His need is essentially technical. This problem is solved by finding a two-way relationship between the three-dimensional and the two-dimensional, between space and its compression on a flat surface. Gehry will have a similar problem, many centuries later when he too will have to measure and translate a manually modeled surface into a virtual space projected on a screen. He too will build his "machine" to make this translation.

Are therefore, Brunelleschi and Alberti as discoverers/inventors of an abstract space made of geometric mathematical shapes ancestors of today's architects?

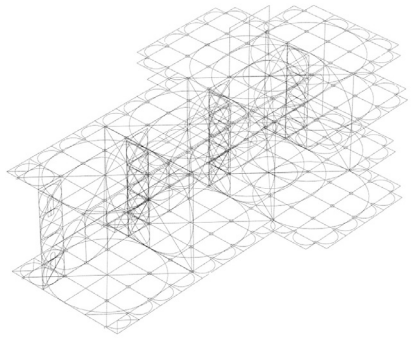
Yes, because they define the tools of architectural design, they invent two-dimensional design and find a way to define and measure infinity and infinitesimal. I find it interesting that the rules of perspective are defined through the dialogue of two distant approaches. The first, essentially empirical, that of Brunelleschi, is based on observation while the second, developed by Alberti, is based on a rational, almost abstract study of projection. The result is a sort of synthesis.
The book underlines the importance of perspective as a technical problem that has substantially influenced the way of thinking of an entire civilization. In the Churches of San Lorenzo and Santo Spirito, Brunelleschi, through the definition of a module/column, builds a space on a base of a cubic three-dimensional grid. The module and its sub-multiples organize the plan and section; he defines a formal rule, a sort of "password" code. Knowing this (the cube) it is possible to define and decode the one-to-one relationship between space (perspective) and its plane projections. Not only is it possible to represent a three-dimensional space starting from its flat projections; if I know the "password" and look at that three-dimensional space I can measure it and draw the plan and the section.
This aspect of the Renaissance is particularly important for contemporary design: the invention of drawing as a tool to decode, on a flat surface, the complexity of a three-dimensional space. At least this is the reason why the Renaissance has particular importance in the text.
How is it possible today to "mentally" measure a complex space/form in order to modify it, make it knowable from a design point of view? In this framework mathematics as a tool for controlling geometry plays a fundamental role. The discovery of perspective has also meant the visual representation of the infinite and of the infinitesimal, concepts, as Panofsky points out, absolutely alien to the sensible world, that is, precisely, abstract. This research emphasizes the essentially tactile value of the plan-stage and visual of the scene/section.

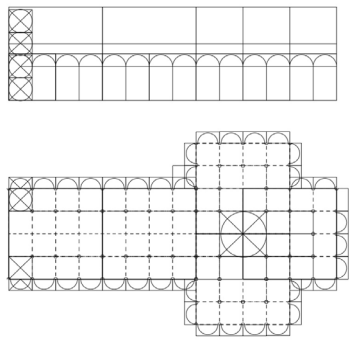
If Panofsky is an author who addresses the question of the limits of Renaissance space, what role does modern art have in the book?

Between the end of the nineteenth century and the beginning of the twentieth century, the artistic avant-gardes put into question, among other things, the concept of an immovable and immutable space. I have therefore tried to re-read, in a technical and almost instrumental way, some artistic experiences of those years to try to understand how some artists have represented the concept of movement in a static and immobile work of art. Boccioni's work



Design Process. The initial mesh: manual/tactile modification process towards the definition of a diagrammatic sketch; Sketches: first step towards the definition of the characters of a form through its geometrical layout; From three-dimensional to two-dimensional: analysis and modification of initial lines through their planar two-dimensional interrelated projections capable of highlighting the reciprocal and simultaneous trend of specific points (maxima, minima, flexes) and their first and second derivatives.

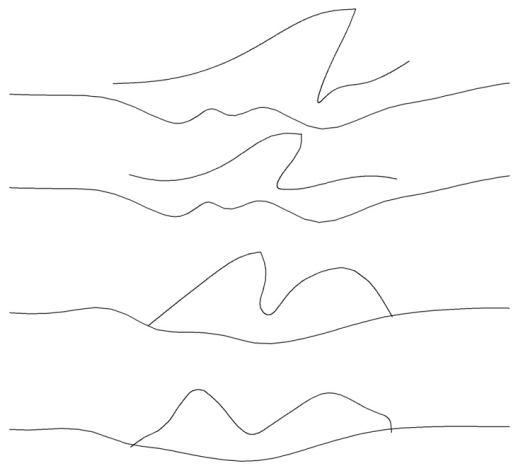


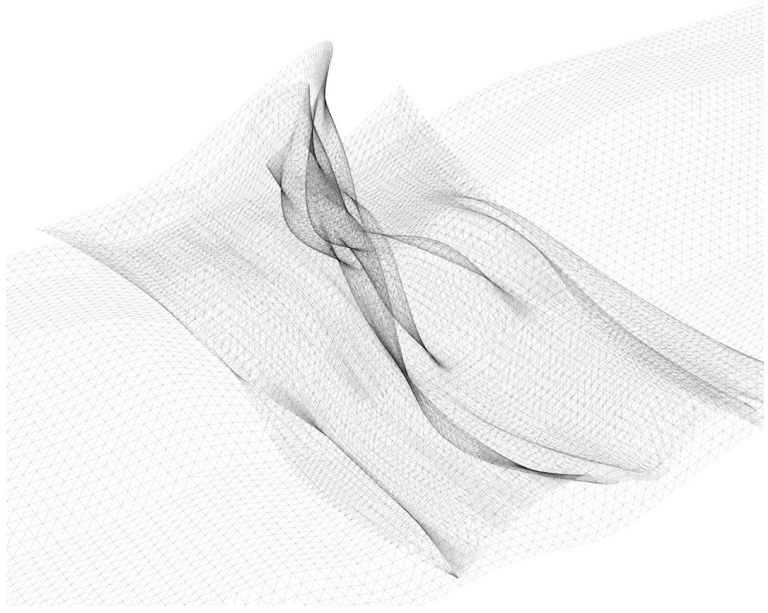


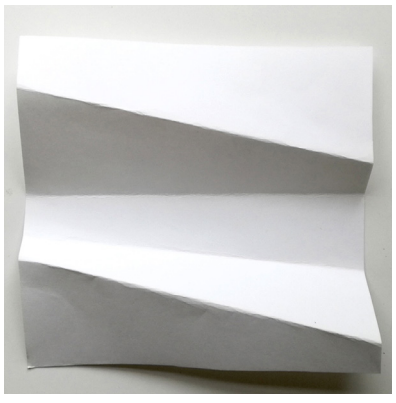
and his Technical Manifesto of Futurist Sculpture (1912) were particularly important as well as Kandinsky's Point and Line to Plane (1926). The latter tries to define a shared "grammar" for the "new art". The line is, therefore, a trace of a point, infinitely small that moves driven by force-vectors.
If the force is only one the line will be a straight segment; if the vectors are more than one and applied to the point in successive and consequent times-frames, there will be a polygonal chain. If the forces are simultaneously applied but vary over time the trace of the point will be a series of curves. The applied vectors-forces and their infinitesimal variations are the elements that characterize and make the curve recognizable. In this regard, Arnheim in Art and Visual Perception (1954) "updates" the classical idea of harmony through the physical concept of balance-equilibrium.
In fact, the composition will have its balance-harmony when the vectorial sum of the forces that determine the trace left by the moving point on the surface will be zero. Also Gehry will interpret the curves as traces of points moved by vectors of different intensity and direction.
One project in particular, that of a single-family residence, Casa Telluride, unbuilt, has always interested me.
I have often used it in theory courses to explain the relationship between images and ideas that inspire the project and the methods to translate "the concept" into habitable three-dimensional forms. To explain the project, the Canadian architect makes specific reference to the Nu descendant an escalier n ° 2 by Marcel Duchamp (1912).
In the personal interpretation I give of that project I describe Gehry's interest in Duchamp as instrumental. The project area is inclined: therefore the Nu descendant an escalier is pertinent to the image of a descending body. From that composition Gehry draws the idea of the juxtaposition of some stones on an inclined plane. These stones are homologous figures, not identical to each other. I can recognize them as similar because of their similar size, color and material. In this way he constructs a study model in which forms are recognizable as frames of the same figure that is rotated and translated along an inclined surface.
Gehry therefore "uses" a work that does not belong to the post-Renaissance, or Cubist, but Futurist tradition. This and the effort to translate pictorial figuration into architectural form was particularly interesting for me. Maybe it's just my personal interpretation, but I think the Canadian architect wanted to understand how Duschamp represented and "crystallized" the motion in a figure. He, therefore, develops the project using sketches and folded cardboard models until he builds the one which is suitable for the "translation" into a virtual-vector space.
In this way it transforms the "vibrations" of the Nude (and therefore the translations-rotations of the stones) into folds in the paper. Such folds are reflected in the digital model as a memory of manual operations on materials that oppose a specific resistance. However, the virtual model can be seen but not touched and does not necessarily imply the definition of an "architectural" space.
Today, through three-dimensional printers, I can produce a physical model of what I modeled in a virtual space. However, this operation excludes the simultaneity between the modeling process (tactile) and the possibility of seeing the effect of this operation in real time.

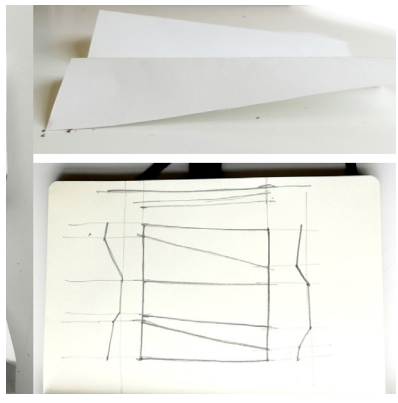
The relationship between the paper and the digital model introduces us to the use of modeling programs. Your approach is, nevertheless, autonomous from that of Gehry. Can you briefly talk about it?

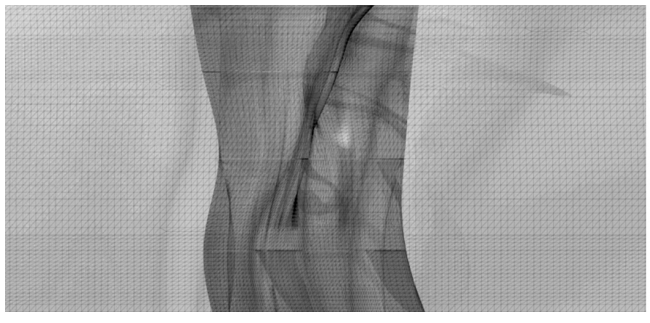
The interest in the relationship between drawings, physical and virtual models, started at the Milan Polytechnic University when, during the years of the doctorate, I helped the students of the Masters in Architectural Design in the development of their dissertations. The starting point was the modeling of wire meshes.
Many authors from the late 1980s dealt with the concept of folding essentially from a theoretical point of view. Even for us, the fold was important, but we wanted to deepen the technical implications related to the act of folding.

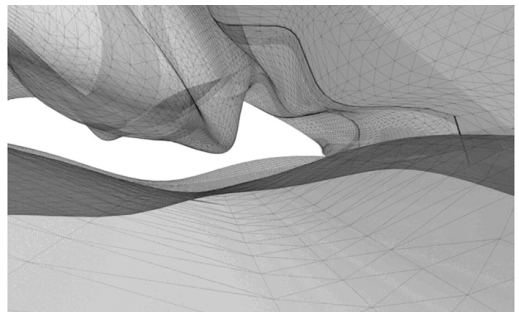


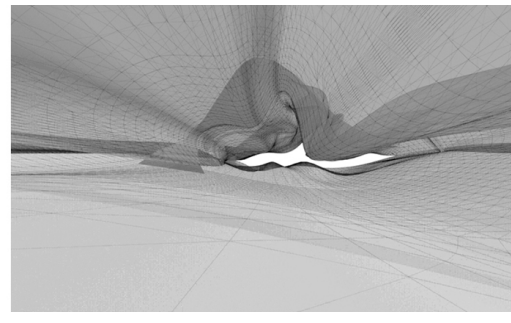


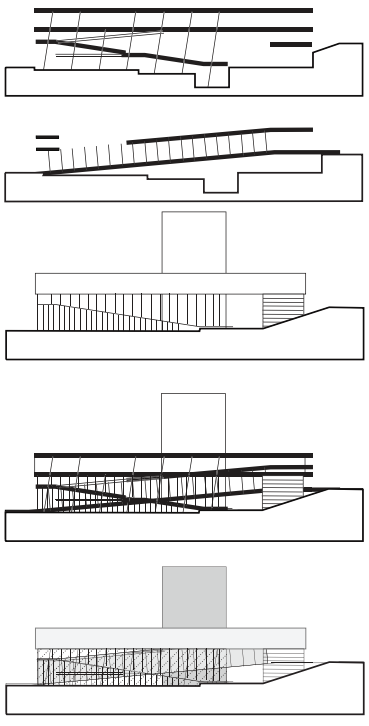


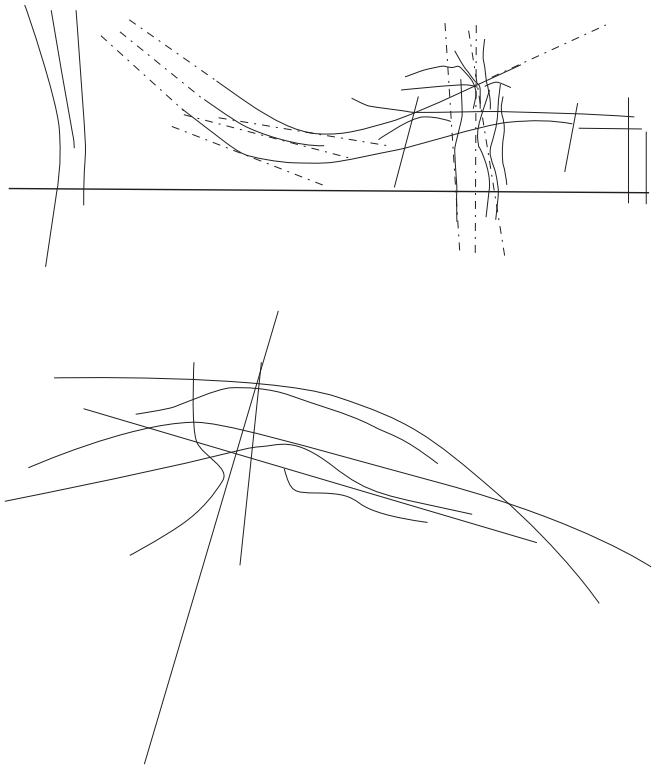












Frank O. Gehry, Guggenheim Museum, Bilbao. Diagrammatic geometric interpretation: the monument between urban fabrics and geographical elements (river and hills). Study of trajectory and structural skeleton, plan and profile. Kunsthal, Rotterdam, OMA: Composition as video montage: Dynamic experience and virtual fragmented transparency. Combination/ Hybridisation between ground and artificial layers: continuity and discontinuity. Virtual, fragmented transparency displays depth, paths (interior and exterior), structures as phenomenal transparent sections.

The fold is a quality of the form and can be described as a line/curve. It shows a structural stiffening. The drawing of this line is also trace and figure of a point that moves through space. This movement was therefore described as a mathematical equation and translated as a NURBS curve.
Our goal was to develop an “exact” configuration (describable by algorithms) that translated the folded meshes into virtual forms that could be digitally modeled. This is the use we made of the study model: a wire mesh which is manually modeled. We therefore started from a sculptural approach: the sense of vision and touch interact simultaneously with a ductile support that offers a specific resistance to a particular stress.
This deformation process takes place by successive refinements.The (study) model implies a necessary selection: it does not faithfully and accurately reproduce a real situation but a measured “simplification”. This “reduction” makes it possible to clarify specific aspects concerning concavity and convexity of the modeled surface.
The modeled mesh, being a “sculpture”, does not necessarily imply a possible habitability of the interior space. Furthermore, the relationship between the static of the model and the 1: 1 scale may not be automatic. We have therefore sought a method that could fix, crystallize the modeled form to verify its static and habitability. Given the particular formal complexity of the models, the deepening through digital tools became necessary. NURBS curves and surfaces were, therefore, the right tool with which to develop this experimentation.
In this framework, the translation of surfaces and curves into equations orients virtual modeling towards a parametric study.
From this perspective, the fold and the way in which we have studied the work of Gehry and other architects can be read.
The concept of fold refers to topological geometry and allows us to see consolidated structures and hierarchies in another light; it reinterprets the relationships between horizontal and vertical and between figure and background. The concept of folding, however, goes much further. It allows to read transitions of infinitesimal variations that are not perceptible as such but readable as integral that is the sum of infinitesimal differential quantities. Software development since the end of the eighties has certainly helped to give an image and an operational meaning to the fold.
Particularly interesting is also to notice how the 3D modeling softwares have been developed simulating manual operations on concrete materials. “Metaphorical” digital modifiers such as torsion, lathe, liquefaction bending and others operate transformations on meshes and NURBS.
Very often the limit of this conceptual translation is precisely the materiality, the specific resistance that, in the “real”, a material opposes in contrast to an applied modification. Hardly, in a digital environment, this specific resistance is somehow simulated.

Let’s move on to teaching: how can the use of digital design tools be conveyed to young students? Can you tell us about the experience at the University of Cape Town?

It has been a very interesting experience that allowed me to grow and. It was especially important for me to find ways to share my research with students. It was, therefore, necessary to clarify, first of all to myself, the importance of drawing as a fundamental moment to measure and “understand” the form and make it “mental and abstract”.
The architectural survey, especially in the first year, is fundamental because it allows you to select and translate the complexity of the world in lines with a measure and a scale. I think that for the architect, especially in the first years of study, having a reference of measures with which to compare his project and give it a “scale” is fundamental.
The city is made of artefacts, architectures whose measures are often the reflection of continuous adjustments and modifications to adapt to human life to a specific period and territory. The question of how big a particular artefact is, be it a table, a street, a row house or a block is an essential moment for the student.
These measures become a reference to design and question us on the reasons why a city, a neighborhood or a building are made that way to accommodate the forms of living.
Gianfranco Caniggia in Architectural composition and building typology: interpreting basic building (1979) talks about “decoding construction processes, extracting laws of behavior, formation and mutation of structures made by man. It seems interesting to me to think of typological reading as the decoding of processes of successive modifications.
In this way it is possible to make a connection between existing three-dimensional shapes, drawing and its interpretation through a genetic code.

From this point of view the parametric design tools become a useful tool.

At this point, I think the experiments with the students of your course can help us understand.

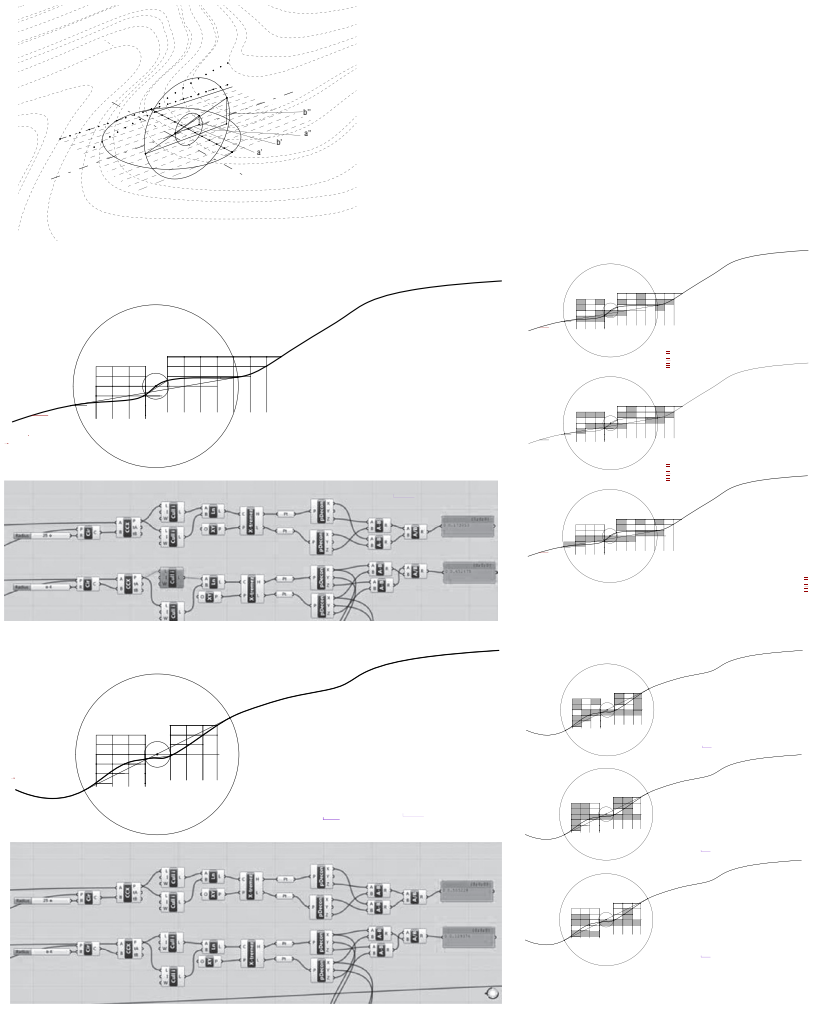
Some practical examples can certainly clarify how I have adapted the concepts described in the book with regard to teaching. The book systematizes and reflects on my Milanese research and ever since aimed at teaching and architectural design; the relationship with the work of the students was and remains therefore fundamental.

The book in fact presents and contextualizes some design experiments developed by students first in Milan and then in Cape Town.

However, I would like to concentrate on the experience of Cape Town because I consider it a verification and a further study of what was studied for the book.

During the last few years, I worked with Julian Raxworthy who, at the time, directed the Master in Landscape Architecture and who had just started coordinating the Master in Urban Design. I shared with Julian, the interest in parametric design and we both wanted to try to use this tool as a method of research and teaching that could bring out some key concepts related to the scale of the city and its design.

I think that the relationship and the dialogue between a conceptual approach to design and one more linked to the physical and “tactile” context can be a key to reading with which to read teaching experiences that I would like to talk about.

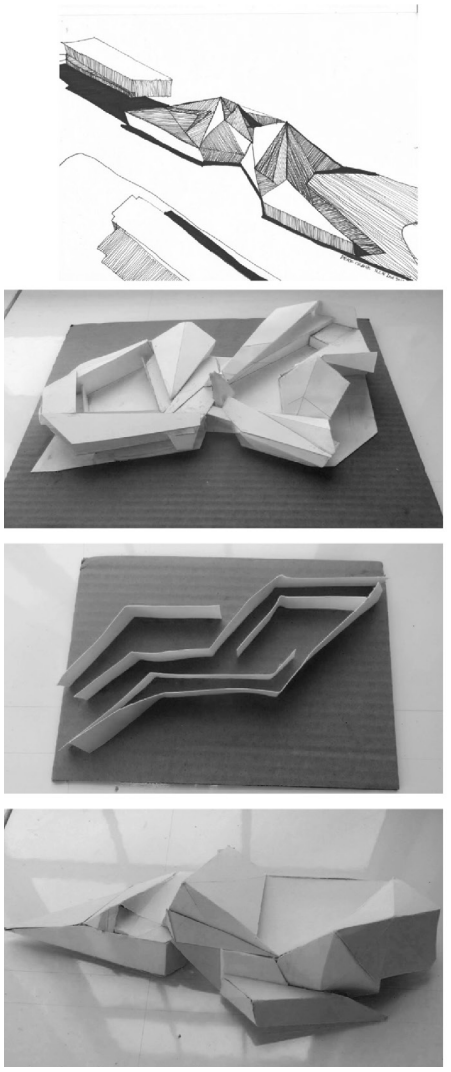


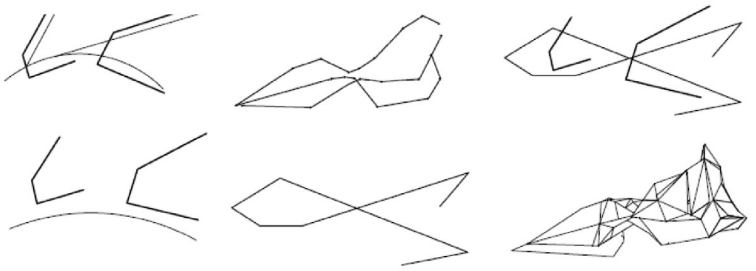
The geometric study is the first step to control a possible structural pattern that varies according to its geometry. The process highlights a set of interrelated planar curves, as projections of the three-dimensional ones which points to the definition of the structural layout by means of main structural conceptual sections

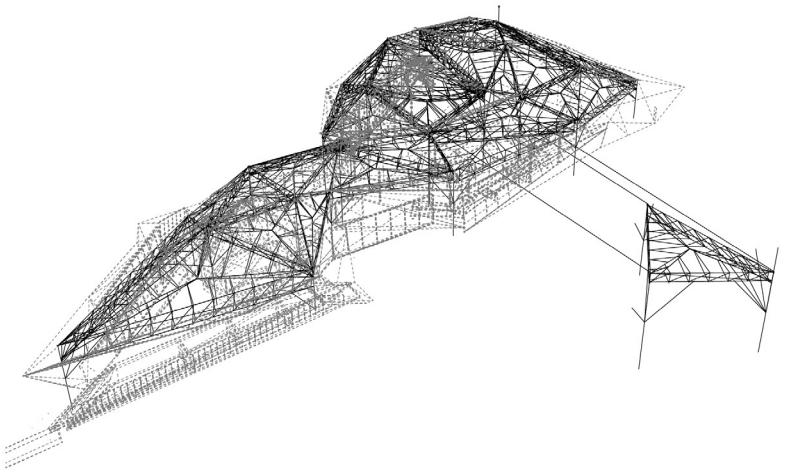
Folding process and rigidity

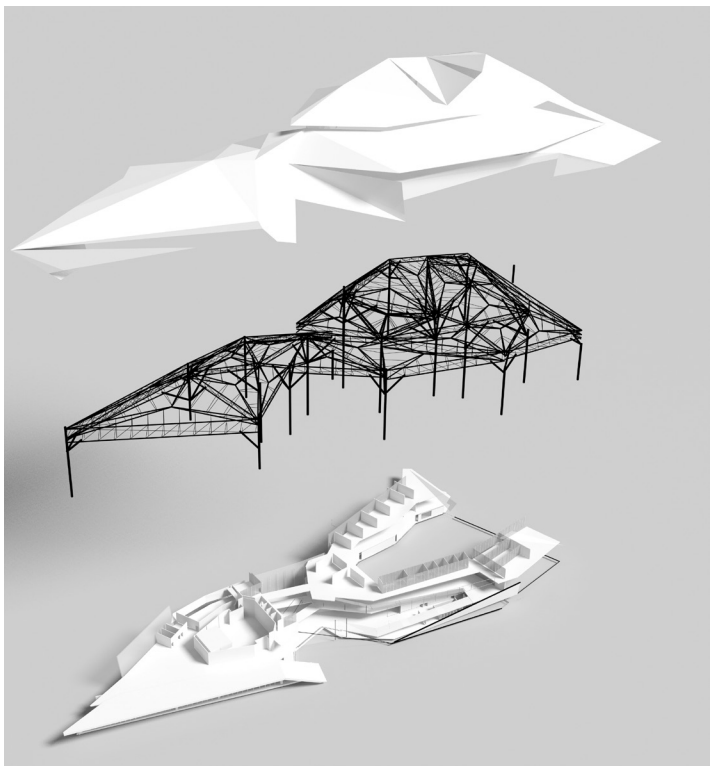
The Fold and the Diagram, between Model and Drawing.

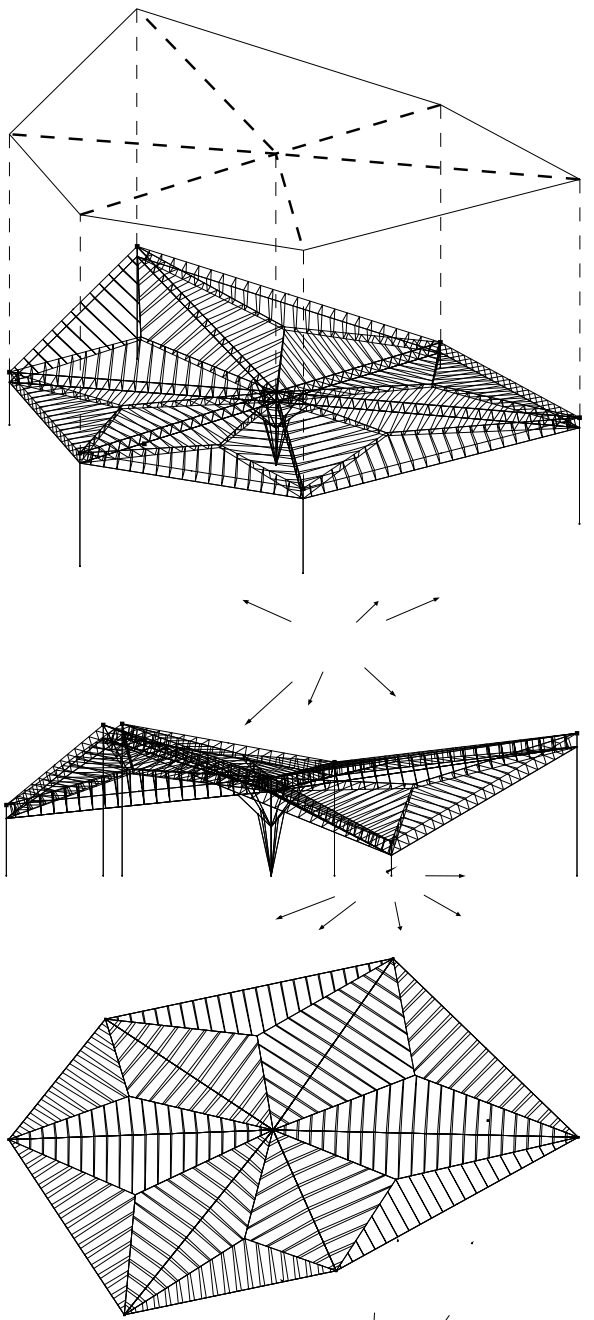
Nicole Lai Lan











The folding process (origami) has been used to imagine a “fractal” strategy that would link the overall image of the building (an Aircraft Museum) that needed to host large voids and smaller spaces related to the human scale and to the context. A parametric algorithm (developed with Grasshopper and Rhino) has been used to convert the conceptual folds into proportioned structural spatial systems in relation to the typological layout and to the span between columns.

Nicole Lai Lan
The Fold and the Diagram, between Model and Drawing
Design Dissertation,
Master of Architecture (Professional)
University of Cape Town, 2016.

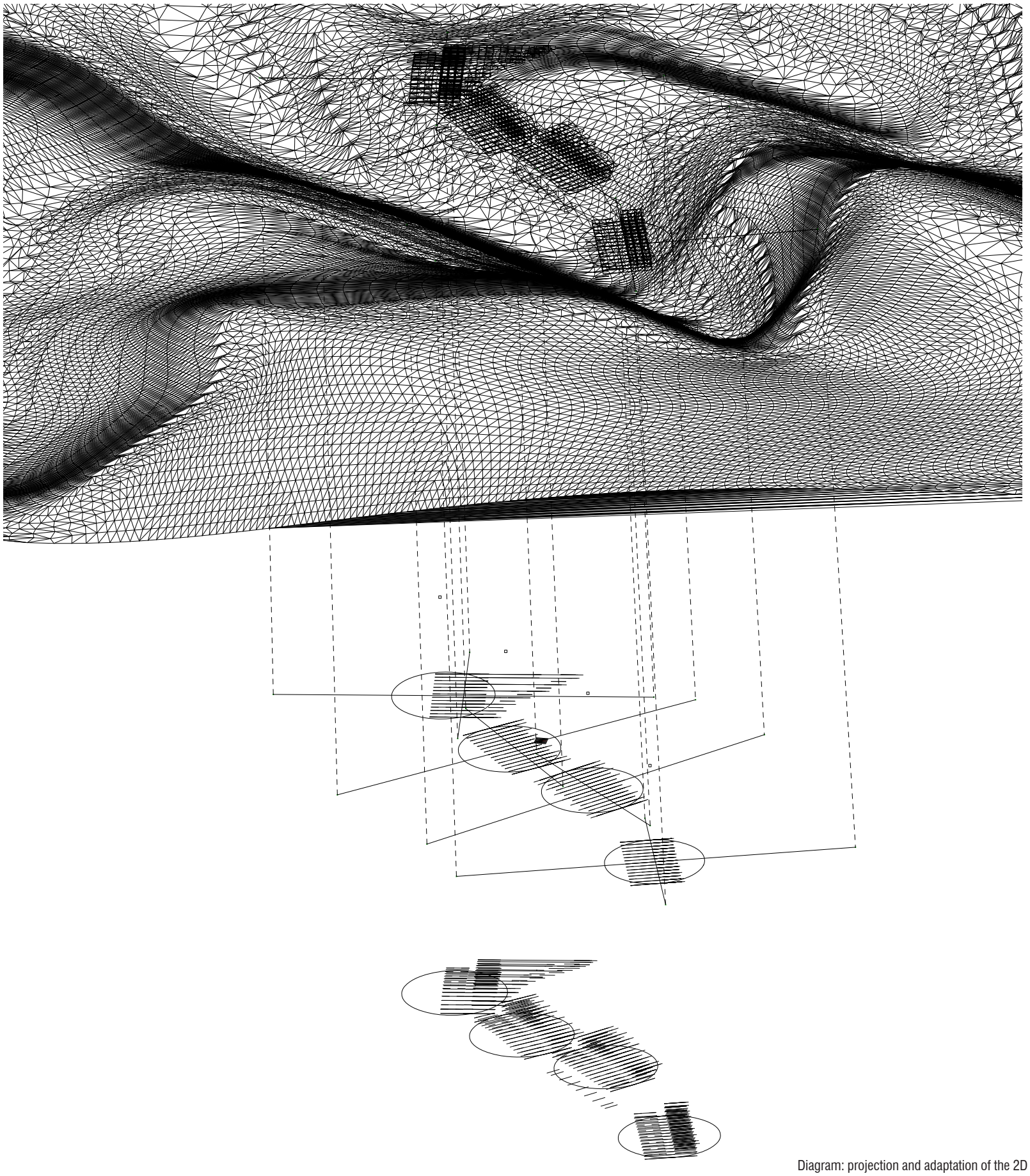


Diagram: projection and adaptation of the 2D plan onto the ground surface.

Workshop.

What kind of courses did you teach?

At UCT a large part of my teaching activity has been addressed to Master / Postgrad programmes. But I felt the need to try teaching the first year. The type of knowledge and cultural diversity of students entering architecture schools is a topic that deserves attention. I say this also in regard to the internationalization processes that our universities have been facing for at least a decade.

I wanted to understand the expectations, the difficulties, the way of seeing the world of these young students and I wanted to understand how I could adapt my knowledge to this type of audience.

I return to the project of the course of which I would like to speak briefly. I thought about how, in a relatively short workshop on drawing techniques, to tie aspects related to the observation of the real, with aspects more properly related to the idea of the project as a process of modification.

I wanted to address these issues by framing them from a technical point of view. I wanted to somehow arouse in them a question concerning the relationship between "artistic creation" and technique, trying to investigate how these two terms influenced each other. I also wanted to introduce them to the digital world as a design tool that must be managed, that has theoretical implications and that can help develop questions and researches during the continuation of studies.

Perhaps a little ambitiously I wanted to convey some parametric design concepts as a tool to link these issues together.

Would you like to specify how?

The exercise takes its cue from the experiment of the folded mesh shown in the book, with the idea of adapting it, simplifying it for a first year course (BAS).

In simplification, however, I think there are still some important aspects.

Some time ago, when I was teaching in Milan, with my friend Matteo Lo Prete and some researchers of the University of Varese we had developed a small software that would allow us to manage the configuration of three-dimensional catenaries.

The idea, inspired by the work of Frei Otto, was to optimize the curvature of complex surfaces as if they were hanging, as if they were catenary in three dimensions.

In this way, by virtually reversing the surface, its loads (relative to its own weight) would have been solely axial and tangent to the surface itself, thus eliminating bending moments.

The aim was to study a method that, in the preliminary-conceptual design phase, could provide a possible static configuration, upstream of long and complex structural calculations. I think the exercise done in Cape Town fits into this research trajectory. The idea was to develop a light roof, of an indicative size of 40x40 m, which could be used as a covered market or as a bus station (the function was actually never pre-scriptive).

I, therefore, wanted to organize the exercise by following these steps: physical model, sketch, digital model, preliminary parametric study of a possible structural configuration, construction of a context (ground and urban fabric), insertion and adaptation of the "conceptual" model into a physical context.

1. Folding.

The exercise was offered to first-year students. Instead of the metal mesh that would produce complex surfaces, the starting point was the 20x20 cm paper sheet. It was imagined that it could correspond to a 40x40m roof of a market. This association has been important as it effectively renders the possible relationship between the model and the building also with regard to proposed materials and applicable technologies.

The first task is the folding of this sheet from side to side according to a selected axis. The folds must not meet and will intersect the two opposite sides of the sheet. In this way the folds give rigidity to a material that otherwise would not have it. It is quite intuitive to imagine that the folds will be able to indicate a possible static-structural direction and a typological configuration. The folds suggest a possible structure without, however, predetermining the more technical aspects.

2. Sketch.

Observing the conceptual model thus fabricated it is required to sketch the plan and the profiles as projections on orthogonal planes of the lines-folds. The purpose of this step is to invite the student to identify a relationship between a manually modeled form and an essentially visual projection. This stage also invites to fix characters that define the form on the model, to make them somehow abstract, "mental" and reproducible in a virtual environment. It will therefore lead the student to consider the model as a means and not as an end. Very often when we begin to manually model ductile materials we run the risk of considering them as sculptures and as the ultimate goal of the process. This step forces to the question: "What did I learn? What, of that model, do I want to develop?"

3. Digital.

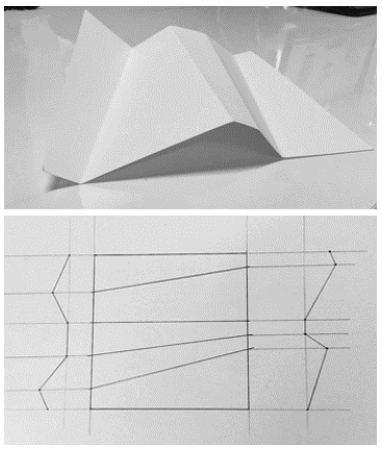
The third step is to redraw the lines "compressed" on the paper into a digital environment. In this case we used Rhino 3D. The lines are first drawn in plan using a reference square and then raised so as to obtain a pattern similar to that of the paper model. The exact reproduction of the paper model in the digital one is not fundamental. It is rather interesting that a mutual correspondence can be individuated and, in any case, this step is considered an evolution of the physical model.

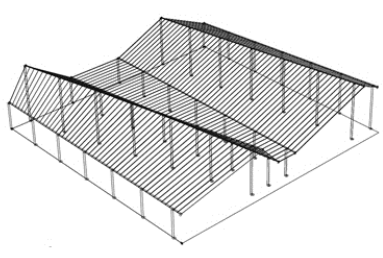
4. Parametric.

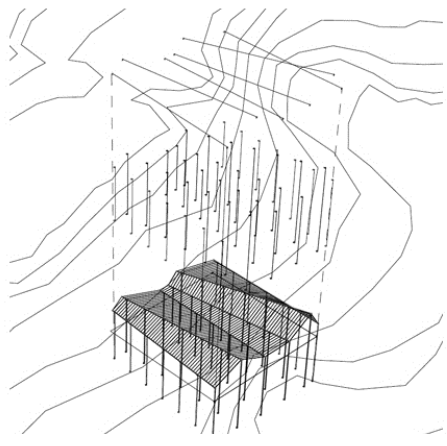
At this point students were asked to start getting familiar with the Rhino plug-in, Grasshopper, and use it to generate a model from those simple lines. Therefore they are connected as a series of ruled surfaces (in this way there will always be a straight segment connecting two lines/folds). With this step students obtained a virtual model which is similar to the paper one. At this stage a parametric analysis that will manage the structural layout can be carried out. Students are therefore asked to create parallel planes that intersect the folded lines at defined distances. Points obtained from this intersection will manage the span between columns and the definition of the secondary structure that connects the lines / folds, (which will be organized according to sub-multiples of the columns' span). Knowing these parameters a first structural dimensioning can be drafted. The span between the columns and the thickness of the beam (as a fraction a/b) will be thus connected. Given a fairly simple structure, by increasing or decreasing the number of columns designers can evaluate the formal result of this choice and the impact that this choice will

BAS 2018	REPRESENTATION 1 ARCHITECTURAL / GEOMETRIC DRAWING	

DIGITAL DESIGN/REPRESENTATION: GEOMETRY AND ALGORITHMS - Dr. Matteo Fraschini







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Aim

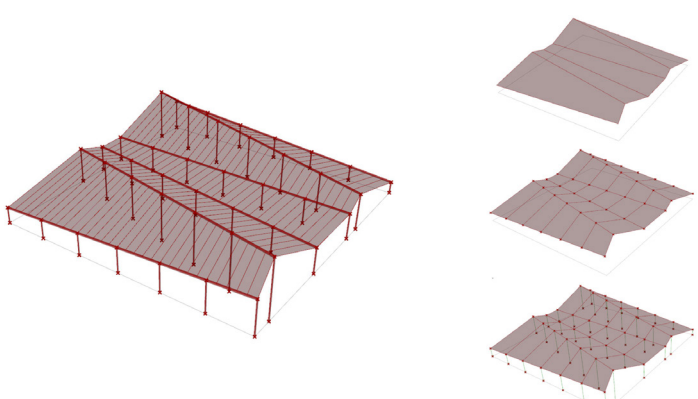
The course deals with specific issues concerning the relationship between a physical model, sketch, and digital model. It aims to allow a first reflection on representation as a necessary operation that allows to know an idea, a space or a form as an essential moment of a design process. In this framework, the student will have the opportunity to deepen selected aspects related to parametric digital design using Rhino 3d software and its plug-in Grasshopper.
Therefore, a series of connected exercises will be proposed which, starting from a cardboard-based conceptual model made by the student, will lead to the "digital" definition of architecture in a specific place.

The course, therefore, will be articulated in the following phases:
- Familiarizing with digital tools: Rhino and Grasshopper
- From 3d to 2D to 3D: projections and sections
- Conceptual model, sketch and parametric digital representation
- Parametric virtual construction of ground and context
- Combination/adaptation of a concept in a context and technical explorations.

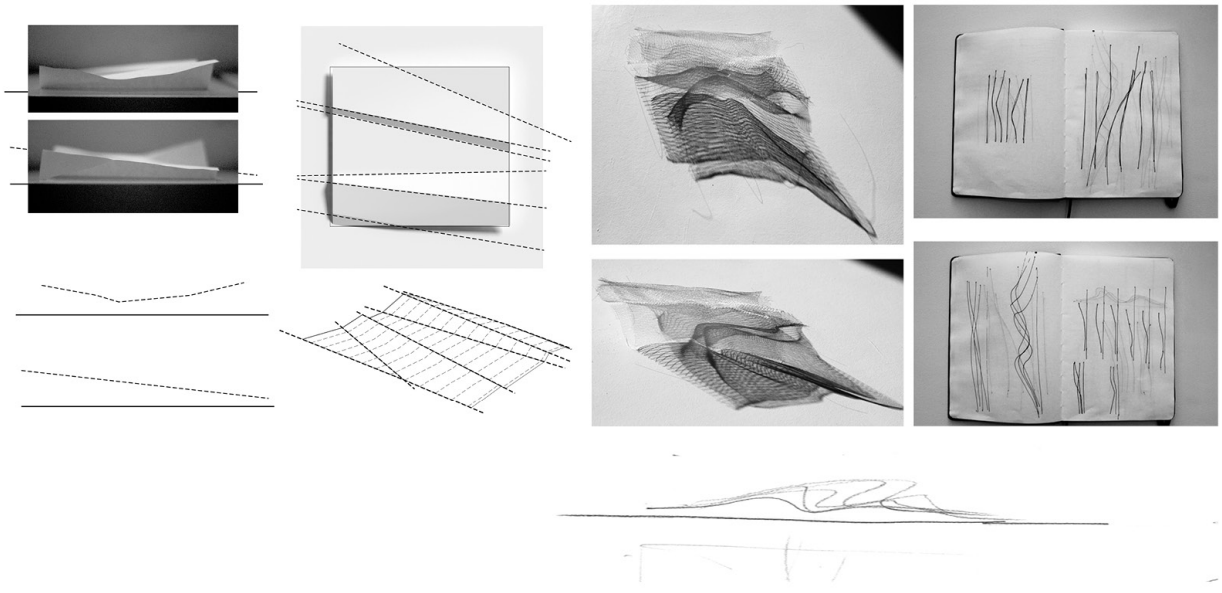
During the course we will briefly discuss methods of production / virtual printing of digital models in pdf files and some editing techniques with Adobe Illustrator.
The upload on VULA of exercises done in the computer lab will be regularly requested (as A3 pdf).

Suggested readings for an in depth research on digital/parametric design:

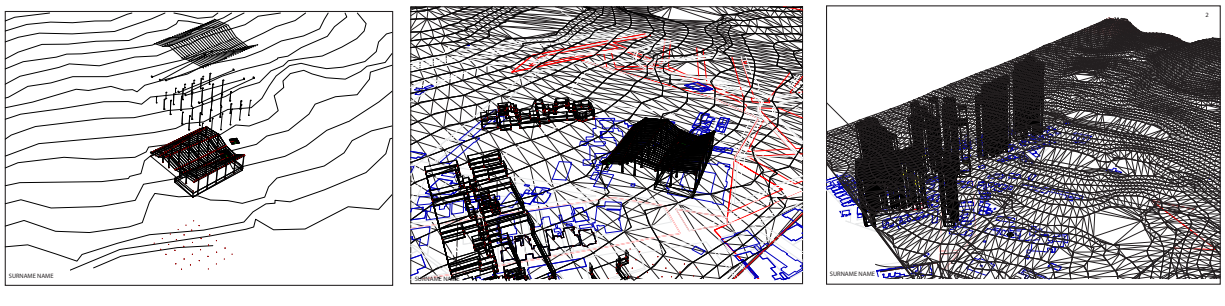
- Allen, Stan. "Diagrams Matter." *ANY: Architecture New York*, no. 23, Diagram Work: data mechanics for a topological age (1998): 16-19.
- Carpo, Mario. *The Digital Turn in Architecture 1992-2012*. Ad Reader. Chichester: Wiley, 2013.
- Lindsey, Bruce. *Digital Gehry: Material Resistance/Digital Construction*. It Revolution in Architecture. Basel: Birkhäuser, 2001.
- Lynn, Greg. "Architectural Curvilinearity: The Folded, the Pliant, and the Supple." *Architectural Design* 63, no. 3/4 March/April *Folding in Architecture* (2004): 111 p.
- Lynn, Greg. *Archaeology of the Digital: Peter Eisenman, Frank Gehry, Chuck Hoberman, Shoei Yoh*. Montréal: Canadian Centre for Architecture, Sternberg Press, 2013.
- Oxman, Rivka and Robert Oxman. *Theories of the Digital in Architecture*. London: Routledge, Taylor & Francis Group, 2014.
- Panofsky, Erwin. *Perspective as Symbolic Form*. Cambridge, Mass.: MIT Press, 1991. Originally published as originally published as *Die Perspektive als symbolische Form*, 1924-25.
- Puglisi, Luigi Prestinenza. *Hyper Architecture: Spaces in the Electronic Age*. Basel: Birkhauser-Publishers for Architecture, 1999.



FOLDING, BENDING, CUTTING
MODELS/SKETCHES 2D-3D, DIAGRAMS/TYPOLOGY/CHARACTER
3DS MAX- RHINO - GRASSHOPPER `



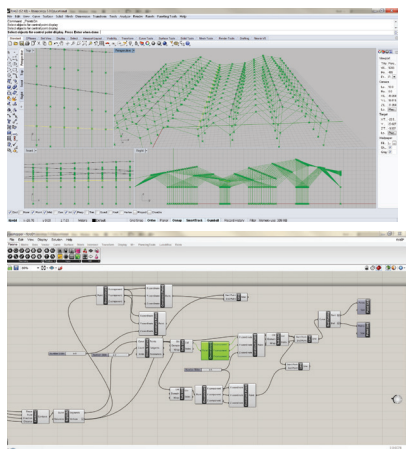
3 d physical (material/tactile) model to 2d (visual/abstract) sketch geometry
couple of 2d projection curves into 3 perpendicular surface
FROM PHYSICAL MODELS TO LINES (GEOMETRY) - STRUCTURAL SKELETON 3D - 2D



have on the structure.

5. Context.

The exercise is so far a study on a form-structure without physical references. The last part of the exercise proposes to the students a method to shape a 3D terrain starting from a flat map indicating contours and buildings. Through simple algorithms contour lines will be projected to the height to which they refer. They will therefore generate the ground mesh (Delaunay Mesh). Similarly, the polylines representing 2D buildings can be projected onto the mesh and extruded. In a few simple steps a 3d model of a context is produced. The "folded" model will therefore be imported into the environmental context. The last step is particularly important: on the one hand it considers the context



to verify the scale of the model and on the other it invites to evaluate the ground-roof-columns relationships. With regard to this last aspect, vertical elements were parameterized not as a projection of points onto a virtual "0" z coordinate but as the intersection of verticals lines with the ground (the Cape Town topography is particularly complex and can offer interesting insights). This intersection reproduces the virtual touching of the structure on the ground. Moreover, in this phase, the model is still formally managed by the fold lines that are the direct transposition of those manually modeled on the paper. The model is therefore "manually" managed through the relative displacement of the vertices of the segments that **represent** the folds and parametrically with regard to the consequent structural scheme. In this way it is possible to adapt these lines to an existing topography and evaluate the space obtained between the natural and artificial surfaces.

Conclusions.

The design procedure thus described helps to highlight the value continuity of selected elements/characters across different design tools. Very often, one of the criticisms related to virtual design methods concerns the lack of the tactile dimension in design processes: what we see on the screen cannot be touched. Digital design is based on metaphors and simulations of manual operations in a virtual environment. In this "representation" there might be the risk that a suitable tectonic-structural reflection doesn't correspond to a specific operation on the (virtual) form. If in a physical model it is possible to identify a correspondence, between form and possible structure, in the virtual model this relationship may not be obvious. Modeling, twisting, folding on primitive forms can, in a virtual environment, easily exceed the limits that, in the "real", the properties of a given material would impose. In a virtual space the resistance of a material solicited by a particular manipulation does not exist. The fold that stiffens the sheet of paper identifying a possible tectonics may not have the same value when operated in a virtual environment only. Moreover, the exercise fosters the construction of tools to solve design problems identifying the specific role of representation methods as necessary techniques to understand and im-plement design practices.

Comments and Reflections

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Behind the Digital

The conceptual boundaries of the territory outlined by the digital revolution are very jagged and undefined. Moreover, this extremely changing phenomenon acted and acts very quickly. Its margins are therefore a place of continuous contamination between a new reality and an immanent and existing physical world to which innumerable practices are connected. The digital therefore contaminates a physical-analog world - it certainly does not replace it. And that of digital is not even a mere overlap on a previous reality. Matteo Fraschini is fully aware of this in his book *DesignDisegno. Geometry, measure and algorithm for architecture and the city.* This awareness is not a small thing because it is rarely detectable in the sector literature and studies. Far more widespread is the naively positivist view of many digital gurus - from Negroponte's *Being Digital* to Mitchell's *City of Bits.*
In this vision, and even more so in that of the large group of followers, the phenomenon is simplistically placed: a novelty that replaces tout court an old tradition. Fraschini, on the other hand, as we have said, frames digital design for architecture from a critical and interrogative perspective. It does not take the atoms/bits polarity as a clear opposition, rather it approaches it as a hybrid fusion.
In fact, he investigates all the stretch marks and always captures the hybridization between a millennial visual and representative culture and the new disruptive potential of digital technology. Symptomatic in this sense is his persistent reflection on the tactile dimension. and the same could be said about the notion of fold, about the concept of footprint, just to cite some examples of the type of investigation conducted in the text. The book, which is not an isolated episode but the dense compendium of a decade of experimentation, started with the PhD at the Polytechnic of Milan, and brings some conceptual cornerstones and the markedly speculative cultural attitude of its mentor, prof. Ernesto D'Alfonso.
Among these key themes, a central place is occupied by the notion of measure and scale, as necessary condition for the readability and representability of space.
Fraschini therefore, throughout the text, holds firm the awareness that the "means is the message", that is, the assumption of the non-neutrality of the representation.
This allows him to understand the difficult status of a representation system such as that of Renaissance perspective which, although aimed at abstractness, implicitly tends towards reality: "It is important to observe how the idea of a homogeneous, abstract, infinite amd mathematical space becomes real and concrete" (Fraschini: 36).
The issue is well understood, also with regard to the impact of Cartesian philosophy.
Thanks to Descartes' rationalist framework, as we know, Perrault determines an epochal change in the conception of architecture and its theory.
The process of quantitative pragmatization, which is now at its maximum expression, and which passes, among others, also through Durand started there. But the consequence of Cartesian theories is the birth of Desargues' projective geometry (strangely not mentioned) which tends to reduce space to a mathematical entity. From this, Fraschini rightly argues, on the basis of Mario Carpo's studies, how the algorithm - the son of measure - becomes the conceptual node at the centre of the parametric and digital.
The basis of the argument lies in the polarity between discrete and continuous quantities and it is considered as much more than the mere discriminant between arithmetic and geometry.
Particularly original is the "urban" approach to the theme and this also reveals the belonging to the school we mentioned earlier. In fact, very often the theme of digital representation tends to be relegated to the representation of an object.
Instead, the investigation is constantly directed towards the city: the case studies of New York and Segovia are particularly significant. After all, the title reads significantly: "... for architecture and the city".

Fraschini chairing a portfolio review session during his time as conv
Cape Town's School of Architecture, Planning and Geomatics. The p
of District 6, and it is an appropriate analogy for his reflections on
Louw, 2014)

The University of Cape Town aims to be a research-intensive University that encourages its staff to link their research and teaching activities. This is something that came quite naturally to Matteo Fraschini during his time there. He made use of the opportunity to integrate the research that is outlined in this publication in several of the courses that he taught or convened, including the *Design and Theory* courses in the undergraduate and postgraduate architecture programmes, the *Representation* course, and in the *Masters of Urban Design* programme.

His book *Design Disegno: Geometry, measure and algorithm for architecture and the city* explores the complex set of relationships between physical space, its representation in analogue form, and the measuring, transformation and re-presentation of this in digital form. Fraschini's work represents a freeing of representation from its two-dimensional constraints that were imposed during the Renaissance, and he manages to develop a model that shows how representation can be digitised without the loss of techne and tactility.

The book traces the trajectory of spatial perception and representation from the Renaissance, through the work of practitioners like Peter Eisenman, Bernard Tschumi, Rem Koolhaas and Frank Gehry, and up to the development of his own model and its potential applications in contemporary contexts. Historical and theoretical analyses are used in combination with technical descriptions and formulae to explain the

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vener of the third year Design and Theory course at the University of project was the design of an Opera House in the contested landscape the scene and the stage as outlined in his book. (Photo by Michael

development of his model, which shows how physical and tactile forms can be digitally measured, documented and translated using digital tools to support architectural design that is more in keeping with the highly complex nature of contemporary society. After careful reflection, his research and methods are tested through student work under his supervision at the *Politecnico di Milano* and at the University of Cape Town, and through various competition entries that he participated in.

Fraschini's explorations find themselves in in-between spaces: The infinitesimal and the infinite, the analogue and the digital, the past and the present, the formal and the informal, the global and the local. It seems that his work is a reflection of himself, and he consistently positions himself in similar in-between spaces like South Africa and more recently in Israel and Palestine. These different aspects and places are unified through careful observation, documentation and reflection, only to re-emerge in three-dimensional forms of his own making. Fraschini argues that the tools that were available to measure and understand three-dimensional space largely influenced architectural design through the ages and he questions whether contemporary form-making has caught up with the complex nature of contemporary tools and environments - his work offers a tantalising glimpse of the possibilities.

In the digital era, the architectural object's interdisciplinary position is being inquired by growing change caused by a new digitally and technologically transformed culture. The architectural object and urban tissues are mutated by information technology and with new digital layers that allow new experiences and perceptions.

Woods, Dekker stated (2000) the foundation for the future is observations of how technological and organizational changes transform cognitive and collaborative activities and demands, and how people adapt to those changes.

While the interconnections between global and urban places in architectural and urban design are not new and long existed, digital age has brought about the multiplication, more intensity, and the new character to give meaning and analyze. One of the main differences today's is the sharpening of non-physical interconnections. Perhaps this also points to a deeper transformation in the larger social, economic, and physical orders (Sassen, 2011).

As our urban societies are no longer restricted to their administrative territory, bounded by the dashed lines on the map. Instead, we live in cities where flows move in and out of geographies, where territories are occupied by multiple collectives at once, and where the procedures, networks, and assemblages of objects and things are vastly distanced from our own capacities to perceive them. It is exactly for that reason that bringing people together spatially may no longer be a viable idea for maintaining a public sphere. Rather, we should start thinking about how we can move from an "Internet of Things" to a public sphere centered around things (de Waal, 2011).

A key analytic move that bridges between these very diverse dimensions and concepts is to capture the possibility that components of a city's topography might be spatializations of global and digital dynamics and formations. These technological advancements that generate shifts in architectural and urban space and culture, represents a major theoretical challenge that they force us to reconsider the implicit definition of the architectural and urban design discipline. There is a sped up change occurring, and we are in such a period.

The smart city, driven by digital technology, is poised to replace the typical networked city of the industrial era, whose success was built on its hard infrastructure, from roads to water supply and sanitation systems, not only as a technological optimum but also as a social and political project (Picon, 2015).

The new digital concepts involve and emphasize optimizing the operational dimensions of the city and its infrastructure, mainly through digital tools; and from a broader perspective, fostering development and information sharing—improving the quality of life through living more intelligently. We need information and communications technology to which should improve everyday city management make it more ecological and sustainable.

The way these new conditions can be resolved and managed is by uncovering the interconnections between urban structures and urban fragments and between orders—global, digital, architectural and urban, etc... This book explores and offers solutions in this new phenomenon by using geometry, measure and algorithm toward possible and useful architectural and urban design decisions.

Fraschini's method of codifying the measures extracted from the visual world and regaining tactile dimension as a tool for managing cities can bring out insightful the method to solve intricate urban design problems. By studying several most complex urban environments around world, underlying how parametric relationships between different figures of spaces determined specific measures which were related to overlapping fabrics, infrastructural networks and landscapes plays a fundamental role to decide and create the system to solve and manage these complex problems. The book provides important insights and strategies for architecture and urban design researchers and professionals.

References

de Waal, M. (2011). The urban culture of sentient cities: From an Internet of things to a public sphere of things. In Shepard, M. (Eds.), *Sentient city: ubiquitous computing, architecture, and the future of urban space* (190-195). New York City: Architectural League of New York

Picon, A. (2015). *Smart Cities: A Spatialised Intelligence - AD Primer*

Sassen, S. (2011). Unsettling topographic representation. In Shepard, M. (Eds.), *Sentient city: ubiquitous computing, architecture, and the future of urban space* (182-189). New York City: Architectural League of New York

Woods, D., Dekker, S. (2000). Anticipating the effects of technological change: A new era of dynamics for human factors. *Theoretical Issues in Ergonomics Science*, 1:3, 272-282, DOI: 10.1080/14639220110037452

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In the last ten years of my academic activity -as university student and researcher- among endless questions I was struggling with, something has been always at the center of my curiosity: **To Split the Complexity**.

In the natural and mathematical sciences, "Splitting" is generally more feasible, as the "being and mutation" process of the object of interest is empirically or computationally predictable, the behavioral patterns are extractable based on universally established rules and therefore the **complexity is quantitatively measurable**. The act of "Measurement" is itself a complex process that extends far beyond the material dimension of an object, and has been always a key-tool for **cognitive splitting**: to analytically measure something is to bring out its past, draw up its present and, more importantly, to predict and simulate its future.

When it comes to the urban environment, we perhaps face one of the most intricate kinds of complexity: a system of physical and non-physical layers simultaneously present and active; powered by constantly evolving economy and politics; floating in ideology, media and demagogy; a **hyper-complex system**. Any kind of intervention in such intertwined system, if relatively targeted to success, requires a deep cognition of that system: a **splitting measure-based cognition**.

But: Is it possible to totally and really split the urban hyper-complexity? Is there any comprehensive tool to measure it? Is it only the matter of instrument?

I think the answers are all No!

The impossibility – to this day at least- of splitting the urban complexity is mostly due to the timeless-ness of its mutation velocity and we are still stuck with our time-based knowledge and this is a fictional story of another note. What is important here is that there is a silver lining act. The one that Matteo Fraschini, in his recent book- "*Disegno; Geometry, Measure and Algorithm for Architecture and the City*"- brilliantly highlights as the focal act of "*Design*" process: "***Necessary Selection***". This is also the main use of good models. They are built of "*elements*" and not just any of them, only the "*necessary*" ones. The silver lining act of measurement when having an urban system on the table(!), is to measure the necessary elements. To do so, we must first distinguish and extract them. Here comes another main focuses of Matteo's work:

"***the Scale Jump***".

The "*jump*" itself is a combined quality of **co-existence**. Having changed the dimension of man's physical and spatial discernment by the new ways of communication, the urban context has also been shifted into a major scale and so the consecutive relations between urban projects and the contextual containers are being blurred respect to their previous net and definitive connections. In fact, what is called as 'the relation between the architectural object and its context', not only pertains to the 'past' and the 'present' time, but also –thanks to the virtual representative tools and simulations- concerns the 'future' of it. Another dimension has emerged: that of **Anticipation**; in our visual and pictorial memory that provides us with pre-images prior the realization of the material object. To subtly identify and extract those **effective points** of "*scale jump*" in the urban context is what I think,

Matteo has well addressed through both historical stemming-from renaissance to the contemporary era- and also his technical study of virtual modeling platforms.

A good model made of *necessary elements* that is able to *measure* the selective layers of complexity, is NOT ALL. There is a crucial final step: The **Re-Contextualization** of the model; the return from the virtual world to the tactile world. Matteo in his Analytical "***Process***", proposes a **responsive meta-context** on which the infinitesimal relations are first translated into quantitative nodes and then remapped onto the "***physical condition***" as **intensity local codes**: A **System of Multiscalar Deformative Forces**.

To sum up, what makes the contemporary urban system more intricate to comprehend, is rooted in the difficulties of 'measuring' its complexities. Measurement is a cognitive act, to communicate with the "world beyond the geometric dimensions" (Gregotti, 1977) and, in a higher scale, to cognize its complicate and intangible dimension; measuring its changes, their velocities and consequences; measuring the hidden order beyond its apparent chaos and also as a motivation for inventing suitable instruments and techniques for such complex measurement. The city we live in and interact with is no longer defined in a limited environment and closed in its physical borders with finite possibilities. The flux of information and digital communication are taking the physical environment to a state of limitlessness; a state with **ultra-locative dimension**; a heterotopic state. The emerging urban dynamics are taking the scale of space-use further from static spatial borders. We need to **Re-Cognize** the physical space, scale and urban configuration; "*Disegno; Geometry, Measure and Algorithm for Architecture and the City*" is a fruitful terrain to do so.

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