

# Another approach to space

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**ABSTRACT:** What if computation could do more than just deliver increasingly intriguing geometries? What if computation could offer us a look at the spaces that are conceivable but not yet imaginable: computed as pure information topologies. Metrical space, especially geometrical space could then be rendered into this relational framework.

Life-Design of urban society has changed during the last decades. New media have entered our perception to a degree never imagined by future sciences of the past. So the question if space-time can still be considered as a single layer in reality arises in philosophy, physics... and Architecture? And for urban society? Individualization takes command. Being special becomes normality. Programs inhabit spatialities, people work and dwell and make company in short, due to increasing nomadism and fluctuation.

Three protagonists are sent in for discussion. Alberti, who is deemed to have created the modern image of 'the Architect', Ledoux, who might best be described as a cultural engineer, preceded shape and transformation grammars and Habraken who reminds us that the ordinary may create spaces far more appropriated than any Architect will ever be able to invent.

But in urban areas, where the life plans of many intersect but should not collide, where comfort should be provided on limited and affordable space, the question arises if these appropriations are still appropriate, whether stacking and adding single use areas in uniform grammars can still be the answer. Maybe the everyday use of space already does find answers Architecture did not yet take into account.

**KEYWORDS:** Computation, Active Space, Quantum Paradigm

## INTRODUCTION

In his text "Questions That Will Not Go Away" Habraken quotes Alberti to point out that the Albertian Turn in his sense was the secession of the intellectual planner dealing with the proportionate 'Lineamenta' from the medieval master-builder dealing with the shaping of material.<sup>1</sup> He furthermore argues that the urban fabrics we perceive as beautiful were mainly done without Architects, but appeared as continuous fields in a specific socio-cultural environment and in a regional tradition of craftsmanship. The appearance of Architecture in the 'common urban or rural fabric' has been a phenomenon since modernism, when new materials were developed that were in demand for a skilled planner. Before this, the application of Architecture was reserved to extraordinary tasks, such as religious or communal buildings or the residences of the Maecenas. But if we take a look at the following citations from Alberti's Ten Books, we may at least ask ourselves if this was really intentioned by the 'Architect':

If Beauty therefore is necessary in any Thing, it is so particularly in Building, which can never be without it, without giving Offence both to the Skillful and the Ignorant. How are we moved by a huge shapeless ill-contrived Pile of Stones? The greater it is, the more we blame the Folly of the Expense, and condemn the Builder's inconsiderate Lust of heaping up Stone upon Stone without Contrivance.<sup>2</sup>  
How many Towns, which when we were Children, were built of nothing but Wood, are now lately started up all of Marble?<sup>3</sup>

The application of valuable materials undoubtedly raises the necessity for a skilled planner and so does the organization of complexity. But maybe it was never an intention of the Architect to exclude the ordinary, as Alberti explicitly states that beauty was necessary in anything. Another protagonist, less well-known but no less exemplary in the course of his vast theoretical work, Claude-Nicolas Ledoux, offers a more radical statement: "Destroy the thatched roofs and you will restore the confidence and the dignity of the people."<sup>4</sup> So he was even less convinced that the ordinary does not need Architecture.

Both of these two statements apply to the use of material, but also address a certain practice in their contemporary environment. Alberti addressed the medieval craftsmen who knew how to work with their physical materials but did not have any idea of how their piece of work would fit into a greater whole, while Ledoux addressed the social disparity towards the end of the Ancien Regime. They were both on the edge of a shift in social organization. Alberti witnessed the shift from medieval absolute space to relative space of mercantilism and Ledoux experienced the early beginnings of industrialization and the change from feudalism to civil society. They both declared the traditional ways of building of their time and locations as being inappropriate for a newly emerging age.

But still the continuous field seems to be intriguing in terms of spatial and social cohesiveness compared to the city of modernity, oscillating between inappropriate extravagance and tedious boredom. Although Alberti might not agree that this 'beauty of the field' is really a sign of the absence of Architecture. He might answer that most buildings representing wealth, from the Venice City Dwelling over the Amsterdam Canal House to the nicely clad but cheaply made pre-modern worker's tenement of the period of promoterism were certainly designed by people who called themselves Architects<sup>5</sup>. And also Ledoux might answer that the continuity of the field only displays the cultural and social coherence of the people accommodated. Not only the well-functioning picturesque downtown quarter appears as a continuous field, but also the Ghetto, the Slum and the shabby shacks of peasant villages. Habraken agrees that when societies change from agricultural to industrialized, from oral to literate, environmental conditions have to adapt as well:

In Modern times, all this changed. Traditional ways of building became obsolete as new materials and new techniques emerged. Age old building technologies could no longer serve the needs of a rapidly changing society. New ways of transportation and communication disturbed familiar processes.<sup>6</sup>

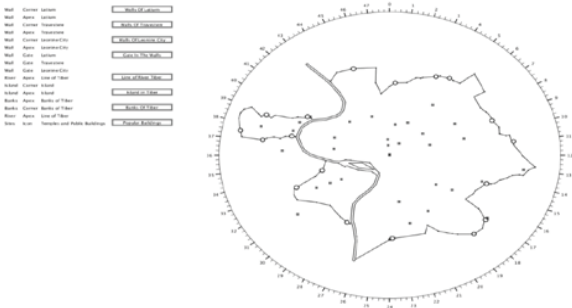
Additionally since Modernism we face the fact that the market for Architects has switched from a seller's to a buyer's market. By rationalizing building strategies, the development of industrial production has grown from producing materials to the production of the buildings themselves. Today everyone can go to prefab house exhibitions and just shop a house of a desired type in any favored variation. Even worse: these types have been produced and improved Thousands of times by the industry. No Architect will ever be able to compete with this, as long as we try to imitate existing themes or types or act in obedience to the field. Architects get employed if no standard solution is required, but rather when creativity is desired. For this reason in architectural research, it appears to be necessary to find answers to questions the field does not ask, as long as we conceive it as an unconscious, self-reproductive mechanism. Taking a sly glance on Christopher Alexander, Alberti might state that we have been given the great gift of consciousness that enables us to reclaim mastership and to find newly appropriated solutions for the multi-ethnic yet multi-ethnic societies of the future.

## 1.0 THE APPROACHES

Not just since the Deleuzian distinction between roman and gothic ages, or the conflict between constructivism and structuralism, or the gap between relativity and quantum mechanics, or the imperative versus the declarative programming paradigm, or the Cartesian versus the Riemannian Spaces, has there been a notion of two sometimes opposed, sometimes complementary approaches to the way objects in space and their relations towards each other can be conceived. The above mentioned protagonists also were chosen, because they exemplify these approaches in the field of spatial organization.

### 1.1. The atomistic approach

The great achievement of Alberti was precisely to open up space, by clearing the field. With a huge effort he studied the field and literally 'pointed' out the remarkable and swept away the in-between. Figure 1 is a self-programmed adaption of the famous Albertian 'Map of Rome', using the parameters as published by Mario Carpo and Francesco Furlan<sup>7</sup> in their favorable explanatory book "The Delineation Of The City Of Rome". The tables Alberti provides are classified in categories, such as 'Walls', 'River', 'Sites', characters, such as 'corner', 'apex', 'icon' and a context in which they appear. The buttons marked by rectangles trigger self-organizing maps to draw the lines in the way Alberti advised us to<sup>8</sup>. For the present paper it is important to note that with Alberti we are in space. His 'Six Elements'<sup>9</sup> and his proportionate 'Lineamenta' establish parametric relations in space. By reducing the continuous field to discrete objects, Alberti delivers the ground on which the new Rome of the Renaissance could be built.



**Figure 1:** Parametric map of Rome as described by Alberti.

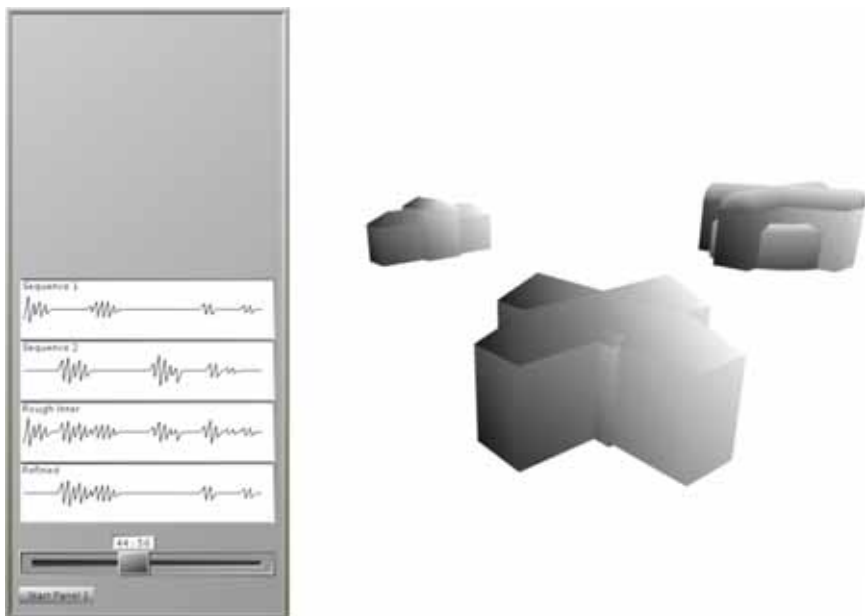
Alberti exemplifies the ‘Atomistic Approach’: There are discrete Elements, whatever they are, and we can relate them. His stance towards the field was not to improve by continuation, but rather to not contradict the forces beyond control.

**1.2. The axiomatic approach**

Taking a leap from early Renaissance to late Enlightenment, Alberti’s counterpart was Claude-Nicolas Ledoux, who will be considered to exemplify the ‘Axiomatic Approach’: Everything is related, but subjected to a unifying grammar, which continuously transforms one instance into another. So with Ledoux and the grammar we are in time: Out of the atomistic structures in space comes a continuous stream of algebraic information processing. And with time the grammar introduces the system.

**1.3. Making instances of types**

If we wish to explore the possibilities of a system, transformation is being introduced, and so are the rules of transformation. These will be arbitrary in the beginning and then appropriated through the course of the possible transformations. This can be exemplified by the rough implementation derived from the transformation grammar of Ledoux for his ‘Propylées de Paris’ as shown in Figure 2. Although this is completely liberated from any content and only based on geometrical bodies it gives an idea, how continuous transformation can also work on discrete objects: There is a certain spatial structure of hierarchical order, axiomatically reaching down from a dominant spatial element to others being constrained to it. By shifting the dominance from one type to another, the elements out of which these are built will change in size and nature. The constrained parts do not automatically flip along with the superior part they are attached to, as long as their own appearance does not contradict the appearance of the superior element.



**Figure 2**

language<sup>10</sup>. By this, a huge number of in-betweeners can easily be created from only a few distinct types: The Grammar fills the space of possibilities.

And this can be laden with complexity, until the program would be able to create the Renaissance Palace or a Chicago-Style High-Rise and everything in between and no Architect will be needed anymore, hence this is an active code in the sense of Bruno Latour as he states it in "On Recalling ANT". There is no creativity in designing in-betweeners or even in re-creating types, as long as they are subjected to a system. This is just mechanistic agency. So, an act of creativity would be to break the rules and to challenge the system. Computation can provide the opportunity to do this experimentally without doing harm to an actual environment.

## 2.0 THE PRE-SPECIFIC

### 2.1. About program

A "hotel", a "shopping mall", or a "school" give us specific 'programs'. That does not necessarily mean that they need specific forms to inhabit. The idea that program makes form is a vestige of the functionalist approach of Modernism. The designers who could creatively fit the program for a hotel in the block formed by historic houses might equally well have done a school, a shopping mall, or the headquarters of a corporation, using the same buildings. Human activities make human beings inhabit human size spaces. The space behind two windows of a canal house can accommodate ten or twelve persons meeting, four or five persons working, a spacious private office; a hotel room for two.<sup>11</sup>

In this quote N. John Habraken gives us an idea of how a whole range of requirements can be accommodated by a single appropriate form. The difference between programs is not settled in the spaces themselves, but in the way these spaces are linked towards each other: Does a private space allow slipping in and out unseen? Does an office connect to other offices occupied by working groups concerned about similar issues? Is a reception room accessible without disturbance of everyday business? So 'program' is more of a question of accessibility than of form. According to this Habraken states on page eight of the same article: "Programs do not make such order, they inhabit it." And this also shows the inappropriateness of the functionalist approach. As he points out in "Type As A Social Agreement" the Qa'a houses of the Arabian medina have a very specific spatial organization according to the traditional socio-cultural organization of the people inhabiting these places. This specific configuration serves a specific functional approach that has been appropriated over centuries. But this function will collapse if social circumstances change. On the other hand, by exemplifying the Amsterdam Canal Houses or the Parisian Hotel, it becomes obvious that the functionality of spaces can change along with demands. So what does this tell us? Every utilization of a spatial configuration imposes a system, but this system is not a spatial one, it is a system derived from the activities taking place. And so, far too often, place and space are being mistaken. In this perspective a place is an appropriated space, bound by constraints to other places within a spatial structure and by this 'placed' or located relationally.

The term 'structure' is here used on purpose: Among the aforementioned examples, the structure remains similar: the public space outside enters into a larger place, which is the 'Diwan' in the Qa'a, the 'Hall' in the Canal House or the 'Grande Sallon' in the Hotel, which then distributes into smaller, increasingly private places. But is this a system? As pointed out, a system involves time and alters a given input information into a processed data output. This does not apply to space: The Diwan is an everyday common room, accessible only to the men of a patriarchic social system. The Hall of the Canal House is a transitional space for receiving guests and immediately taking them somewhere else, but representing the wealth of the owner in a mercantilist society, while the Grande Sallon of the Hotel, certainly has the same representational purposes, but has been the location of extravagant gala evenings in feudalist society. So a spatial structure can host very different processes of different socio-cultural systems.

If speaking of grammars, the idea of meaning in a language will quickly arise. Ledoux for example tried to establish a semiotics of space, by implementing spatial figures. The cube, he argued, was the sign for justice:

[...] the shape of the cube is the symbol of justice, it is to be placed on a square base, from where it will punish the tort and reward the virtues.<sup>12</sup>

He applied the cube for his designing of courts and at least from the point of view of the Third Estate towards the end of the Ancien Regime this was a ridiculous misconception. And at the latest when he built the 'Propylées' his effort in supporting and improving the social system by manifesting it in a 'spatial system' ended up contradicting his own intentions.

So even in grammar it seems possible to go beyond the axiomatic hierarchical notion of the Chomsky-Grammar, by referring to the Danish linguist Louis Hjelmslev<sup>13</sup> who stated that form and content are in arbitrary but appropriate relation. We can provide spatial structures, where the activities of the people who make up the inhabiting systems can take place and yet avoid the conflicts we produce if we try to impose our own reductive understanding of a particular system.

## 2.2. In the field

The examples given by Habraken are well chosen, as they show the genericness behind the given specific types. So it appears to be appropriate to create spatial organization<sup>14</sup> as generic as possible and yet render it into the typicality the people we wish to accommodate are familiar with: preserve the richness of possibilities by simultaneously seeing that socio-cultural systems are changing, utilization is changing, demands are changing through the challenges of high fluctuation, multi-ethnic environments and the changing life-plans in modern, yet contemporary, society.

All systems, even the very high-tech one's, develop, change, and bloom through use. To learn about them we should connect to the group that applies them. Books will only tell us what is no longer in discussion. The fully documented system is a dead system. [...]

Partly to cope with this dynamic variety we have learned to use systemic abstractions speaking more generally, for instance, of building morphology or spatial orders, translating them later into specific materials and products<sup>15</sup>.

Another way to put this is: if we speak of systems in space, we speak of pre-specific systems, which will be specified by their particular utilization, typified by particular application of materials and construction methods. Sometimes a stylistic application of geometrical forms is just glued on the structure's skin which is unfortunately mistaken for 'Architecture'.

But this also raises the question whether a particular spatial structure that can be inhabited by different programs might not also represent several fields at the same time. This is the moment where the approach of 'active space' comes into play. Which means: a spatial structure allows for patterns of activities, without determining what these activities will be, unless a program is formulated. So the program becomes an individual within the generic.

## 2.3. On the economy of systems

According to the three aforementioned protagonists there are also three approaches towards dealing with the process of building. Alberti's atomistic approach does not actually involve a system:

But herein, I repeat my Advice, let your Moderator be the Prudence and Counsel of the most experienced Judges, whose Approbation is founded upon Knowledge and Sincerity: Because by their Skill and Directions you will be much more likely, than by your own private Will and Opinion, to attain to Perfection or Something very near it.<sup>16</sup>

For him the Architect is one among many skilled professionals, although responsible for the coordination of the building process. For Ledoux and his axiomatic view, the Architect is the one and only responsible central person in charge:

It is the architect who must keep an overview; he can exhaust the possibilities of the industry, he can economize the products, he can avoid costly repairs, he can propagate the funds his art makes available for him in abundance.<sup>17</sup>

Habraken again has a rather technical perspective where the systematics of building itself is put into the centre

Today's pluriform environment does not allow a single product like a brick to support all communication in the field. The building is now a composition of systems, each with their own modular principles. Different buildings may contain different systems and materials.<sup>18</sup>

With the help of grids, traffic of parts in space can be organized. In fact, for a single project, more than one grid may be used. Starting from a basic grid, other grids, serving their own systems, may have modules derived from the base grid module by multiplication or subdivision. Interrelated grids may operate on different levels of intervention.<sup>19</sup>

This is due to the increased complexity of contemporary building projects. Nowadays many Architects are usually involved in a single project. But this also raises the necessity for a new way of organization. Like Alberti Habraken centers his approach towards organization of objects in space.

Taking this one step ahead would mean an inversion of this notion, like Ledoux<sup>20</sup> did compared to Alberti: not to organize objects in space but the spaces themselves. But unlike the baroque conception of adding, subtracting and crosscutting units of space, we are now, as with Habraken, operating on different levels of space; on superimposed programmatic fields. The relations between these fields have to determine how these different layers 'deal' with each other. This is why a conception of active space might rather be called an economy than a system. Several systems, or axioms, of equal value deal with each other, instead of ordering them into grids, which will be determined by a unified common denominator.

This is why Riemannian spaces are so interesting. There is not one function governing one specific figure, subsuming it under the smallest common denominator, but local curvatures of space itself that rule over one part of it, contracting it to all the other parts. The link between them is the Cipher, the 'nothing', which contains the code of computing how the systems cope with each other. Coding opposed to formulation is what makes computation different from calculation. Coding is a creative process and not an act of agency. Another, not too literal, analogy to the Riemannian approach to geometry would be this: instead of defining a non-Euclidean form through  $n+1$  Dimensions, which means nothing but to define a non-Euclidean form yet by means of Euclidean space, we operate with  $n-1$  modes of variability and we do not include a single form into a Newtonian Container Space of reference, but the spaces are made up out of themselves by their locales. The so derived structures could then be rendered into a contextual space of a given environment.

The same should hold true for the territories of human groups. Although we are able to sense each other the shopper at daytime will not be disturbed by the party-people of the night. Instead of thinking positively: this is a zone for working, this is a zone for residential purposes, this is a zone for etc. it could be possible to avoid contradiction between differentiated utilizations.

One approach to render connectivity and non-connectivity into space could be the following one: Stating there should not be a single function governing a spatial figure, but rather an equational approach of local operations. Space is used as an active element of computation. Quantized bits of space then have to cope with each other by a grammar, contracting the ways how they impact on each other.

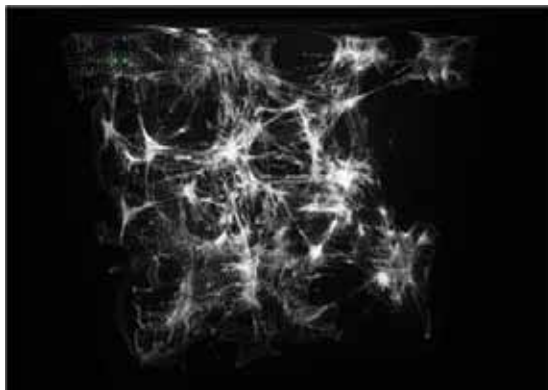


Figure 3

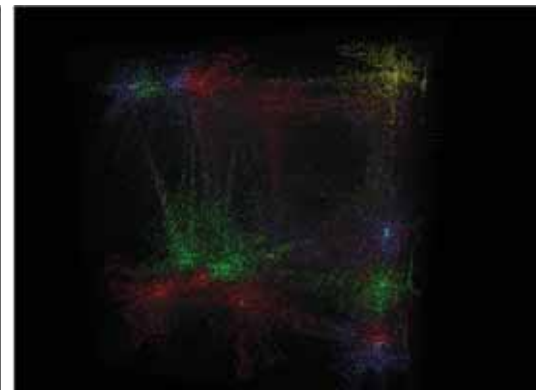


Figure 4

By this, space becomes a morphogenetic topology, as it would be called in geometry optimization<sup>21</sup>. Only in this case we are not talking about material objects in space but about how systems included in space inhabit and transform its structure. Figure 3 shows how agents induce their properties on such spatial quants. These were named 'Spaxels', as they like Voxels, have got spatial dimensions, but they can take attributes and values of the agents embedded and through this bridge the connections between them. As shown in the figure, these connections make up joints, where no object (agent) has been before, widen up to shady volumetric figures and shape the spaces in between. Taking it a step further, it can also be shown how different fields can be promoted simultaneously. In Figure 4 it can be seen how some fields do connect and others do not, e.g. the ones represented as red and green. This tool can now be equipped with the data from an actual environment or even better with a continuous stream of data taken from the movements and gatherings of actual groups of people. The volumetric figures represent the localizations of as yet undetermined activities, but may exemplify those solutions already incorporated in the 'ordinary', the everyday life of the people we build for.

## CONCLUSION

To summarize the above mentioned strategies, there are four major issues to rely on:

1 - The Atomistic Approach. There are computational tools such as the self-organizing map, which do not represent a hierarchy. They just order Elements of equal value, reduced to numerical data and liberated from all possible content.

2 - The Axiomatic Approach: The field, as N.J. Habraken defines it, is constituted by grammar. A grammar consists of infinite vocabulary, finite alphabet and a specific set of rules. The grammar fills the space. It is implicitly contained in any field and needs to be explicated.

3 - Rather than finding the positive rules for the few things allowed, Christopher Alexander gives us a great approach to figure out the negative rules, for the things to avoid. No matter how extensive a set of these negative rules will be, the possibilities remaining are still vast compared to the few possibilities offered by a finite set of positive laws.

4 - Computational programs can only be disparate and reductive, because anything else would mean they become tyrannical: All we do in scripting is to define selective modes, chosen from everything there is, for a specific reason: we may never mistake the tool with the ruler.

The Spaxels as a species of quantized active space opens up the potentiality to embed objects in space, which are distinct and unconnected but yet able to react on each other by analyzing the potential drop of properties in their locale.

Ongoing experiments with this tool could help to represent more in space than just geometries, but to render back information topologies into geometrical figures. Ending this paper, there is one more term to introduce: Modernism and Functionalism have been about reason and mechanisms. Like the last great axiom trying to explain the universe "E=mc<sup>2</sup>", this involves judgment on cause and effect. But Architecture has arrived in the digital age, which is not about judgment but it is about appropriation and making sense out of information. In a quantized environment axioms become elements themselves, dealing with each on equal ground. Each one is special and that is normality. Philippe Morel recently brought about the term 'Quantum Architecture'<sup>22</sup>. Not comparing this adjacent approach to the sophistication of his work, but quoting him by permission as a source of inspiration. This is why the Spaxels introduced in this paper are considered to be a new approach to space: what they do is negotiate information bit by bit, not imposing an axiomatic function, but superimposing fields for activities.

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## REFERENCES

- Leon Battista Alberti, 1755. *Ten Books On Architecture*, trans. Edward Owen, London, accessed Dec. 2014:  
[http://archimedes.mpiwgberlin.mpg.de/docuserver/images/archimedes/alber\\_archi\\_003\\_en\\_1785/downloads/alber\\_archi\\_003\\_en\\_1785.text.pdf](http://archimedes.mpiwgberlin.mpg.de/docuserver/images/archimedes/alber_archi_003_en_1785/downloads/alber_archi_003_en_1785.text.pdf)
- Mario Carpo and Francesco Furlan, 2007. *The Delineation Of The City Of Rome* Tempe, Arizona, ACMRS.
- N. John Habraken, *Type As A Social Agreement*, 1 (Seoul, 1988), accessed Dec. 2014,  
[http://www.habraken.org/html/downloads/type\\_as\\_a\\_social\\_agreement.pdf](http://www.habraken.org/html/downloads/type_as_a_social_agreement.pdf)
- N. John Habraken, *Tools Of The Trade; Thematic Aspects of Designing*, (1996), accessed Dec. 2014,  
[http://www.habraken.org/html/downloads/tools\\_of\\_the\\_trade\\_final.pdf](http://www.habraken.org/html/downloads/tools_of_the_trade_final.pdf)
- N. John Habraken, *Questions That Will Not Go Away: Some Remarks on Long-Term Trends in Architecture and their Impact on Architectural Education*, (2006), accessed Dec.2014,  
[http://www.habraken.org/html/downloads/questions\\_that\\_wont\\_go\\_away.pdf](http://www.habraken.org/html/downloads/questions_that_wont_go_away.pdf)
- Louis Hjelmslev, 1953. *Prolegomena to a Theory of Language*, (Baltimore, Waverly Press)
- Bruno Latour, 2006. "Über den Rückruf der ANT," In *ANThology: Ein einführendes Handbuch zur Akteur-Netzwerk-Theorie*, edited by, Andrea Belliger and David J. Krieger, Bielefeld, Transcript
- Claude-Nicholas Ledoux, 1981. *L'Architecture considérée sous le rapport de l'art, des moeurs et de la législation*, Nördlingen, Uhl.
- George Stiny, *Shape: Talking about Seeing and Doing*, (2006), accessed Feb. 2015,  
<http://shapetalkingaboutseeinganddoing.org/Shape.pdf>

## ENDNOTES

<sup>1</sup> A/N: Reading the books of Alberti one will quickly realize, that there is only one passage in over 700 pages, where Alberti states, the Architect should accept advice from the skilled craftsman, as he best knows the materials he is working with. But there are vast parts in the Ten Books, in which Alberti very precisely describes, how the different materials were produced, how they should be applied, what granulation of sand for which purpose of what kind of mortar. Or: how the abutments should be placed on the bearings to prevent flashover. His Ten Books are not a manifesto to distinguish the Architect from the craftsman, but rather a tutorial on how a good building should be planned *and* crafted.

<sup>2</sup> Leon Battista Alberti, 1755, 357

<sup>3</sup> Leon Battista Alberti, 1755, 562

<sup>4</sup> C.-N. Ledoux, 1981, 103

<sup>5</sup> An analogy to this would be the development in China during the recent years. My fellow Wu Jiaji, who was working in Philip Johnson ° Alan Ritchie's office in Shanghai the time I visited in 2006, could not understand my pity in tearing down 'these shabby old Hutongs' and replacing them with comfortable high-rise residential buildings. Our own view on our past in Europe is also quite romanticizing since we forgot about the terrible conditions in these 'wonderful' traditional housings in Europe, which are nowadays equipped with toilets and bathrooms and still seem full if they are inhabited by around one-fifth of the people they were actually built for.

<sup>6</sup> N. J. Habraken, 2006, 2

<sup>7</sup> Mario Carpo, Francesco Furlan, 2007

<sup>8</sup> In fact the "Apexes" are drawn as "Corners" – for the sake of brevity.

<sup>9</sup> regio, area, partes, partibus, tectum, apertio

<sup>10</sup> 'Language' in the sense of George Stiny, which defines language as system.

<sup>11</sup> N. J. Habraken, 1996, 7

<sup>12</sup> C.-N. Ledoux, 1981, 115

<sup>13</sup> Louis Hjelmslev, Prolegomena to a Theory of Language, 1961,

<sup>14</sup> I do hesitate to use the term "spatial order" as 'the order' is necessarily top-down commandment, while 'organization' is unfortunately connoted by a functionalist point of view, but at least neutral in the sense of how it is achieved.

<sup>15</sup> N.J. Habraken, 1996, 12

<sup>16</sup> Leon Battista Alberti, 1755, 94

<sup>17</sup> C.-N. Ledoux, L'Architecture, 1981, 122

<sup>18</sup> N.J. Habraken, 1996, 34

<sup>19</sup> N.J. Habraken, 1996, 35

<sup>20</sup> Although it has to be added that the baroque void certainly appeared long before Ledoux.

<sup>21</sup> With kind regards to Asbjorn Sondergaard and his remarkable work topology in digital fabrication.

<sup>22</sup> With kind regards to Phillipe Morel and his inspiring talk he gave at our chair during the time this paper was written.