Computational Politics and Architecture
From Digital Philosophy to the End of Work

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Forward to History.
The Return of Transversal Ontologies in the Digital Age of Architectural Production

In the nineteenth century it was handcraft, under Modernism the rationality of the machine—today, however, it is the logic of the digital that demands inclusion in the content of architecture. It defines architecture as that practice in which the cultural logic of an era finds its translation in the physicality of the human environment. Indeed, with "architectural computation", "mass customization" and "digital fabrication", a fundamental change in architecture is identified (Gramazio & Kohler 2008).

Today, on the cusp of digital advancement, architecture is actively realigning itself within the constantly changing "force field of technology" (Gleiter 2008, 11-26). It is precisely in this time of radical cultural change that the question of production conditions in architecture resurfaces, also in its full contradictory nature as once modernism had brought to the fore. This can not only be seen as a major technological shift, but leads according to Antoine Picon to the thesis that the new conditions of production of architecture are not only the expression of a novel constructive culture but simultaneously are one of its constituent characteristics (Picon 2010, 212-213). The thrust of digital technologies divides opinions, but less in the sense of formal rhetoric than as the point where key implications for the discipline can be identified.

To discuss the question of the changing conditions of architectural production and their technological canvas, it is necessary to address both the implications and the reasons that constitute the basis for this massive shift. This cannot be simplified to a linear progression of
technology but is the consequence of 'global displacements' [Picon 1996, 37-49] that have to be discussed from a larger systemic perspective. Indeed, there are variations on this theme, but one approach seems to be particularly relevant: the idea that the digital habitat today expresses itself as a constructive artefact that is detached from simple drawings, rather it results from "algorithmic coding" [Carpo 2011, 47] and expands into variation and space. However, this does not imply that the role of the designer is excluded. The architectural design is still guided by specific intentions. It is by no means that the designer's affects and creativity are obsolete. Quite the opposite: the new digital technologies allow for design and fabrication processes that are mediating a new constructive reality between the environment and with the human being.

As a result, the question of new production conditions contains not only a rational, technological side but also an affective one. This "transversal" relation raises questions about the history behind, and thus the status of, architectural production in the digital age. According to Mario Carpo, the question of production conditions is a recurring one; every time it resurfaces, it indicates a fundamental change not only in architecture but also in culture [Carpo 2009, 49-54]. This holds true for the debates in the period of early modernity as well as for their (structuralist) return in the sixties when protagonists such as Konrad Wachsmann, Elifried Huth and Günther Domenig or Yona Friedman developed constructive modular building systems, facing an exponential proliferation produced by the post-war economic, geopolitical and social order.

Catalysed under the rise of new digital technologies, these investigations into novel structural typologies returned to the subject of architecture, delving into advanced design and manufacture methodologies that can vary, or even mutate into new and unpredictable architectures.
when combined with other disciplines such as material or construction sciences; indeed, architectural production became flexible and extended beyond the realm of electronic drawings whereby radical new construction opportunities directly began to alter architecture's reality. It is in this light that this essay indicates a fundamental change, which may belong to a larger history, fostering the return of "transversal" ontologies in the digital age of architectural production.

Practical aesthetics and transversal operations

From the middle of the nineteenth century it was the transition from traditional building techniques to the machine production that raised an important point that was rarely taken into consideration: the close relation between architecture and the specific conditions of materials and how they work. This is when Gottfried Semper entered the debate with his book *Style in the Technical and Tectonic Arts, Or, Practical Aesthetics* [Semper 1860]. Struck by the idea that "style is the conformity of an artistic phenomenon with its genealogy, with all the conditions and circumstances of its becoming", Semper tried to find coherence between the intellectual act of design and the material act of making. Semper started with considering formative motives in art and architecture, corresponding to what he called the "four elements of architecture", such as the use of particular materials involving specific constructive procedures. At a different level, Semper presented technological sets as variations of these basic elements in such a way that they would achieve their own style and therefore cultural identification. In so doing, he developed a rather "parametric" idea of materiality and turned against idealistic notions of art and architecture, directing the attention from the idea onto the things themselves [Caché 2000, 190-197].

As Semper shows, the intrinsic nature of complex material forms in art and architecture cannot be simply invented, but represents the congruence of material with its becoming, not in the sense of an "absolutism", but rather as a process2. According to Semper, this was obvious in textile aggregations where seams and woven materials provided a new understanding of materials as they emerge and evolve. "There can be no doubt", Semper writes, "that the first principles of style are bound up with this earliest of [textile] artistic techniques" [Semper (1860) 2004, 113]. He further explains that these are "a natural and logical consequence of the raw material" [Semper (1860) 2004, 171] whereby the invention of weaving technology defines the earliest form of concise material expression, making visible the natural law of the textile construction and its "tectonic" behaviour. Thus, it was no longer simply the idea of the artist or the craftsman, but also the technology of working, or phrased differently: the conditions of production.

In reference to Carl Boetticher’s *The Tectonics of the Hellenes* (1862) he stresses that the working of textiles shows, in fact, the complex history of their making, and also of their present condition [Hermann 1981, 26-60]. For Semper, Boetticher’s definition is meant to establish a strong tectonic link between a material and the technology that creates a certain style. But, less narrowly constructed than Boetticher’s argument, Semper included such heterogeneous elements as cultural organization and therefore represents with his approach one of the major contributions to the history of technology in architecture.

However, Semper made—in accordance with his definition—a crucial distinction between the material act of production, centred on the textile working, and the relevance of the craftsman. From this perspective, it is by no means solely the technical processes applied to the material that evolve as architectural expression, according to

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2 "[...] the hand of the producer is seldom or never one that has sufficient ability and leisure to be the inventor at least when the invention goes beyond the realm of the empirical sciences and mathematics to become, at least in part, a conception in the artistic and formal sense." [Semper 1860, 171].
Semper, there are also the manual processes of the craftsman and the surrounding cultural context that influence the purely technical and material object in such a way that it becomes something special, the expression of its time. Therefore, Semper's focus on the essential intersection between the technical and construction processes that the material requires on one hand and the creative, individual and foremost 'affective' processing through the craftsman or producer on the other is often misunderstood. Here an affective side, different from the material, constructional and hence rational side, can be distinguished. This allowed Semper to redefine the role of production, aligning it with the way it is understood, and thus forcing the act of materialisation to constantly engage with its surrounding culture. Following Semper's argument on this, material construction and the processing of the craftsman become one, defining the production of art and architecture as an apodictic 'transversal' operation. In addition to Semper's theory, it is important to characterise this perspective on architectural production in relation to fundamentally different kinds of realities—such as modernist thought.

**A modern medium of design**

The notion of 'transversal' ontology on which Semper's theory is founded, invokes necessarily relating foundations in architectural production to the forms of digital processes in order to become a material reality. Thus these imply a historic function and follow an evolution that is part of the pattern of major technological changes. Indeed, around the turn of the twentieth century, the debate on the conditions of production was given a new impetus due to the shift from craftwork.

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3 Here, the term "construction" represents the material act of making and includes the relation between material, structure and fabrication and extends towards the discussion of crafts and mechanical assembly. Given this definition, construction is directly linked with surrounding technology and includes complex strategic choices which lead to fundamental consequences of the intercourse between architecture, science and technology, but also with their cultural dimension. Being a stimulating force throughout architectural history, from Semper to Gotthilf Semper's Reconstruction of the Greek Parthenon temple.

[Semper 1860]
to mass production, which Semper had not fully described, but at that
time was increasingly shaping culture.

At that point, architecture embraced the machine age, adopting this
dictum in general and offering an abstract view of architecture as
something that radically reflects the conditions of its making—an inter-
pretation that has provoked disagreements among architects and theo-
rists ever since. In 1926, Walter Gropius proclaimed in his Principles of
Bauhaus Production that the changed conditions of production resulted
in technical and social laboratories, in which the difference between
machine and handcraft has far less to do with the different nature of the
tools employed in each, but to the subdivision of labour in the one
and the undivided control by a single workman in the other. Therefore,
Gropius adds, "the contrast between industry and the crafts is much
less marked by the difference in the tools they use than by the division
of labour in industry and the unity of the work in the crafts" [Gropius
1971, 95]. More precisely, Gropius' notion of technology is meant
to adapt the division of labour to the principles of efficiency that can
be deduced from the physical world and the interpretation of nature;
here, technology is used to "humanize nature by appropriating it to
human needs and concerns" [Picon 1996, 40] and to adapt sup-
posedly natural principles of efficiency to the organisation of labour
and production.

In other words, Gropius' thoughts on technology and the conditions
of production in architecture comprise a mixture of know-how and in-
teriorized rules. The various levels overlap and were linked to social
progress and economic concerns. In relation to this, Gropius postu-
lates that all objects must make do in the modern world, and that
this applies to all cultural artefacts that form an integral part of the
human socialisation process, such as telephones, cars, and furniture,
but also to the houses in which modern human beings live. It must be
noted that, in accordance with twentieth century political philosophy,
in a world of constant movement and transformation, architecture
can no longer rely on familiar, traditional means to resolve current
problems. According to Gropius, it has to extend beyond traditions
and adapt to the changing needs of the present and henceforth to
machine production. This attitude is well illustrated by the Bauhaus'
approach to engineering and architecture in terms of basic functions
and needs, providing a general frame for the collective design—a
chair, a building or a city. In so doing, Gropius, together with a num-
ber of protagonists of the Bauhaus, thus claimed to give the products
a content of reality and significance in order to limit mankind's "ensla-
vement" by the machine, and so evolving goods specially designed
for mass production. In turn he argued that there "[...] is no danger
that standardisation will force a choice upon the individual, since
due to natural competition the number of available types of each
object will always be ample to provide the individual with a choice of
design that suits him best" [Gropius 1971, 96]. In this broad sense,
a new kind of "rationality" evolved which was linked to novel ways of
studying efficiency in social processes, founded on new relations of
parts and the whole, and between labour and machine production.

It is important to point out that Gropius never insisted that in the age
of machine production buildings had to look like machines. As explai-
ned above, he argued that architecture should incorporate or absorb
the cultural logic of its time, transforming its conditions of production
[Schwartz 2008, 212-216]. What was actually at stake in the shift
from craftwork to mass production was the transition from Semper's
"affective" understanding of material working towards a more "ra-
tional" understanding of operations and functions. In fact, spectacular
progress was made at that time through this approach, resulting from
the added value derived from the application of serial mechanical
processes. According to Gropius, the cause lies neither in the machine
itself nor in its logical consequences of functional and sequential pro-
cesses of fabrication, but most importantly in the mechanistic mentality
of the age where individualism was progressively replaced by collec-
tivism. This laid the foundation for the massive introduction of optimi-
ization, standardization and economics in the field of architectural pro-
duction, enabling the rationalization of components, the sequencing
of labour and logistics. This notion of work, between human effort and
mechanical power, became a "modern medium of design" [Banham
1980, 281].

As a result, Gropius believes that the machine age is an indication of
a cultural advancement where the individual was sublimated. Indeed,
Gropius' point is more cultural than functional: there is no affective,
individual or handicraft constituent in mass production since machi-
nery and serial manufacture has no anthropological, individual driver

4 It must be stressed that Gropius' sublimation of the individual in favour of the machine
Thus the machine in architecture, according to Gropius, is indifferent to individual drive or the craftsmen’s influence—it is the result of repetitive, purely rational mechanical processes. This not only gave the origin of Gropius’ demand for mass-produced artefacts but also gave the whole debate a modern route that was related to economic and social theory.

The return of affect

In this regard, Gropius clearly took up the “transversal” ontology of architectural production theorized by Gottfried Semper but expanded his conception towards the anthropological setting of the (modernist) human condition. In contrast to Semper, who stressed the constructive-material side, Gropius gives more weight to the modernist collective, the coupling of rational fabrication and social progress. And nothing less is at stake today, in the digital age, regardless of how this may be achieved and how this may manifest itself in overall architectural practice. In fact, mediated by the new digital technologies further potentials for design open up, in the realization of which a new relationship with the new material formations and the cultural environment can be created. It is one essential aspect that the question of architectural conditions of production therefore raises: it begins to extend the traditional dialectics of handcraft and machine production, linking individual influences in the design and serial production in fabrication that are both no longer determined mechanically but algorithmically by the computer.

Is more differentiated than discussed in this context; in fact, what Semper has originally defined as the craftsmen’s influence in the making of things, the inadequateness and imprecision of manual labor, turned out in Modernism as the engineer who was planning production sequences, assembly logistics and mechanical tooling. These tasks are in themselves complex systems in which the individual engineer is subordinate to a wide range of specifications and constraints of the overall production system. But the engineer could also have an individual influence, even though on a radically extended scale of production. The former influence of the craftsman was therefore shifted, yet still existent. For more information, see [Cullin 2006] and [Merdinger 1985, 12-23].

5 This can be further exemplified by the teaching course project “Spatial Aggregations I” (2012) by the group of Gramazio Kohler Research at ETH Zurich, collaborators: Luka Piskacek (Project Izade), Thomas Casalberti; students: Petrus Azemelouas-Eudstion, David Jenny, Gabriele Schör, Rupke Chauhan, Evangelos Pantazis, Stylianos Paliotis, Rahil Shah, Stella Azarian, Iva Damjanovic, Hjalmar Schried, Lukas Mersch, Katharina Schulte, Enzo Valierio, Andreas Kissel, Kulkarni Pande, Christian Grewe-Reiffmann, Sonia Cheng, Joe Liao.
Today, the potential of new conditions of production in architecture lies in this "man-machine" connection—very much in the sense of Semper's and Gropius' "transversal" understanding of architectural production, and this is not just incidental but central. This return of "transversal" ontologies requires an understanding beyond deterministic approaches that are exclusively autonomous, physical or consistent. These implications may be seen as the result of architecture; however, to take things a step further, these conditions are a basic index of a cultural stance of the discipline, prior to the translation into an aesthetic, programmatic or political vocabulary. It is in this regard that the dynamic force of architectural production resurfaces and begins to foster the inflection with a new cultural surrounding. The historical perspective on conditions of production in architecture provides a way of connecting technological change with cultural evolution. Such a connection is in no way direct; instead it is "transversal" and faced with a number of influences and constraints. In this sense the conditions of production in the digital age of architecture indicate a fundamental return to history, revisiting the age of craftwork and the era of mass production, but further these imply a turning point in the making of things, in the thinking of things. The new conditions of production are, therefore, the driving force of this shift, as well as their result. They not only foster changes in the construction and fabrication of architecture: they shape architectural culture.

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