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## **Tools of perception**

**On the impact of digital technology on architectural design**

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### On the impact of digital technology on architectural design

#### Abstract

Over the last ten to fifteen years the architectural tools and ways of working have gone through significant changes, which mostly originate from the use of new digital technology in all the processes preceding a building.

Digital technology creates possibilities of developing new architectural languages because with digital 3D-modelling programmes it is possible to shape complex forms that only a few years ago would have constituted a far more difficult and extensive task. And with a computer aided building component industry the prize of a special and customized product often equals that of the standard product. Likewise, the forms of cooperation in the design process as well as the organisation of the work process are changing because of the possibilities of simultaneity and net-working inherent in digital communication.

But questions are rarely asked, as to whether digital tools also have the effect of changing the very way in which the architect conceives the building he is designing? Whether digital tools may – given the fact that they change the architect's visual and conceptual access to the design object, also changes his perspectives and priorities in relation to what is important when designing a building?

In the phenomenological tradition there is an understanding of tools and techniques as being non-neutral. Heidegger stresses in *Being and Time* that any tool is not only a means to an end. When using any tool or technique some properties or qualities of what is worked on become recognizable or visible in a specific way, which is linked to this specific tool or technique, while other properties or qualities become invisible or irrelevant. The use of any given technique, then, entails a particular way of perceiving the world, at the expense of other potential ways of perceiving.

In the paper, this understanding of the non-neutrality of tools and techniques will be used as a point of departure for addressing and discussing the questions which have been raised above. Through relating analyses of two buildings - one by UN studio and one by Henning Larsen Architects - to the design and planning processes which preceded them (including the digital visualization and planning tools which have been used), traces will be pointed out of how the applied digital tools and techniques have enhanced certain qualities and properties of the buildings in question, while failing to actualize other qualities important in pre-digital architecture.

#### Tools are non-neutral

In Heidegger's tool analysis in *Being and Time* he states that *"The less we just stare at the thing called hammer, the more actively we use it, the more original our relation to it becomes... The*

*act of hammering itself discovers the specific "handiness" of the hammer*".<sup>1</sup> It is by using a hammer as a tool that we understand what a hammer is and how it can be used.

Further on Heidegger states that *"What is peculiar to what is initially at hand is that it withdraws, so to speak, in its character of handiness in order to be really handy. What everyday association is initially busy with are not tools themselves, but the work."*<sup>2</sup> Because the tool in order to be really handy is formed in accordance with its use, it becomes transparent. And the moment we use a tool our attention is not directed towards the tool, but towards the work we are doing with the tool. That is why it is very difficult to acknowledge the impact of tools and techniques. But there is more than work going on, when we use a tool. *"Our absorption in taking care of things in the work world nearest to us has the function of discovering;..."*<sup>3</sup> Heidegger says. The use of a tool or a technique makes qualities of the surrounding world visible. Different tools emphasize different qualities of a thing, like when working with a shovel we are shown other qualities of earth, than when working with a rake. Or a technique reveal to us certain qualities of the world that surrounds us, like when a windmill or a sail shows us the wind as a driving force.

The use of practical tools and techniques makes us generally look at the surrounding world in a certain way, *"The forest is a forest of timber, the mountain a quarry of rock, the river is water power, the wind is wind 'in the sails'".*<sup>4</sup> Nature or the surrounding world becomes visible as a standing resource.

### **Technology is a way of revealing**

In *The Question Concerning Technology*<sup>6</sup> Heidegger goes further into the question and makes a distinction between the purpose of technique and the essence of technique. The purpose of any technique is a means to an end, but the essence of technique is the act of revealing. *"If we inquire step by step into what technology, represented as means, actually is, then we shall arrive at revealing. The possibility of all productive manufacturing lies in revealing. Technology is therefore no mere means. Technology is a way of revealing"*.<sup>6</sup> The word 'technique' stems from the Greek *technikon* that originates from the root *techné*. *Techné* refers both to the work and skill of the craftsman and to the arts of the mind and the fine arts. According to Heidegger *techné* was by the ancient Greek linked with *epistémé*, and the two words were terms for knowing or cognition in the widest sense. In this sense *techné* is a way of revealing, a way of bringing-forth qualities of the world that surrounds us. It is something poetic.<sup>7/8</sup>

What distinguishes techniques is not only what they make possible, but that they reveal qualities of the world and makes them visible or recognizable. The use of a technique is a special kind of cognition. In this way the available tools and techniques play an important part in the construction of our understanding of the world, and they have a decisive influence on our conception of the world that surrounds us.

### **The tool – a frame of experience**

In contrast to Heidegger, who is primarily interested in the general interaction between our techniques and our understanding of the surrounding world, Don Ihde (philosopher of technol-

ogy) is interested in the frame of experience so to speak, that is linked to every single tool. How the wall, for example, is experienced through the nail and the hammer, when we drive a nail into the wall. We experience the wall when it gives room to the nail, and feel whether it is hard or soft inside. An experience of the wall that is different from how we would experience the wall without the hammer, with your hands, eyes and ears.

In this transformation of our experience, which is linked to the use of every tool or technique, Don Ihde has pointed out two invariants in his book *Technics and Praxis*<sup>9</sup>

When we use a tool or technique our perception of the thing or material we work on is transformed, and in this transformation some qualities are amplified and others are reduced.

This phenomenon he exemplifies very tangibly with the image of how a dentist uses a probe to examine our mouth and teeth.<sup>10</sup> The probe makes it possible for the dentist to feel small cracks in the tooth or a soft spot telling that a cavity is developing. That means the probe reveals micro-features of the tooth that you could not see with the naked eye or feel with your fingers. At the same time there are some features of the mouth and the tooth that the probe cannot pass on, like the shine of the enamel and the moisture of the mouth. When using the probe the perceptual experience is transformed and some aspects of what is examined become amplified (cracks and cavities) and other aspects are reduced (the shine and the moisture).

The direct perception, without using a tool like the probe, is not more true than the perception through the probe, they are just different.

What Don Ihde is stating is that when we recognize that the tools or techniques that we use also define the frames of perception, it has extensive consequences for the understanding of our knowledge about the world. Not only concerning the knowledge we have as individuals through our daily practices, but also when it comes to our collective knowledge, as gained through science.

What does this mean if we turn our attention towards architecture? The described structure of amplification and reduction in our perceptual experience that is linked to the use of any tool or technique, applies also to the tools and techniques that the architect employs.

### **The tools of the Architect**

The work of the architect is an indirect praxis. He develops the forms, specifies the structures and materials that form the basis of the construction of the building, but he does not build the building himself. In contrast to the craftsman the architect works primarily through representations, they are his tools. Like the tangible tools of the craftsman, the representational tools of the architect amplify some features or qualities of what is dealt with, while other features are diminished (and thereby perhaps overlooked). In this way the tools that the architect uses influence his understanding and knowledge about the design he is creating.

The most important tools of the architect are drawings (plan, section, elevation) and models, and of course their digital equivalents.

With these tools it is possible for the architect to try-out different solutions and to communicate them without building them. Firstly, in the design process the architectural tools are used in an

ongoing testing of possibilities, as a kind of dialog between the architect and his model or drawing. Secondly the architect can, by forming his drawing or model in a way that communicates his idea best, pass on a picture of the building before it is built, and in that way form a basis for a dialog between the architect and his client. And lastly, the architect can through working drawings communicate the form of the building and its execution very precisely to the workmen who are constructing the building.

But as argued before, the architectural representational tools are not mere neutral expressional tools, they do also constitute a certain frame of perception and cognition

And the digital tools that are used in present day architecture will amplify other features of what is sought described by the architect, than the will the analogue drawings and models.

### **The coding of form and line**

When we look at a plan, a section or a 3D depiction on the computer screen in Microstation, Auto CAD or any CAD software system it looks at first glance like the corresponding depiction drawn by hand. The projective relation between the drawing or the model picture and what is depicted is the same in both cases. But the CAD drawing or model contains more information than its analogue counterpart: In the numerical information that lies behind every form in a digital drawing or model is the basis information for calculating amounts and prices, management of the construction process, or simulations of e.g. day light, thermal conditions, fire development and so on. But in order to use that information the geometries have to be coded.

To utilize these possibilities the production drawings or models made in CAD are in most countries integrated in a communication community in the building trade where every geometrical object has a code that refers to material, structural function or the consultant responsible for the line. Thus, on the screen it is visible whether the wall is made of in situ cast concrete, concrete elements, brick or wood. The window differs from the wall, the beam differs from the ceiling and the partition wall differs from the exterior wall and so on. Graphically these differences become visible because the wall is coloured blue, the window is green, the partition is white, the floor is yellow, the beam is red and so on.

Likewise the colour of the line tells which of the given consultants is responsible for that specific line or element of the building.

This means that the individual features of the building are amplified and made very visible by the drawing or model, thereby reflecting the building as an assembly of parts, not as a unity. It is the composite quality of the building that is emphasized.

The amplification of these features in the digital drawings and models makes them quite different from their analogue orthographical or perspective counterparts. Here the building is shown more uniformly unless one takes pain to separate different parts or units or materials with colours. What is new in the digital tools is that this division is an integrated part of the every view of the building during the design process.

Of course this is only one of several ways of looking at the planned building in a design process. Perhaps one concurrently works in more spatially illustrating 3D visualizations, or in physical

models, or in black and white prints. But no matter how one works in the initial stages of the design process, it is common for most building projects that the planning for the execution of the project in the final stages of the design process is produced in CAD (planning) programmes, with the described coding of every line or object.

What is interesting is that the way CAD tools emphasize the composite qualities of the building seems to influence choices made in the design process. As we will see in the Town Hall in Ijsselstein made by the Dutch architectural office UN Studio, the coding of every part of the building becomes an important basis for the architect's aesthetic decisions and perhaps also for his very concept of what a building is or might be.

### **The Town Hall in Ijsselstein**

The town hall is a very complex building compounded of many different units. No structure is determining the form or division of the building. On the contrary the building consists of many overlapping structures. A complexity that perhaps reflects the freedom that digital planning gives: The complex form is as easy to draw, detail and execute as the simple one.

Every part of the building is accentuated as a separate part or unit: The triangular form of the café room is separated from the town hall lying on top of it, with a different angle.

Every room and every function is emphasized with a form, a height or a material that differs from the room or function next to it. This applies to the three parts of the building (the town hall functions, the administration and the culture centre) and to every room within these three parts. And within each individual room both its conceptual and functional parts are accentuated with shifts in material or intersecting forms.

In contrast to all these different forms there are a few coherent elements in the building. A wedge shaped form is linked to the circulation; wooden panels refer to the actual town hall functions. And the thin green fold of the glass façade is a membrane around all these differences and shows the limit of every part, not only externally to the surroundings but also internally between the parts of the building. These connecting elements traverse the different floors and individual rooms. In this way every function of the building is coded with form and every material is coded with meaning.

The focus in the design is on communicating the different parts and functions that every room consists of, rather than forming an integrated unity. And the emphasis on the composite quality of the different functionalities and rooms is made are through difference of form and material, rather than through difference in spatiality.

You can see the different elements that cut through the room: The wooden panelling in the town hall, that stops where the seats for the public are placed, with exception of for the wedge formed passage with wood on the wall and the floor, (that you can see at the right side of the picture, behind the chairs) that connects the hall to the administration.

The system or meaning in this coding of form and material in the building is impossible or at least very difficult to perceive when you are inside the building. In printed drawings and in physical

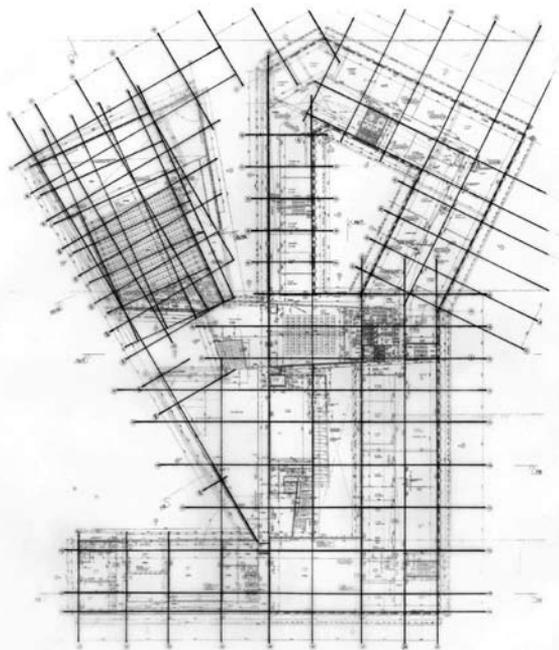


Figure 1 Plan of the Town Hall with module lines accentuated

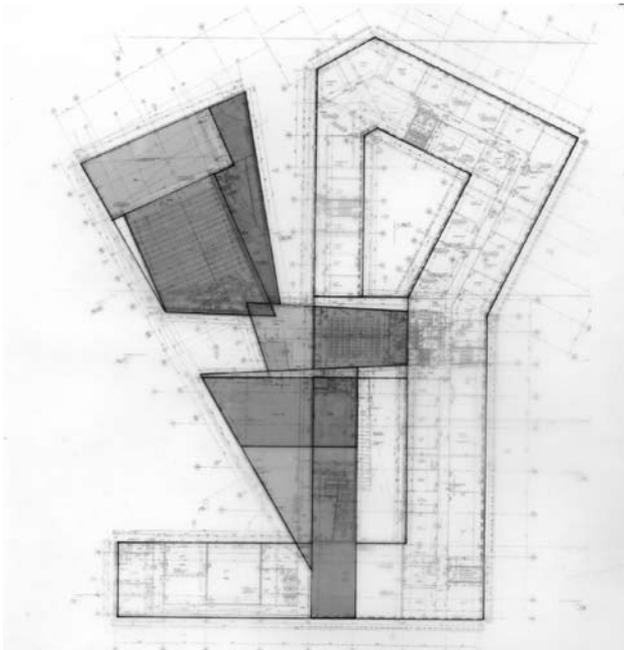


Figure 2 Plan drawing of the Town Hall, with all the different units emphasized with a shape.

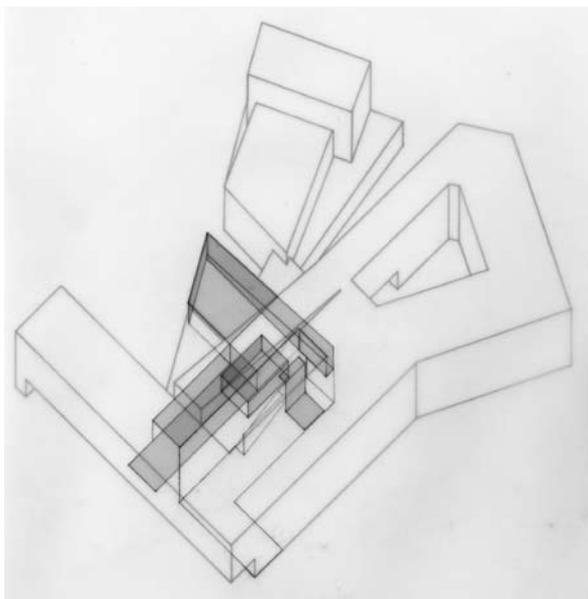


Figure 3 Axonometric view showing the wooden panelling in the public town hall functions

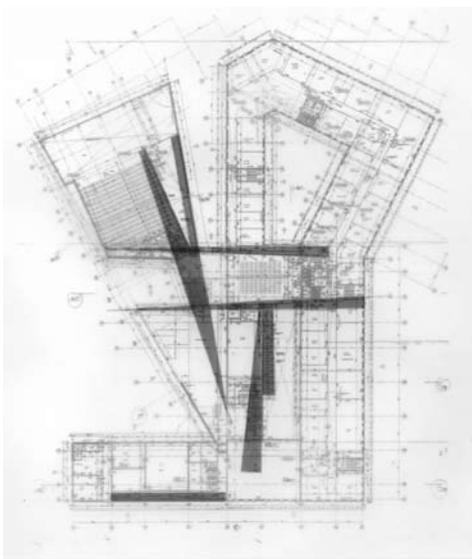


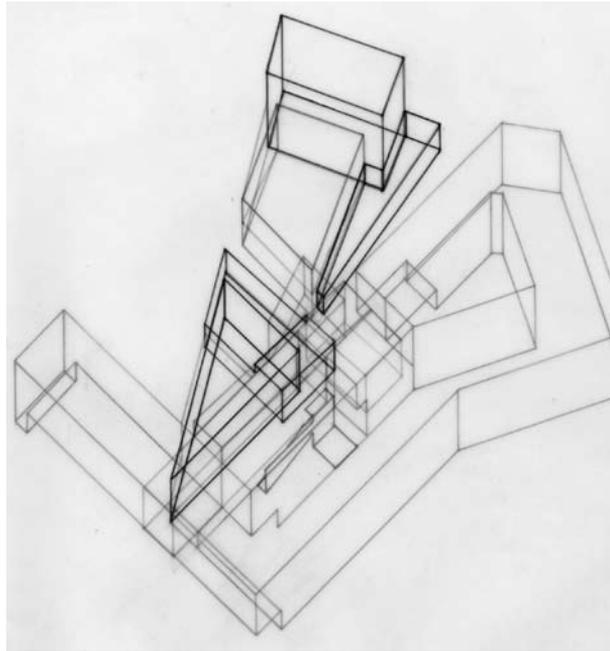
Figure 4 Plan drawing of the wedge shaped circulation lines



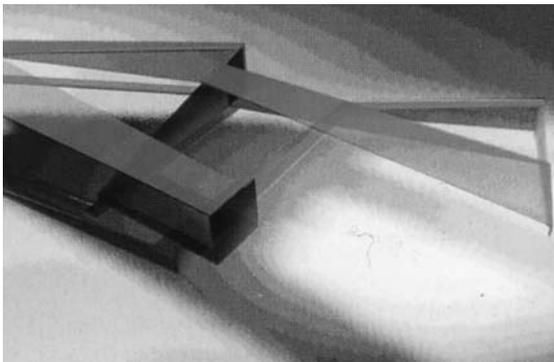
**Figure 5** The town hall, where the public functions and the administrative functions of the building meet.



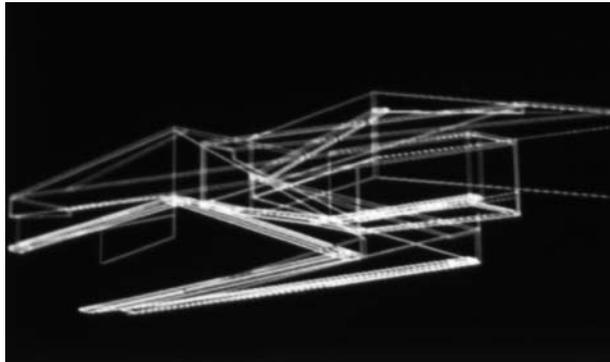
**Figure 7** 3D puzzle



**Figure 6** Axonometric view of the building with the functional units drawn in different colours



**Figure 8** View of the circulation in the building – sketch from the initial phases



**Figure 9** Wire frame – all the different parts of the building are separated with colour.

models it is impossible to see. But on the screen in CAD planning or modelling software the many different entities would show and the traversing forms and materials would be visible as clear patterns.

The amplification of the composite features of a building in the CAD planning tools becomes a point of departure in the design process. An amplification that seems to further an understanding of a building as an assembly of equally important parts, rather than as a unity with integrated subordinate parts.

It was primarily digital tools (Auto CAD and 3D studio) that were employed in the design process that preceded the Town Hall in Ijsselstein, supplemented with analogue cardboard models that all were in a size that suggests that they were primarily made for conceptual considerations.

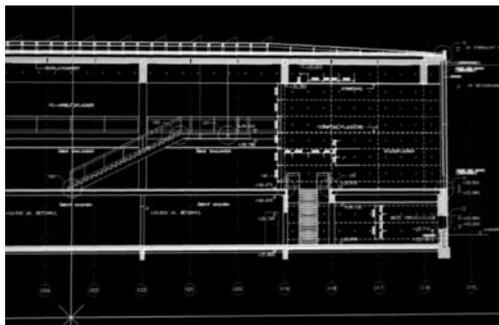
### The University Library in Roskilde

In the design process that preceded the other example – The University Library in Roskilde by Henning Larsen Architects, hand drawings was used in the initial phases. After these initial rounds CAD (Micro station) was employed until the final execution drawings. 3D modelling programmes were not used, but all the way analogue cardboard models in a scale that made them useful for studies of the internal space supplemented the analogue and digital drawings.

The library is a much simpler building than the town hall in Ijsselstein. It consists of two parts: an open library hall with glass façades on the three sides of the hall and a more closed long wing made of bricks, containing offices, lecture and meeting rooms and supplementary functions to the library.

Inside the two parts of the building these two different ways of making space are emphasized. In the open library hall, every element in the room is accentuated as a thing in itself: The structural elements are separated from the façade, and likewise from the roof. The floor between the ground floor and first floor is withdrawn in order to separate it from the vertical structural element. And every other element and fitting is likewise distinctly separated from each other.

In the long wing every element or detail is fitted to the next, so they create a continuous surface: the suspended ceiling is in the same level as the bottom side of the beams, the windows are holes in the wall in order to accentuate the box quality of the wing.



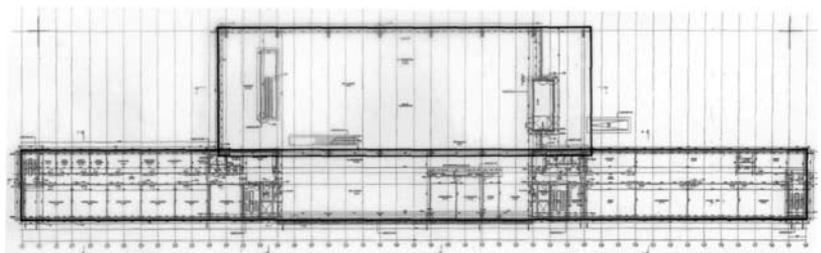
**Figure 10** section of the building on the screen in Micro station



**Figure 11** View of the library hall.



**Figure 12** View from the balcony on the first floor in the wing.



**Figure 13** Plan drawing showing the two parts of the building, the library hall and the long wing containing the secondary functions

There is, as in the Town Hall, an emphasis in the design on the functional differences that the building is compound of, but in the library it is primarily done with making spatial diversity. Having said that, there is also in the detailing, like in the town hall, an emphasis on all the different parts and elements the library consists of. Every element is a thing in itself, whether it fits to the next like in the long wing or is accentuated as a free element as in the library hall, though it is not as explicit as in the Town Hall.

I find it reasonable to link the accentuation of the composite quality of the building in both examples to the amplification of the same features in the digital tools. The inherent qualities of the latter having influences choices made in the design process.

This influence from the tools applied in the design process is of course a general phenomenon that can be observed in relation to the analogue orthographical drawing used by architects before the digitalization as well, (see my Ph.D. Thesis *Drawing and Building – a study of the relation between the tools of the architect and the built work of architecture*, Kbh. 2005).

Certain tools amplify or visualize certain qualities/properties of the material we work on and influence the way we see and understand and as a consequence of that, form the material.

For architects there is, I believe, importance in acknowledging that tools we use are not only instrumental means to an end, but also influence and to some extent frame our understanding of architecture in a time were new digital tools and technology every day open new possibilities.

## Notes

- 1 Ibid .p. 70
- 2 Ibid. p. 70
- 3 Ibid. p. 72
- 4 Ibid.p. 71
- 5 Martin Heidegger, *The Question Concerning Technology*, in Basic Writings ed. David Krell, New York 1977, from German 'Die teknik und die Kehre', Stuttgart 1957/1962
- 6 Ibid. p.295
- 7 *Techné belongs to bringing- forth, to poiésis; it is something poetic.* Ibid. p. 294
- 8 *Thus what is decisive in techné does not lie at all in making or manipulating nor in the using of means, but rather in the revealing mentioned before. It is as revealing, and not as manufacturing, that techné is a bringing-forth.* Ibid. p.295
- 9 Don Ihde, 'Technics and Praxis', Dordrecht 1979, p. 21
- 10 The referred example is taken from Don Ihde, 'Technics and Praxis', Dordrecht 1979, p.18-21

