



# ARCHITECTURE TRANSFORMED – ARCHITECTURAL PROCESSES IN THE DIGITAL IMAGE SPACE

**HUBERT LOCHER, DOMINIK LENGYEL, CATHERINE TOULOUSE, FLORIAN HENRICH**

**ABSTRACT** | The production and conception of architecture are not only shaped by the technical-constructive aspect but also by their visual representation. Since the 1980s, with the advent of digital technologies for the design and visual representation of architecture (computer-aided design), far-reaching changes have occurred, resulting in fundamentally new possibilities for linking technical design and visual reproduction (computer rendering to virtual photography). This cooperative project undertakes an investigation of these essentially process-related relationships outlined here in design and visualization during the transition phase from analogue to digital planning and display format methods from 1980 to the present. In exemplary studies on the use and application of the new tools and their visual products (images), the aim is to determine how the 'digital image' has changed the concept and production of architecture from the perspective of art history and media criticism on the one hand, and the production aesthetic point of view of architectural and architectural image production on the other.

**KEYWORDS** | architecture, Computer-Aided-Design (CAD), interdisciplinary collaboration, digital image, visualization

## Idea and concept of the project

The project entitled "Architecture Transformed - Architectural Processes in the Digital Image Space" is one of the projects of the DFG priority program "The Digital Image", which is largely based on the connection of two partners with very different profiles. These are on the one hand Hubert Locher, who holds a professorship in art history with the focus on "History and Theory of Visual Media" at the Philipps-University of Marburg and acts as the overall director of the project, and on the other Dominik Lengyel, incumbent of the Chair of Architecture and Visualization at the Brandenburg University of Technology Cottbus-Senftenberg, as co-director and project editor of the Cottbus subproject. The project coordinator and researcher in Marburg is Florian Henrich, the project research in Cottbus is managed by Catherine Toulouse.

At the center of the joint project is the question of the role of the digital image, of the digital visual representation of architecture in the course of architectural production in the decades from 1980 to the present, which has been significantly and increasingly influenced by digitization. Its aim is to examine the assumption of a media-specific imprinting of the architecture by digital design and presentation methods during the design process and the representation that continuously accompanies it.

When we speak in this context of architectural production and of architectural processes, we want to emphasize that we understand architecture as a complex process supported by several actors, at the end of which there may be a built artifact, but whose actual product is generally architecture as a multi-layered concept. The physically tangible and spatially perceivable building made of concrete, metal, wood, stone, glass is a part of the whole, it is the material reference object on which is tested and in which is realized what has previously been worked out and negotiated in a complex design process.

In this creative process, according to one of the basic assumptions of our project, visualization plays a central role in principle, because we build according to ideas that have to be articulated, visualized, modeled – in a word ‘visualized’. Such ideas are always informed by already existing ‘images’, and it is by no means true that it is only images of completed buildings that shape the concept of architecture. The idea of a building requires visualization, undertaken in different ways and in different formats, both for its elaboration in the iterative process of design and for its material realization. From the initial concept as a sketch through the model-based presentation in a competition, and on to the designed representation for communication and marketing purposes, methods of visual modeling and pictorial representation are used throughout – from the drawing to the built model and photography. While the design of a building is already created by means of different pictorial procedures, the finished building itself is still marketed using pictures. The same applies, of course, to those architectural ideas that are not designed for realization from the very beginning, whether as social utopia or as technological visions of the future.

Whether as an idea, a concrete design or a physical object, architecture is always dependent on being conveyed by means of images. In this respect, we assume that the various aspects of pictorial representation, together with the associated media transformations, are to be seen both as integral parts and as processual components of what finally appears as architecture. It can therefore be supposed that architecture is fundamentally shaped by the image.

This may be generally have been true ever since pictorial representations of architecture have existed, but the meaning of the pictorial is historically variable. As early as 1994, Beatriz Colomina, for example, convincingly argued that since the beginning of the 20th century, with the wider availability of photography and the imminent flourishing of illustrated journals, architecture has become a mass media phenomenon – with significant consequences for architecture itself.<sup>1</sup> In this sense, Cervin Robinson and Joel Herschman, in their 1987 *History of the Photography of Buildings from 1893 to the Present*, entitled *Architecture Transformed*, also pointed out the mutability of what is understood and presented as architecture depending on the way it is presented in the media, in this case its photographic representation.<sup>2</sup> Not only did this change communication about architecture, the images received not only have a retrospective effect as documentation, they also change ideas prospectively. The reproductions result in new images, new concepts and ideals.

This is where our considerations start, assuming that from around the mid-1980s onwards there would once again be a far-reaching media reshaping of the architectural, in that the spectrum of visual information of the architectural process would gain in importance in the age of digitally supported architectural production and would be reformatted and spelled out in many different ways (fig. 1). Once again, we think, there is a transformation of architecture under the sign of the pictorial, which is now no longer the photographic light image, but an image that can be determined in a genuinely different way, namely the digitally generated architectural visualization.

Our project is about considering architecture as this digital image in digital space and its effects on the idea and concept of the architectural. With the advent of digital design and display tools and the associated development of computer graphics – this is its central hypothesis – a rapid and fundamental change in media took place between 1990 and 2000: the almost complete replacement of analogue design representation by digital images. Our goal is to grasp the drastic changes to which this medial change has led in the course of digitization, both at the level of architectural design and at the level of visual architectural representation.

In hardly any other area of design has digitization been so clearly reflected and led to such comprehensive transformations as in architecture. Due to the peculiar hybrid position between art and engineering, the transformations through digitization have an effect on several levels: firstly, in the area of technical construction and building practice; secondly, in the artistic figuration of the building and thus in the visual representations of the respective phases; finally also in communication, the promotion and marketing of architecture.

Research has focused primarily on the consequences of digitization for architectural production in terms of the design process, its tools and results<sup>3</sup>, as well as on questions of digital imagery and virtual simulation<sup>4</sup>. In contrast, the aspect of the visual representation of architecture in the digital age has so far received only sporadic attention.<sup>5</sup>



increment (for example: a minute) thereafter.  
 Example: Ten minutes after the criteria statement the machine checks for the specified state once a minute.

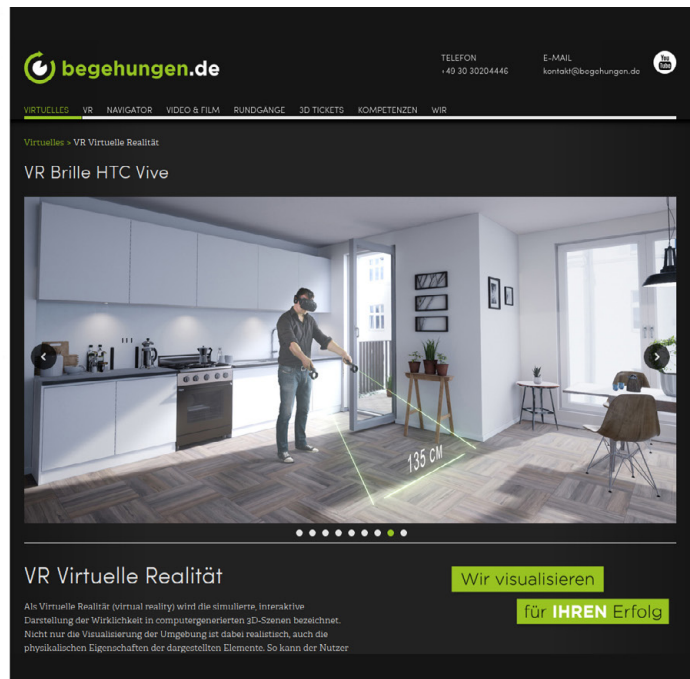


Figure 1. left: Program URBAN 5; ARCH+, no. 4 (October 1968): 67; right: www.begehungen.de; November 2020; screenshot.

The project attempts to do justice to this duality of design and representation, of construction and representation, of design and image as one of the specific characteristics of architecture through the cooperative structure of its research approach. Instead of starting from the simple assumption of a deterministic relationship between the design and image tools and the results produced with them, the aim here is rather to arrive at a theoretical reflection of the possible effects and impacts of the digital architectural image on the production, reception and interpretation of architecture in the age of digitization on the basis of an art-historical recording and description of the phenomenon, on the one hand (Marburg subproject), and a practice-oriented architectural, scientific and empirical analysis on the other (Cottbus subproject).

The two starting points for our research will be, firstly, the spread of the digital image of architecture and its reception within the discourse on the practices and effects of the increasing digitization of architectural production, which has been in the process of self-differentiation since the 1980s (fig. 2), as is comprehensible in the contemporary journal literature. Secondly, the digital design and image tools will be analyzed with regard to their concrete effects on the results achieved with them within the framework of an empirical study. The overarching question is here whether specific software-related, visually mediated standardization tendencies within design and architectural image production can be identified, named, and traced back to the use of digital design programs.

Once both subprojects have thus taken up starting positions as far away from each other as possible, the goal is to come closer and closer together through a permanent exchange of work and to continually increase the common intersections until finally the results of both projects culminate in the joint exhibition planned for its conclusion.

The exhibition "Architecture Machine", which opened in October 2020 in the Architekturmuseum in Munich, is a direct testimony to the topicality of the crucial question for the project.<sup>5</sup> Particularly relevant for our project, however, is the book published by Inge Hinterwaldner (fortunately represented with her own project in the SPP "The Digital Image" and certain to be an important and exceptionally competent discussion partner for us) and Sabine Ammon in 2017 under the title *Bildlichkeit im Zeitalter der Modellierung*<sup>7</sup>, which emphasizes the importance of pictoriality in the digital design process, most emphatically also because the significance of imagery, in the digital design process especially, but also in the entire architectural discourse in general, is always controversial.



Figure 2. left: "Thema: Computer-Aided-Design – Zum Stand der Kunst"; ARCH+, no. 77 (November 1984), middle: CAD: Architektur automatisch? Texte zur Diskussion. Braunschweig and Wiesbaden: Bauwelt-Fundamente, 1986, right: digital real: Blobmeister, erste gebaute Projekte. 2001.

This is where we would like to start and, in the sense of Ammon and Hinterwaldner, decisively underline the conceptual part of the image. In doing so, however, our focus is not only, and not primarily, on the design process, nor on the technical modeling, but rather on the part that the digitally generated image plays in its own right in both architectural discourse as a means of communication and representation according to its particular aesthetics, and in the negotiation process of what architecture should be and how it should appear.

## Marburg Subproject

When we ask in our project about the role and influence of the 'digital image' on concept and form of architecture from the 1980s to the present, "Architecture Transformed" is intended to indicate that we are starting from at least three different levels on which such transformative processes can be observed: firstly, the level of visual representation of architecture and the dependence of representation on the medium of representation; secondly, the architectural design process and the shaping of the design result by the design tool; thirdly, the level of the media reception of architecture and its effects and repercussions on architectural design.

While image production and the question of the design consequences of digital design tools are the starting point for the investigations in Cottbus, we want to complement this in Marburg by expanding the perspective to the aspect of reception. We want to focus not only on the digital image of architecture itself, but also on its manifold media usage contexts of communication, mediation and marketing of architecture.

We are particularly interested in the way in which the digital image of architecture influences those who deal with it. Digital architectural representations are ubiquitous, from the high-quality and artistically sophisticated design visualization on the homepage of the architectural office or in the architectural competition, through the lifestyle design magazine and the advertising of the construction or real estate company, to the trivial sign on the construction site.

Already in the design phase, the digital architectural image can evoke such a concrete idea of the future building through the creative possibilities of simulating a hypothetical situation suggestively or even persuasively close to reality and turn the prospective design into a fixed idea, that this can sometimes lead to considerable conflicts, as the example of the Elbphilharmonie Hamburg shows particularly clearly.

Last but not least, those who design and visualize architecture themselves are not exempt from the influence of the digital image of architecture, including the architects themselves, who play a decisive role in the production of architecture and images. This raises the question of whether a dialectical relationship can ultimately be assumed here, i.e. whether and to what extent digitally generated architectural image worlds in their specific visual composition and their own aesthetics have an impact not least on those who themselves design, construct, and shape architecture, and thus ultimately on the architectural artifacts of the present. This is the hypothesis to be investigated in the Marburg subproject.

What becomes evident at the same time, however, is the fact that it is not only the designing architects themselves who produce digital architectural images, but also external professional agencies that have specialized in the service of architectural visualization. In the face of such obviously deliberate atmospheric staging and the stimulation of emotions by depictions that aim to achieve this, it seems quite appropriate to speak of architectural image worlds.

It very quickly becomes clear that this obviously here concerns a lucrative business with an accordingly developed market, as can already be ascertained by means of a simple Google search inquiry. On the other hand, it should not be overlooked that the practice of external architectural visualization has a long tradition reaching far back into the pre-digital age. Rather, it leads to the fundamental question of the general relationship between design and visualization in the process of architectural production. This question seems to play a not insignificant role in an investigation of the effects of digital design and imaging tools on the results achieved with them.

The situation becomes even more complex due to the fact that digital photography under the keyword "HD" [High Dynamic Range Image] is currently showing tendencies that signify a stylistic transformation of the image away from the 'classical' photographic appearance with its still effective promise of reality and objectivity towards a somehow 'artificial' image aesthetic. Likewise, in the field of computer visualization under the keyword "CGI" [Computer Generated Imagery], the trend towards ever more perfect realistic representation continues. One consequence is that it is increasingly difficult, at least for the untrained eye, to distinguish the digitally post-processed photographic image of a real building from the digitally generated 'photorealistic' visualization of a prospective design. Not only does the 'photorealism' of digital architectural visualizations seem more convincing than just a few years ago; rather, a convergence of digital and photographic image aesthetics currently seems to be the case, with the border between the two becoming more and more blurred.

The influence of such digital image worlds has apparently reached such a point that today, when walking through the new development area, over the freshly redeveloped wasteland or the area of the former freight station, one often has the feeling: "Hey, I'm standing in the rendering!"<sup>8</sup> (fig. 3)

In Marburg, we want to get to the root of this phenomenon by considering the change from the analogue to the digital image of architecture itself as a media transformation process. What we intend to do is to grasp the digital image as a medium of design representation both as an aesthetic and discursive phenomenon and to trace its genesis, its use and its discussion.

Our starting point is the question of the role of the digital architectural image in the formation of stylistic concepts about what 'digital architecture' is. The focus is on possible correlations and mutual influences between, on the one hand, the introduction, spread and establishment of digital architectural representation and, on the other hand, the development of those images and conceptual concepts of 'digital architecture' that were first introduced in the years around the turn of the millennium with the term 'blob'. The historically extremely short-lived phenomenon of 'blob architecture' serves here, however, merely as a first tangible peak and thus as an entry point into a much larger field of topics that must be considered, namely the contemporary debate on the digitization of architecture, which began in Germany around the mid-1980s at the latest.

In order to work on these questions, we use the medium of architectural journals in Marburg, which will be surveyed as examples to systematically trace and analyze the entry of the digital image of architecture from 1980 to the present in the context of in-depth journal research, namely on the basis of *ARCH+* and *Bauwelt*. Both are renowned professional journals that complement each other in an almost ideal way due to the differences in their thematic conception, their content orientation and their journalistic function. Although both are German-language journals, the continuous reporting on international competition events and the debate on current issues that



Neue Zürcher Zeitung

## «Hey, ich steh im Rendering!»

Am Computer erstellte Bilder spielen in vielen Bereichen eine grosse Rolle. Als Architektur-Renderings simulieren sie die Zukunft, als gäbe es sie schon. Mit Folgen für die Wirklichkeit.

Andrea Roedig 3.11.2015, 05:30 Uhr

Figure 3. left: Overbuilt industrial area in Leipzig; completion 2019; photo: Florian Henrich, right: Article by Andrea Roedig in NZZ; November 3, 2015.

extends beyond national borders also enable the international dimension of the development and dissemination of the digital architectural image to be kept in mind.

Magazines generally offer the advantage that they usually have both an image and a text layer. Thus *ARCH+* and *Bauwelt* regularly contain not only up-to-date visual material that can be captured and analyzed over time, but also descriptive, reflective, commentary and evaluative statements that reflect the respective contemporary opinions and views on the phenomenon of 'digital architecture'. These kinds of statements are available as texts of different formats and can be made accessible to scientific analysis via a corresponding methodical access. On the one hand, they offer the opportunity to discursively reconstruct the chronology, stages and central statements of the contemporary debate on 'digital architecture' accompanying the process of digitization. Equally, they make it possible to check, contrast and, if necessary, correct common assumptions or historiographical narratives about the history of 'digital architecture' that are in the process of being formed today.<sup>9</sup>

All the issues of all 40 volumes of both journals were systematically and completely reviewed, photographically recorded and documented, the results being stored as Excel tables together with the photos in a common cloud, which serves as a project database. The image and text material prepared in this way can be viewed there by all project participants and used for subsequent evaluation.

Regarding the content evaluation of the picture material contained in the journals, three different dimensions are in the foreground: Firstly, the qualitative development of the digital architectural image is to be examined, which is to say, an initial image-critical-aesthetic determination is to be established. It is necessary to work out significant quality changes and shifts as well as the creative specifics of digital image aesthetics and to classify equally different image types and to identify standardization tendencies in terms not only of presentation conventions or image formulas, but also of approaches to image design. Secondly, the quantitative dimension of the media diffusion of the digital image of architecture in architectural journals will be investigated chronologically. Thirdly, it is necessary to comprehend the establishment of digital design representation as a separate pictorial genre and to critically explore its functions as an image in typical and specific contexts of use.

On the textual level, the following questions are initially of primary interest: How is the digital architectural image commented on and discussed by contemporaries? Which advantages and disadvantages are attested to it in comparison to analogue representation methods? What status is it assigned? What is the relationship between the development of digital design visualization and that of CAD tools? Which interactions exist? At what point does digital design representation emancipate itself as an independent genre of architectural visualization?



Figure 4. Rüdiger Kramm; Computer drawing without and with revision; *ARCH+*, no. 77 (November. 1984): 40f.

Journal research was started in January 2020, beginning with *ARCH+*. To conclude, here are a few initial observations mentioned (status year 1996):

- The digital architectural image found its way into *ARCH+* at the beginning of the 1980s in graphic mode: as a plotted CAD drawing that is often revised manually (*ARCH+*, no. 77 (Nov. 1984), 40/41) (fig. 4).
- As an independent, applied design visualization, the 'digital image' first appeared in 1988 in the context of "de-construction by computer" (*ARCH+*, no. 96/97 (Dec. 1988), 52/53).
- In terms of quantity, however, the digital image of architecture rarely appeared until then. Until the mid-1990s, the predominant medium of representation was without question physical model photography.<sup>10</sup>
- On a discursive level, the sequence of topics dealt with shows how the reflection on designing with the computer begins in the mid-1980s. Step by step, a discussion about a completely new approach to architecture unfolds, which is far more complex in its range of content, goals and motives than buzzwords such as 'blob' or 'parametrisation' would suggest.

All in all, as is already becoming evident here, it is a long way for the digital architectural image to go until the feeling arises: "Hey, I'm standing in the rendering!" In the mid-1990s this is definitely not yet the case.

## Cottbus Subproject

Complementing the art-historical, media-critical perspective on the digital image of architecture in Marburg, we want to examine in the Cottbus part of the project the influence of CAD on architecture and its mediation from the perspective of the designers.

First of all, we would like to briefly explain what is meant by CAD. In full text it means Computer Aided Design, i.e. the promising claim of designing with the help of the computer. In functional terms, however, it simply means that drawing and constructing is no longer done with a pen and ruler, but with the computer mouse, which clicks and drags predefined functions to the desired geometric position.



It is as abstract as it sounds. It is only a matter of familiarization that a line is the result of three clicks: the first one on the tool, the second one on the starting point of the line and the third one on the end point. Alternatively, both the selection of the tool and the positions can be typed in as text and numerical values, which renders the working method even more abstract. Of course, the touchpad has now also found its way into this field as an input tool, but the less precise controls will take another generation to make up for the once again unfamiliar indirect steering of a computer mouse.

Once CAD becomes three-dimensional, it becomes more complex, but the structure and the input are similar. However, the first danger already awaits us here, when well-intentioned offers to make working more convenient are all too readily taken up without being fully understood, not to mention critically questioned. They then lead to the so-called automatism, in which we see one of the most important reasons for the obvious convergence between tool and architectural result.

As architects we also design and visualize ourselves. Our specialization is the visualization of architecture. This includes above all the design in the visualization, but also the design of architecture and visualization in general in research and teaching. Our own experience with CAD dates back to 1986. At that time, CAD programs were only marginally represented in the field of architecture; the majority of architects continued to draw and design by hand until well into the 1990s.

Since then, the change from analogue to digital has largely been completed, both in offices and in research and teaching. As of today, practically no architectural office can be imagined without CAD.

This is why the influence of this tool seems to become so evident. The development of CAD programs is hopefully far from being finished, the list of desired features is practically endless. Up to now, no program has been able to meet all the demands of integrated planning. Basically, the programs are divided into two categories: on the one hand, programs specifically for architectural planning with connectivity to databases and exchange between specialists, engineers and urban planners – so-called integrated planning – and on the other hand, programs with geometrically precise definition and at the same time the highest possible degree of flexibility, which are commonly used in mechanical engineering and industrial design. Attempts to combine the two genres have so far almost inevitably led to concessions to their most highly developed competitors.

For both program types we have selected representatives who were trend-setting for different reasons. The concept of “Building Information Modeling”, or BIM for short, has been established at the latest since the program *ArchiCAD* came onto the market in 1984. It means that not only are lines defined, which can then be combined to form surfaces or bodies, but also that objects are defined which have a clear function right from the start. BIM constructs a wall, a ceiling or a roof.

This so-called object-oriented construction method enables integrated mass determinations, cost estimates and interfaces to specialists such as civil engineers. The complexity of this implementation for architecture, however, when the design goes far beyond standard buildings in its formal language, can unfortunately still be seen in most buildings designed with BIM, a circumstance, which will probably disappear in the long term with the revival of BIM, which has gained considerable momentum in recent years.

The original and almost contradictory concept for this is that of free drawing in surface and space, which only provides for an interpretation as architecture in a second step. In 1998, sixteen years later, a new development was published based on the long-time undisputed *AutoCAD*, which exceeded the limited geometry of BIM programs: In contrast to *AutoCAD*, long considered overloaded, the CAD program *Rhinoceros* combines an intuitive interface with geometric versatility that far exceeds the needs of the majority of architects.

With *Rhinoceros*, a movement that began much earlier is now becoming more and more established. The extent to which the accuracy of fit of the tool determines the action, the workpiece, becomes clear when looking at the use of the computer by particularly progressive architects such as Peter Eisenman or Frank Gehry (fig. 5 right), who designed or realized their iconic early work with another CAD program, *CATIA*, which is even older, namely from 1977, and which was not developed by architects but by the aircraft industry in order to achieve the precision in modeling required for aerodynamic performance. The handling of *CATIA* is accordingly anything but trivial, moreover the demands on computer hardware at that time were significantly higher than those of today's PCs.

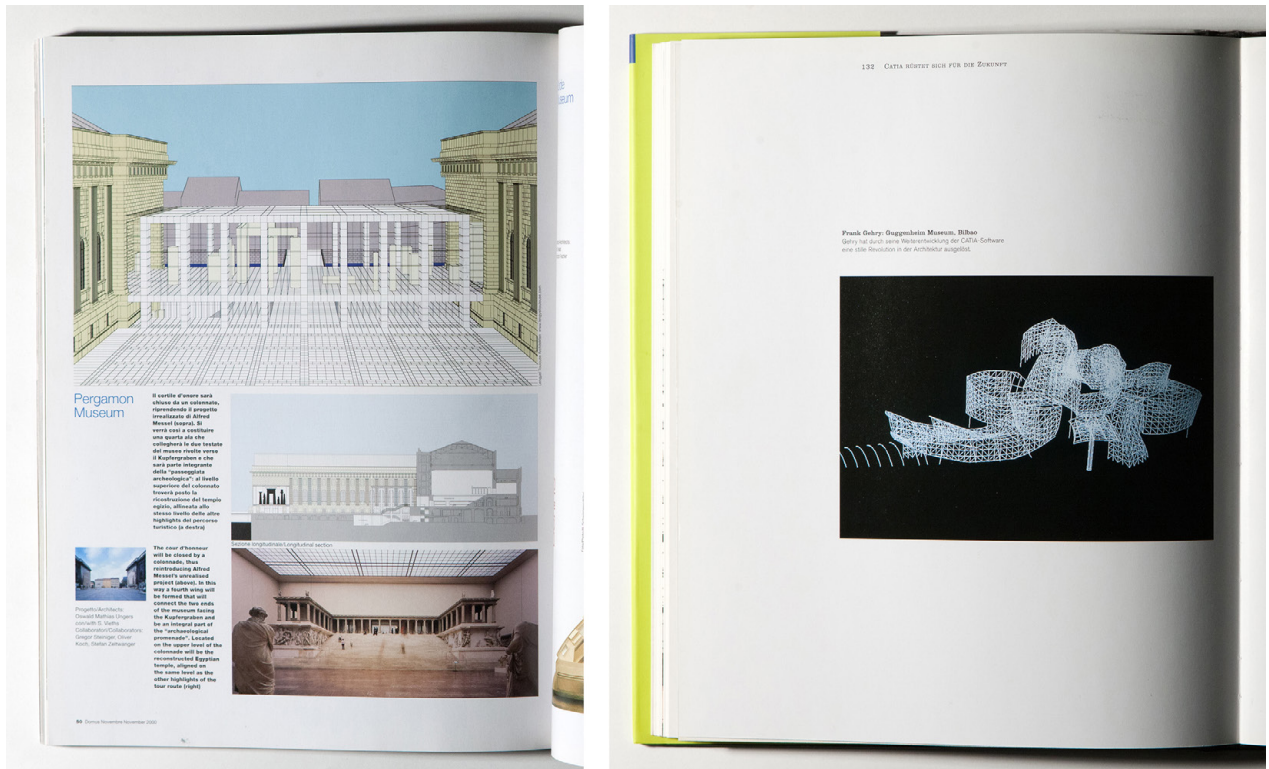


Figure 5. left: O. M. Ungers Office; Pergamon Museum Berlin; visualization: Lengyel Toulouse Architects; DOMUS ((November 2000): 50), right: Frank O. Gehry; Guggenheim Museum Bilbao; J. Steele. Architektur und Computer. Munich: Callwey, 2001: 132.

On the other hand, the differences to the *ArchiCAD* program type are already apparent in the tools palette, which is both a blessing and a curse. Efficiency and automatism can only be distinguished from each other if there is a well-developed sense of design. With *ArchiCAD*, the simple, direct path to the result leads to the definition of such objects, which can be defined with as little effort as possible using the obvious tools: straight ceilings, vertical walls and sloping roofs.

In addition, especially with such specialized architectural programs, there are object libraries. Libraries facilitate planning by providing prefabricated objects. This remains relatively harmless for furniture or building hardware. All major manufacturers provide their furniture as CAD files, usually free of charge, for the simple reason that architects can use them in their buildings and later buy them or have them bought by their clients.

But more dramatically, such objects are used for architectural components such as windows and doors or entire roof dormers. In these cases library elements can lead to completely unreflected results. A prefabricated staircase relieves the architect of a great deal of work, especially if the geometry is a little more demanding, as is often the case with staircases. The regression of mathematical education has made it increasingly necessary to use computer-aided solutions even for such rather trivial problems that were routinely solved by hand in the times before the computer.

With *Rhinoceros*, in contrast, the decision for the right tool is not as easy. No tool alone can produce a component suitable for production planning. The path to the finished component is a series of successive steps, so that it is almost irrelevant whether you start with a cuboid or with a line curved freely in space. For furniture this makes no difference. But architectural components such as windows are not available in *Rhinoceros*, so the user cannot be tempted to use prefabricated components. Formal conflicts arise in cases where, for example, free forms of the outer shell meet rectangular forms such as doors.

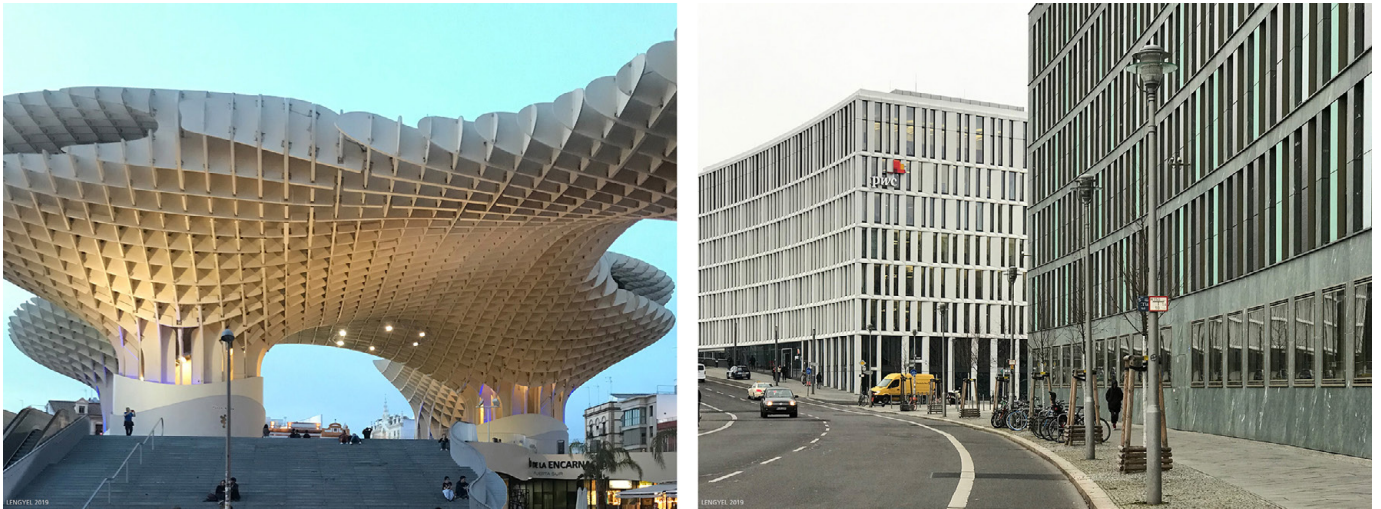


Figure 6. left: Jürgen Meyer H.; Metropol Parasol in Sevilla; finished 2011; photo: Dominik Lengyel, right: KSP Jürgen Engel Architekten; PricewaterhouseCoopers office building; finished 2015; opposite central station Berlin; photo: Dominik Lengyel.

Here too, the result is certainly determined by the creativity and enthusiasm of the user. Therefore, as a first step in the course of our project, we are also running an experimental design seminar for students of architecture, which will reveal the differences in the influence of the tool on architecture and visualization in direct comparison.

The seminar is designed to work on the same architectural task with the two opposing programs mentioned above – *ArchiCAD* and *Rhinoceros*. The subject is the classic design task retreat in the sense of a place of withdrawal for two people. The architectural vision is to be designed for a place that is only specified by a single photograph. This place is located literally and metaphorically on a green field. Beyond that there is no further concretization or restriction. The goal is the visual realization of the architectural imagination only. In contrast to the usual approach, the design here is not the complete building with floor plans, sections and views, in which the construction, details and calculations are then developed, but the digital image alone.

We understand the focus on the image not as a shortage of architectural depth, but as a commitment to visualization as the most expressive way of communicating an architectural idea. It can be said that only the image shows the architectural design intention in its genuine form, or in other words: the presentation is the project. With this task we attempt to empirically verify whether geometrically simpler software produces correspondingly geometrically simpler visions, while geometrically complex software produces likewise visions.

As CAD becomes more widespread in architectural offices, we can also observe collateral effects when these offices do not use the programs in the way they were intended. This can be considered a creative approach or just an efficient use as opposed to hand drawing. In our research project, therefore, in addition to the experimentally oriented examination of the effects of the various digital design tools in the context of the design seminar, we also want to examine cases from the visualization practice of larger and well-known architectural offices, which show how a pronounced design intent can resist the traps of seduction by CAD.

The architect Oswald Mathias Ungers, for example, did not use the *ArchiCAD* program for integrated specialist planning in the sense of BIM, nor did he use predefined library elements. His motivation was solely the digitization of the technical drawing using a software that is particularly easy to learn, more efficient reproductions, digital printing and the sending of data digitally to the repro service. Even in visualization, CAD was used as an efficient method of constructing linework perspectives. The result was images whose digitality completely vanished behind

their analogy to the earlier drawings of the office of Prof. O. M. Ungers, which had still been drawn by hand with ink pencils (fig. 5 left). In its early phase, the digital architectural image thus merely adopts the graphic mode of the technical drawing. Apparently, this is already indicated by the findings of the journal research (see above).

This rather restrained attitude towards CAD is contrasted with the open-minded approach, which attempts to find the architectural form through CAD (fig. 6). The influence of CAD is naturally more evident in such work, especially in the early days of CAD. As already mentioned, these include the architects Peter Eisenman and Frank Gehry, and later also Zaha Hadid and Greg Lynn. Even the architect Hans Kollhoff, whose architectural design is much more oriented towards the analogue era, helped CAD to develop a new visual language. His visualizations do not hide the digital, but combine a traditional architectural language with the possibilities of the digital image.

Our contribution as practicing architects to the joint research project is therefore also the examination of what is technically feasible. To this end, the third step is to assemble the development of tools for design and visualization with regard to the two exemplary programs *ArchiCAD* and *Rhinoceros*, sorted chronologically according to their versioning. In this way we want to relate the digital tools to the development of architecture and visualization as we find them in the material of the Marburg journal research.

Whereas in Marburg the central question is: To what extent does the digital image generally change the concept and perception of architecture, in Cottbus we are asking specifically how the digital image changes the shape of architecture. Our aim is to determine those architectural design elements or features that can be plausibly addressed as components of a 'digital architecture'. In accordance with our profession, this will have to be presented in the form of a visual argumentation.

As a result of our cooperative research project we expect to see a clearly recognizable connection between tool and image. We hope that it will be possible to express this relationship through images alone. For this reason, we are planning a joint exhibition at the end of the project, which will show the development of the architectural digital image using relevant architecture. For the first station of our exhibition, we are pleased that Hans-Dieter Nägelke from the Museum of Architecture at the TU Berlin has agreed to the use of his museum at the end of the first funding period.

## NOTES

<sup>1</sup> Beatriz Colomina, *Privacy and Publicity: Modern Architecture As Mass Media* (Cambridge: MIT Press, 1994).

<sup>2</sup> Cervin Robinson and Joel Herschman, eds, *Architecture Transformed: A History of the Photography of Buildings from 1839 to the Present* (Cambridge: MIT Press, 1990). See also Hubert Locher, "Zur Einführung: Fotografie als Darstellungs-, Entwurfs- und Gestaltungsmedium der Architektur im 20. und 21. Jahrhundert," in *Architektur Fotografie: Darstellung – Verwendung – Gestaltung*, ed. Hubert Locher and Rolf Sachsse (Munich: Deutscher Kunstverlag, 2016), 9–22; Hubert Locher, "Mythogene Fotografie – Architektur, Fotografie, Gemeinschaft," in *Architektur Fotografie: Darstellung – Verwendung – Gestaltung*, ed. Hubert Locher and Rolf Sachsse (Munich: Deutscher Kunstverlag, 2016), 178–203.

<sup>3</sup> For example Peter Zellner, *Hybrid Space: New Forms in Digital Architecture* (London: Thames & Hudson, 1999); *digital real: Blobmeister, erste gebaute Projekte*, ed. Peter C. Schmal (Basel et al.: Birkhäuser, 2001), exhibition catalogue; Carolin Höfler, "Form und Zeit: Computerbasiertes Entwerfen in der Architektur," PhD diss., (Humboldt University Berlin, 2009); *Wendepunkte im Bauen: Von der seriellen zur digitalen Architektur*, ed. Winfried Nerdinger (Munich: Ed. Detail, 2010), exhibition catalogue; Bernhard Langer, "Computerdarstellung. Vom Programm zum digitalen Ökosystem," in *Die Medien der Architektur*, ed. Wolfgang Sonne (Munich: Deutscher Kunstverlag, 2011), 157–168; Mario Carpo, *The Digital Turn in Architecture 1992–2010* (New York: Wiley, J, 2012); Svenia Schneider, *Blob-Architektur für das 21. Jahrhundert: neues Paradigma oder Relaunch einer ehrwürdigen Tradition?* (Marburg: Tectum, 2012); Sabine Ammon and Eva Maria Froschauer, eds, *Wissenschaft entwerfen: Vom forschenden Entwerfen zur Entwurforschung der Architektur* (Paderborn: Fink, 2013); Ekkehard Drach, ed, *Das Verschwinden des Architekten: zur architektonischen Praxis im digitalen Zeitalter* (Bielefeld: transcript, 2016); Carin M. Schirmacher, *Paradoxien des Digital Turn in der Architektur 1990–2015: von den Verlockungen des Organischen: digitales Entwerfen zwischen informellem Denken und biomorphem Resultat* (Berlin: Pro Business GmbH, 2018); Barbara Wittmann, ed, *Werkzeuge des Entwerfens* (Zürich: Diaphanes, 2018).

- <sup>4</sup> For example Jörg H. Gleiter, ed, *Die Realität des Imaginären: Architektur und das digitale Bild, Proceedings of 10th International Bauhaus Colloquium Weimar 2007* (Weimar: Bauhaus-Univ., 2008); Bernd Sum, "Simulation als Entwurfswerkzeug für den Architekten: Untersuchungen zur Integration in ein Curriculum am Beispiel der KIT-Fakultät für Architektur," PhD diss., (KIT Scientific Publishing 2017); Sabine Ammon and Inge Hinterwaldner, eds, *Bildlichkeit im Zeitalter der Modellierung: operative Artefakte in Entwurfsprozessen der Architektur und des Ingenieurwesens* (Paderborn: Fink, 2017). Likewise, the digitization of architecture itself has become the subject of historical research: Greg Lynn, ed, *Archaeology of the Digital: Peter Eisenman, Frank Gehry, Chuck Hoberman, Shoji Yoh* (Berlin: Sternberg Press, 2013); Andrew Goodhouse, ed, *When is the Digital in Architecture?* (Berlin: Sternberg Press, 2017).
- <sup>5</sup> Philip Ursprung, "Photoshop und die Folgen: Das Dilemma der Architekturdarstellung," in *Die Realität des Imaginären: Architektur und das digitale Bild, Proceedings of 10th International Bauhaus Colloquium Weimar 2007*, ed. Jörg H. Gleiter (Weimar: Bauhaus-Univ., 2008), 171–176; Dominik Lengyel and Catherine Toulouse, "Die Bauphasen des Kölner Doms und seiner Vorgängerbauten: Gestaltung zwischen Architektur und Diagrammatik," in *Diagrammatik der Architektur*, ed. Dietrich Böschung and Julian Fachmann (Paderborn: Fink, 2013), 327–352; Dominik Lengyel and Catherine Toulouse, "Die digitale Visualisierung von Architektur," *Blickpunkt Archäologie*, no. 2 (2016): 91–98.
- <sup>6</sup> *Die Architekturmaschine: die Rolle des Computers in der Architektur*, ed. Teresa Fankhänel and Andreas Lepik (Basel: Birkhäuser, 2020), exhibition catalogue. In this context, a further publication should be mentioned, also published in October 2020, in which the topic of 'digital architecture' is treated just as comprehensively: Ludger Hovestadt and Oliver Fritz, eds, *Atlas of Digital Architecture: Terminology, Concepts, Methods, Tools, Examples, Phenomena* (Basel et al.: Birkhäuser, 2020).
- <sup>7</sup> Sabine Ammon and Inge Hinterwaldner, eds, *Bildlichkeit im Zeitalter der Modellierung: operative Artefakte in Entwurfsprozessen der Architektur und des Ingenieurwesens* (Paderborn: Fink, 2017).
- <sup>8</sup> Andrea Roedig, "Hey, ich steh im Rendering! Über Architektur, Bild und digitalen Realismus," *Wespennest*, no. 169 (2015): 66–69.
- <sup>9</sup> Florian Henrich's dissertation with the working title "Die Kanonisierung des Neuen Bauens – Architekturausstellungen in der Weimarer Republik 1914–1934", in which this methodical research approach is being tested on a larger scale, is in its final phase. See also Florian Henrich, "Der Ursprung und das Fagus-Werk. Architekturhistoriografie und Fotografie," in *Architektur Fotografie: Darstellung – Verwendung – Gestaltung*, ed. Hubert Locher and Rolf Sachsse (Munich: Deutscher Kunstverlag, 2016), 131–147.
- <sup>10</sup> Florian Henrich, "An der Schwelle zum Digitalen – analoge und digitale Methoden der Architekturvisualisierung in der Bauwelt 1987," *Das digitale Bild*, May 18, 2020, url: <http://www.digitalesbild.gwi.uni-muenchen.de/an-der-schwelle-zum-digitalen-analoge-und-digitale-methoden-der-architekturvisualisierung-in-der-bauwelt-1987/>.

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**HUBERT LOCHER** is Professor for the History and Theory of Visual Media at the Philipps-University Marburg, and director of the German Documentation Center for Art History – Bildarchiv Foto Marburg ([www.fotomarburg.de](http://www.fotomarburg.de)). His publications include *Kunstgeschichte als historische Theorie der Kunst 1750–1950* (Munich 2001, 2nd ed. 2010), editorship of the four-volume anthology *Quellen zur Theorie und Geschichte der Kunstgeschichte* (Darmstadt 2007–2009), including a contribution as author to vol. 4, *Kunstgeschichte im 20. Jahrhundert* (2007). Joint editorship of *Art History and Visual Studies in Europe: Transnational Discourses and National Frameworks* (Leiden 2012), *Reinhart Koselleck und die politische Ikonologie* (Munich 2013), *Architektur Fotografie. Darstellung – Verwendung – Gestaltung* (Munich 2016). Hubert Locher is co-editor of the *Marburger Jahrbuch für Kunstwissenschaft* and of the quarterly *Rundbrief Fotografie: Analoge und digitale Bildmedien in Archiven und Sammlungen*.

Correspondence e-mail: [locher@fotomarburg.de](mailto:locher@fotomarburg.de)

**DOMINIK LENGYEL** is Professor of Architecture and Visualization at the Brandenburg University of Technology Cottbus-Senftenberg and co-owner of Lengyel Toulouse Architects Berlin. He is a member of the European Academy of Sciences and Arts in Salzburg. His publications include (with Schock-Werner and Toulouse) *Die Bauphasen des Kölner Domes und seiner Vorgängerbauten* (Cologne 2011) and (with Toulouse) “Die Gestaltung der Vision Naga” in *Königsstadt Naga. Grabungen in der Wüste des Sudan*, ed. Karla Kroeper, Sylvia Schoske, and Dietrich Wildung (Munich 2011), 163–175, “Die Echtersche ‘Idealkirche’. Eine interaktive Annäherung” in: *Julius Echter: Patron der Künste, Konturen eines Fürsten und Bischofs der Renaissance*, ed. Damian Dombrowski, Markus Josef Maier, and Fabian Müller (Berlin 2017), 127–136, “Zum Erscheinungsbild der Visualisierungen des Berner Münsters” in *Das Berner Münster*, ed. Bernd Nicolai and Jürg Swiss (Regensburg 2019), 218–230.

Correspondence e-mail: [lengyel@b-tu.de](mailto:lengyel@b-tu.de)

**CATHERINE TOULOUSE** is an architect, Assistant Professor of Architecture and Visualization at the Brandenburg University of Technology Cottbus-Senftenberg, and co-owner of Lengyel Toulouse Architects Berlin. Her publications include (with Schock-Werner and Lengyel) *Die Bauphasen des Kölner Domes und seiner Vorgängerbauten* (Cologne 2011) and (with Lengyel) “Die Gestaltung der Vision Naga” in *Königsstadt Naga. Grabungen in der Wüste des Sudan*, ed. Karla Kroeper, Sylvia Schoske, and Dietrich Wildung (Munich 2011), 163–175, “Die Echtersche ‘Idealkirche’. Eine interaktive Annäherung” in: *Julius Echter: Patron der Künste, Konturen eines Fürsten und Bischofs der Renaissance*, ed. Damian Dombrowski, Markus Josef Maier, and Fabian Müller (Berlin 2017), 127–136, “Zum Erscheinungsbild der Visualisierungen des Berner Münsters,” in *Das Berner Münster*, ed. Bernd Nicolai and Jürg Swiss (Regensburg 2019), 218–230.

Correspondence e-mail: [toulouse@b-tu.de](mailto:toulouse@b-tu.de)

**FLORIAN HENRICH** studied cultural sciences, art history, and psychology at the University of Leipzig. Since 2012 he has been a research assistant at the German Documentation Center for Art History – Bildarchiv Foto Marburg and is working on his doctoral thesis on architecture exhibitions and canonization in the Weimar Republic 1914–1934. His publications include “Der Ursprung und das Fagus-Werk. Architekturhistoriografie und Fotografie,” in *Architektur Fotografie: Darstellung – Verwendung – Gestaltung*, ed. Hubert Locher and Rolf Sachsse (Munich 2016), 131–147.

Correspondence e-mail: [florian.henrich@fotomarburg.de](mailto:florian.henrich@fotomarburg.de)