11. Virtual Photography as a Visual Method of Communicating Scientific Hypotheses about Architecture

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In the context of the visual mediation method of scientific hypotheses about architecture, the term *virtual photography* is intended to emphasize the importance of the projection of virtual models. The reason for this is that the virtual model usually represents the final product in the visual mediation of ancient architecture. This model is often referred to as a reconstruction and its projection as a rendering, which means that the technological aspect is central to the concept. The authors counter this position with the importance of photography as the decisive factor in visual mediation. In the visualization of the imperial palaces on the Palatine in Rome, the actuality of the architectural design of the interplay of the courtyards and their connections via gallery corridors becomes particularly clear and effective from a pedestrian perspective (Fig. 11.1). This corresponds to the claim in archaeology to establish visual representations as a counterpart to verbal hypotheses. The aim is therefore to create representations that also reflect the uncertainty of knowledge and not, as is usual in the entertainment industry, predominantly fantasies. In the visualization of the Meroitic Royal City of Naga in present-day Sudan, whose architecture, like that of classical antiquity, was polychrome, the temples and residential buildings are only shown in their spatial arrangement in order to avoid any speculation regarding their specific color scheme (Fig. 11.2). The substance of hypotheses of uncertain knowledge is not the actual appearance, which in most cases is lost forever, but rather the intention behind the architecture, i.e. the building intention that led or more precisely could have led to the realization of architecture. In the visualization of the construction phases of Bern Minster, one specific pillar, which has since been built over, had to be portrayed in order to

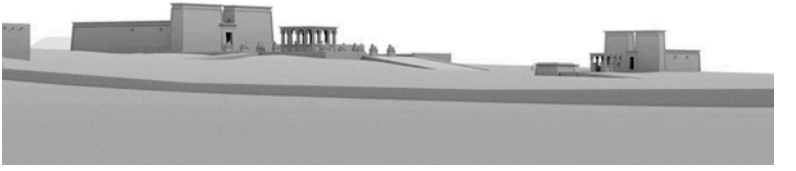
convey the spatial impression that would originally have been achieved (Fig. 11.3).

A visualization that takes these circumstances into account can therefore only attempt to reproduce the actual characteristics of the architectural idea and at the same time the hypothetical content of its uncertain components. This is where the potential of such a visualization lies. It is achieved by combining the two traditional architectural representation methods of the design model and the architectural photography. In the visualization of the choir of Cologne Cathedral around the year 1856, immediately before the laying down of the partition wall to the later crossing from the year 1320, contemporary watercolors served as a basis, but through graphic liberty they were able to counteract the extreme distortion of the photographic projection of the vaults (Fig. 11.4). Modelling and photography help to translate the archaeological hypothesis into a visualization that assigns different geometric abstractions to the different levels of uncertainty in the knowledge – and thus reveal the uncertainty in an intuitively recognizable way. At the same time, it employs methods of traditional architectural photography in order to create a spatial impression that is as realistic as possible despite the abstraction. In the visualization of the construction phases of Cologne Cathedral, around the year 1320 CE the Gothic choir, half of Hildebold Cathedral from the 10th century, of which a dedication picture from the 11th century survived, and Santa Maria ad Gradus, of which only the foundations can be verified, co-existed simultaneously (Fig. 11.5).

With abstract geometry in particular, however, this means meticulous composition. Both steps are genuine disciplines of design. However, while the importance of the spatial model is undisputed, the significance of its projection is generally underestimated. This is the reason why the projection of the virtual model is called *virtual photography*. The term is therefore intended to emphasize that the projection is an indispensable part of the concept of the *visualization of uncertainty*. The illustrations in this chapter are taken from some of our projects, which were developed in close co-operation with archaeologists and art historians.

11.1 Palatine Hill in Rome around 300 CE. Commissioned by the German Archaeological Institute, Berlin. Displayed, among others, in the exhibition "Jenseits des Horizonts" of the Excellence Cluster TOPOI at the Pergamon Museum Berlin, 2012, and in "Antike Architektur im Blick – 40 Jahre Bauforschung am Architekturreferat des Deutschen Archäologischen Instituts, Berlin" at the Science Center Bonn, 2014.

11.2 Royal City of Naga in Sudan around 350 CE. Commissioned by the Association for the Promotion of the Egyptian Museum, Berlin. Displayed at the State Museum of Egyptian Art Munich, 2011, and at the Art Forum of the Berliner Volksbank, 2011–2012.



11.3 Hypothetical representation of a wall pillar before the addition of a reinforcing tie beam in Bern Cathedral. In Bernd Nicolai and Jürg Schweizer, eds., "Das Berner Münster – Das erste Jahrhundert: Von der Grundsteinlegung bis zur Chorvollendung und Reformation (1421–1517/1528)." Regensburg: Schnell & Steiner, 2019.

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11.4 Cologne Cathedral choir after a watercolor by Johann Peter Weyer around 1856 CE. Displayed at the exhibition commemorating the 150th anniversary of the Cologne Cathedral choir at the Conference Center of the Archdiocese of Cologne, 2013–2014.

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11.5 Cologne Cathedral with Hildebold Cathedral around 1025 CE. Commissioned by the Cathedral building administration under the Cathedral master builder Prof. Barbara Schock-Werner. Displayed in the 2010 state exhibition of North Rhine-Westphalia at the Roman-Germanic Museum of the City of Cologne, 2010, since 2010 as a permanent installation in the entrance area to the archaeological zone of Cologne Cathedral.

Visualization of Uncertainty

The *visualization of uncertainty* is a method for the visual representation of spatial hypotheses that takes into account scientificity, hypothetical character, clarity and reflection in equal measure. This means not so much a juxtaposition as a weighing and balancing of sometimes conflicting, mutually constraining requirements. Such a visualization creates an immediate spatial image for the viewer that corresponds as closely as possible to the scientific hypothesis and at the same time reveals its hypothetical character. It thus pursues the goal of acquiring and communicating knowledge by reflecting on this knowledge throughout the entire process of perception. However, while the hypothetical character is due to the scientific nature of what is presented, its vividness depends on the architectural design. This emphasizes the two complementary competencies of the two interlinking disciplines: science is responsible for the

hypothesis, design is responsible for communicating it. Some thoughts on this:

Architecture and archaeology appear to be very different disciplines: architecture creates space, archaeology researches the past. Nevertheless, architecture and archaeology both work with the fragmentary. While archaeology attempts to derive past knowledge for scientific insight, architecture approaches concretion about the future from the sketch of an idea in the design process. Dealing with the uncertain is therefore motivated differently, but is comparable in essence, insofar as it also involves methods of development and communication. The commonality can be used in the visualization of the uncertain for archaeology, as architecture has developed a differentiated set of representation methods in the course of its disciplinary development, which are able to develop and convey not only the architectural intention, but also explicitly what is not yet defined in it.

Uncertain knowledge is an essential part of science, and this raises the question of an appropriate visual representation of this knowledge. The most urging question, however, is what should be visually represented at all. In most cases, the knowledge base is not sufficient for a photorealistic reproduction of lost architecture in a scientific manner. An overwhelming proportion of attempts to realistically depict lost architecture, i.e. to simulate its original appearance, consist of pure fantasy, as demonstrated by the entertainment industry. The risk that these imaginative visions are assumed to be authentic, as suggested by the term reconstruction, is not only scientifically problematic. They give us no reason to doubt what we have seen or even to infer its hypothetical origin.

If, on the other hand, the focus is on scientificity, i.e. the hypothetical content of the architecture, then it would be appropriate to make the fact itself, that it is a hypothesis, the subject of the visualization. This also creates an image of architecture, but not the simulation of a fictitious reality. What emerges instead is the image of an architectural thought, an architectural idea. The visualization then explicitly – and at the same time intuitively recognizably – shows the vagueness of knowledge and thus the scientific nature of archaeology by explaining and at the same time questioning what is shown. Still, to empathize with a picture, it needs to look like an excerpt from a consistent world. This is achieved by limiting the field of vision, as photographer, sculptor, painter, graphic artist and film maker Werner Graeff expresses it, "particularly noteworthy that every viewer involuntarily endeavors to imagine the further course of cut forms beyond the edge of the picture. One is tempted to fill in

what is missing."[1] However, coherence is not only dependent on the image section, but also a question of materiality and color. A black and white photo, for example, makes no statement about the colorfulness of the subject.

Photography as a Composition

The view upon the information described above, the composition of the image – and thus above all subtle information – is just as decisive for its communication and interpretation. The same geometric content can be viewed in an infinite number of ways. But as the aim of the mediation is to introduce the viewer to the scientific hypothesis, although it is a hypothesis, this is best understood when it appears both natural and intuitive. For architectural hypotheses, this means that they appear as if they were built architecture. For this, the geometric detail, materiality and polychromy are abstracted, but not the spatial impact. So while the abstractions challenge the viewer to engage intensively, reflexively and sometimes controversially, the projection, i.e. the virtual photograph, can recapture the viewer, reassure him at least with regard to the space. This succeeds if the projection corresponds as closely as possible to the natural perception of space. This is precisely what the concept of *virtual photography* is intended to express, i.e. projecting abstract geometry as if it were built architecture. However, this is not limited to technical aspects, but also the design of the composition.

This is how the photographer Julius Shulman answered Joseph Rosa's questions about which aperture to set for a particular shot, "That's not important. You can learn that anywhere. Learning to see is the important thing."[2] In this short answer, with which "he brushed the question aside," has already said the essentials, namely that his architectural photography is not about a fixed canon, but about the photographer's inner attitude towards photography as an image, the composition of the image, the "constructed view."[3] The concept of constructing, i.e. the direct translation of perceptual seeing, describes the

1 Raoul Hausmann and Werner Gräff. "Wie sieht der Fotograf? Gespräche [1933]," in *Texte zur Theorie der Fotografie*, ed. Bernd Stiegler (Stuttgart: Reclam, 2010), 190.

2 Esther McCoy, "Persistence of Vision," in *A Constructed View: The Architectural Photography of Julius Shulman*, ed. Joseph Rosa (New York: Rizzoli, 1994), 10.

3 Joseph Rosa, "A Constructed View," in *A Constructed View. The Architectural Photography of Julius Shulman*, ed. Joseph Rosa (New York: Rizzoli, 1994), 35–110.

special attention of the architectural photographer, and it is significant how Shulman adopts this term, coined by Rosa, for himself: "The title he chose opened up a whole new perspective on my life's work."[4]

Despite this supposed programmatic opening of architectural photography, there are some constants in the constructed images that take visual perception into account and are responsible for the fact that the image statement corresponds to the architecture. The extent to which this claim corresponds to the image of traditional architectural photography is made clear by Ralph Melcher in the volume accompanying an exhibition on *Architecture in Contemporary Photography*, when he contrasts the deliberate construction of photography with painting by arguing, "that both artistic techniques – at least in the 19th and early 20th centuries – are characterized by capturing the essence and character of what is depicted as far as possible, by being 'accurate'."[5] Immediately afterwards, Melcher opens up the spectrum of means used to achieve this very essence beyond the supposedly objective depiction, at least for painting, by including the artistic means: "This is why also expressionist or constructivist painting styles are realistic in the sense that they want to express a special content, the essence of things and events."[6] It is significant that Shulman, as a photographer, opens up this subjective reference to painting even further and also refers to clearly technical aids in his photography when he describes a surrealist alienation, the effect of which, however, only becomes apparent at second glance: He is vehemently opposed to the accusation that the use of infrared film does not depict "the true nature"[7] of a building: "I always felt that this was a ridiculous attitude: the photographer can 'see' the potentials and, with [various types of] film, can go one step beyond dullness to produce something that is ›there‹, but is not necessarily seen by the eye."[8] This is significant insofar as *virtual photography* in the *visualization of uncertainty* is particularly united with virtual modelling in that it has a direct influence on what is captured by the virtual camera. On the other hand, in the *visualization of uncertainty*, something invisible ("something … not … seen by the eye"[9]) is explicitly depicted as a con-

4 Julius Shulman, *Architektur und Fotografie*, (Cologne: Taschen, 1998), 299.

5 Ralph Melcher, "Die Architektur als künstlerische Bildgattung," in *In Szene gesetzt. Architektur in der Fotografie der Gegenwart*, ed. Götz Adriani (Ostfildern-Ruit: Hatje-Cantz, 2002), 71.

6 Ibid.

7 Shulman, *Architektur und Fotografie*, 77.

8 Rosa, "A Constructed View," 76.

9 Shulman, *Architektur und Fotografie*, 77.

stituent element; namely the – if hypothetical – architectural idea. That such artistic – or artificial – distortions do not necessarily alienate the character of what is depicted results from the independence of architecture, photography and mental models: architecture is a spatial phenomenon that is not only perceived stereoscopically, but with all the senses.

A photograph, by contrast, is a two-dimensional image and thus an initially independent object, while the mental model, the image of architecture that arises in the viewer's mind, is the actual goal of the mediation. Rolf Sachsse writes in *Raumbilder – Bildräume*, characteristically a publication about photographs taken by architects: "The image of space, however large it may be, is always a model of perception, an offer to the viewer in the hope of a broad level of similar experiences as a basis for understanding."[10] The first delimitation – between the object and its photographic representation – is particularly important for the *visualisation of uncertainty* because the architectural idea, i.e. more than just the geometric content of the virtual model, is to be conveyed in *virtual photography*. The second delimitation – between the visual and the mental image – exists because each form of visual perception creates an independent – individual – model in the viewer's mind. And this even applies when the documentary character, the depiction of what has been discovered, is in the foreground, as Gilles Mora writes in a review of Walker Evans "Le photographe n'est plus là pour travailler la composition, mais cadrer le pré-composé, l'ordre et la configuration préexistante des surfaces visuelles s'offrant au regard."[11] And Roland Barthes also emphasizes that, in contrast to drawing, "photography cannot intervene in the object despite the choice of subject, point of view and angle of vision,"[12] which, technically speaking, already covers most of the point. Similarly, Ulrich Loock emphasizes the challenge to the viewer's imagination in Thomas Struth's illustrated book *Unbewusste Orte* (Unconscious Places): "And with its perspectival character, photography demands that the viewer create a world for himself from the inventory."[13]

10 Rolf Sachsse, "Raumbilder– Bildräume. Architekten fotografieren," (Munich: Deutscher Kunstverlag, 2009), 4.

11 Gilles Mora, "Introduction," in *Walker Evans* (Paris: Contrejour, 1990), 12.

12 Roland Barthes, "Rhetorik des Bildes [1964]," in *Texte zur Theorie der Fotografie*, ed. Bernd Stiegler (Stuttgart: Reclam, 2010), 39–52, 86.

13 Ulrich Loock, "Photographien aus der Metropole," in *Thomas Struth. Unbewußte Orte*, eds. Thomas Struth and Ulrich Loock (Cologne: Schirmer, 1987), 79.

In contrast, in the early days of photography, the viewer's ability to "involuntarily read his hypothetical explanation into the image,"[14] as Anton Martin noted in 1865 in his *Handbuch der gesamten Photographie*, was initially viewed critically; hypotheses were therefore considered unobjective. The importance of passing on sensory impressions and information from one form of representation to the next in photography was also emphasized in Daniela Mondini's laudatory speech at the Bauhaus-Archiv in 2015 for the exhibition by contemporary photographer Hélène Binet: "Although it is addressed to the human eye, the photographic message evokes multisensory associations, such as hearing and touch, comparable to the perception of an architectural space."[15] Association and interpretation as well as the passing on of attributed meaning across several forms of representation are the central aim of architectural photography, even when taking virtual photographs of virtual architecture. This is because the mental image of architecture should be as close as possible to the verbal hypothesis. This is precisely why *virtual photography* represents one of the two central translation processes from the hypothesis via its geometric representation and photographic composition to the mental model. Shulman is naming this translation: "What are the benefits of this particular branch of photography and where might it be heading? You could say that we are literally 'translating' architecture."[16]

But whether photography actually directs the gaze to what is depicted or to itself is a controversial issue. Art historian Hans Belting takes Thomas Struth's images, which seem so everyday, as an opportunity to point out the historical dimension of this ambivalence:

> My view has ignored the surface of the photograph in order to perceive what lies 'behind' and is in the picture. This brings me to the famous question of whether photography offers an image of reality and what it shows of itself in the process. Vilém Flusser reversed a thesis by Roland Barthes when he wrote that technical images 'are not windows, but pictures,' i.e. mere surfaces with information. 'It is not the world out there that is real …, but only photography that is real' … It seems, however, that I confirm

14 Lorraine Daston and Peter Galison, "Photographie als Wissenschaft und als Kunst [2007]" in *Texte zur Theorie der Fotografie*, ed. Bernd Stiegler (Stuttgart: Reclam, 2010), 67.

15 Daniela Mondini, "Architecture in Photography," in *Dialogues. Photographs by Hélène Binet*, ed. Daniela Mondini (Berlin: Bauhaus Archiv, 2015), 61.

16 Shulman, *Architektur und Fotografie*, 17.

> Barthes' thesis when I initially do not notice the photograph at all and only ever speak of what I discover in it. He spoke of the photograph as pure contingency. 'Whatever a photograph shows, it is always invisible: it is not the photograph that one sees,' but the thing itself.[17]

That this interpretation is resolute but essentially ambivalent is interesting in that *virtual photography* is directly affected by this ambivalence. It does not want to direct the view to the depicted object itself, neither does it want to stop at the depicted architectural idea. Instead, it wants to go further, it wants to direct the view to the underlying hypothesis – and to do so with such clarity that the necessity of the subsequent next step of translation – from the visual image to the mental image – should become obvious to the viewer. In this way, the viewer cannot avoid reflecting on which of their own thought processes are stimulated by the image. Shulman postulates an almost salutary prospect for "good" photography:

> Good photography is a joy. It reflects the human ability to reflect, weigh up and evaluate! With a careful approach, we can learn to rediscover these born skills. Then photography will no longer be a mystery. Rather, it will broaden our mental horizons.[18]

Nevertheless, the question remains as to how this can be achieved. The simple basic rules of photographic composition fulfil the purpose of emphasizing the reference to reality in the *visualization of uncertainty*: The aim is to visually understand the architecture behind the abstract form. Rosa attributes this almost didactic approach to Shulman's entire oeuvre: "Shulman's work is based on persuading the viewer to understand visually the architecture that he is depicting."[19]

This recourse to the tradition of architectural photography relies on the appropriately trained eye in the interpretation of these images and thus compensates for the abstract content. The first priority is therefore given to those components of the composition that reproduce the spatial visual impression of the hypothetical space as undistorted as possible. This includes the position of the viewers in space. The viewers should not only actually be at a natural eye level

17 Hans Belting, *Photographie und Malerei. Der photographische Zyklus der Museumsbilder von Thomas Struth* (Munich: Schirmer Mosel, 1993), 7.

18 Shulman, *Architektur und Fotografie*, 286.

19 Rosa, "A Constructed View," 63.

above a position that can be taken up in the architecture, they should also realize this to be able to rely on it. In case the viewers are at a greater height, they should also be able to perceive this clearly, for which not only aerial photographs are suitable, but especially those with an extended focal length. These correspond geometrically to the view from a satellite. The ideal geometric form of such images is the parallel projection, which has no point of view in space, as the projection of the geometry is parallel and no longer directed to a projection center. The most unadulterated spatial impression possible also includes the reliability of what is perhaps the most important basic constant of spatial perception, the vertical. It is the processing of the integral of visual perception in movement, of the body, the head and the eyes, which orients the mental model of space in the imagination. This succeeds despite the hemispheric projection on the retina. It is therefore the task of photography to take this phenomenon of spatial vision into account and to carry out the photographic, i.e. planimetric, projection onto the image plane in such a way that verticality is maintained. If the projection resembles the mental model as closely as possible and thus fulfils the clear purpose of reliability, it constitutes the starting point of architectural photography as Shulman describes it on the occasion of a review of the commissioning of a new camera: "I quickly realised how to achieve the most important function, which was to prevent the vertical lines of a building from collapsing."[20] His judgement of those photographers who do not fulfil this basic requirement can be directly applied to the current practice of digital architectural visualization: "In this day and age of advanced camera technology, you often see photos with poor, distorted views of buildings."[21]

Just as, for Shulman, technical progress is leading to more and more amateurish photographs being created, the increasing ease of use of computer programs in visualizations is leading to a detachment from fundamental insights from architectural representation, such as the eye-catching distortion caused by an arbitrarily tilted image plane. The reason for this is a phenomenon that lies in the translation between the physiological image on the hemispheric retina and the perceived image in the mind. The curved projections on the retina are not only corrected by the brain so that straight lines are interpreted as straight lines – a phenomenon so natural that it is rather difficult to imagine that the image on the retina is curved. Line correction also

20 Shulman, *Architektur und Fotografie*, 235.

21 bid., 236.

means that the mind largely interprets the spatial orientation of objects correctly, for example whether an object is orientated vertically or horizontally in space. The simplest example of this, and Shulman also refers to this, is vertical building edges, which "prevent the vertical lines of a building from collapsing" (see above). Geometrically, this is due to the orientation of the image plane of the perspective projection. For Shulman, it is the technical adjustability of the lens; for computer visualization, it is a question of conscious image composition. Additional technical effort, as in camera photography, is no longer necessary in the computer.

That the creative quality of a photograph has a significant influence on the reception of what is depicted – within the *visualization of uncertainty* this is the underlying hypothesis – may not come as a surprise, but is explicably postulated by Shulman for architectural photography:

> As I know from decades of experience, photographs become part of history and therefore the documentation of a building must be done in such a way that the viewer is first attracted by the visual expression of the image. Only then will the quality of the architecture become visible and be able to appeal to the viewer.[22]

That this can also succeed under the conditions of abstract content is already reflected in architectural photography, from outside photography, when Walter Benjamin describes the added value that arises when no people are depicted in photographs: "But where man withdraws from photography, for the first time the value of the exhibition becomes superior to the value of the cult,"[23] as from within photography, when Shulman describes, in the spirit of Winckelmann, that omitting color improves the legibility of contours: "Black and white … in its monochromatic state tends to emphasize form and tone at the expense of the total exposition possible by color photography."[24]

With regard to color in particular, it cannot be avoided that misunderstandings arise in terms of architectural meaning, since architecture in the tradition of classical modernism sometimes radically dispenses with color. White cuboids often stand for a certain architectural direction, which can lead

22 Ibid., 16.

23 Friedrich Meschede, "Statt Ansichten – Stadt an sich," in *Thomas Struth. Unbewußte Orte*, ed. Thomas Struth and Ulrich Loock (Cologne: Schirmer, 1987), 87.

24 Rosa, "A Constructed View," 76.

to a misinterpretation of visualized hypotheses. The viewer must be aware of this potential misinterpretation not to be subject to it. To ensure this, the visualizations can be accompanied by an explanatory text, as can several representations of different variants. However, the legibility demanded by Shulman also favors the monochrome representation ("emphasize form and tone"[25]). This is because the clarity with which monochrome images reveal and emphasize spatial relationships is overlaid or even prevented by polychromy. Spatial relationships therefore benefit from the abstraction of color.

The conscious treatment of the two exemplary aspects of people and colorfulness should be exemplary for all possible abstractions in traditional architectural photography, the significance of which extends decisively further in the *visualization of uncertainty*. On the one hand, the value of the architecture allows it to be transferred to the present day and to be re-evaluated from today's perspective as a reference for architectural planning. On the other hand, the omission of color in black and white photography not only emphasizes "form and tone" in general, but in particular, in accordance with the intention of the hypothesis, to place form in the foreground to avoid a statement about the much more uncertain polychromy.

Despite the creative composition described above, the documentary character remains preserved, as the aim of *virtual photography* in the *visualization of uncertainty* is always to convey something concrete, namely the architectural hypothesis. This in no way turns architectural photography into documentary photography; however, it consciously distinguishes itself from purely artistic photography, just as for instance Albert Renger-Patzsch claimed for himself: "Let us therefore leave art to the artists and try to use the means of photography to create photographs that can stand the test of time thanks to their photographic qualities – without borrowing from art."[26] And even if the obvious concept of objectivity does not really lead any further at first, when László Moholy-Nagy actually demands "The secret of their effects is that the photographic apparatus reproduces the purely optical image and thus shows the … distortions …. Therefore, in the photographic apparatus we possess the most reliable aid to the beginnings of objective vision,"[27] the concrete example of distortion in

25 Ibid., 76.

26 Meschede, "Statt Ansichten – Stadt an sich," 85.

27 László Moholy-Nagy, *Malerei Fotografie Film*. Reihe Bauhaus Bücher 8 (Munich: Albert Langen Verlag, 1927), 26.

architectural photography is explicitly and almost pointedly rejected by Shulman: "Such a failure … urges the photographer to weigh up his compositions carefully."[28] In conclusion, the rules of design should also be applied to photographic documentation, i.e. the difference to artistic photography lies not in the significance of the design, but in the intended message of the image.

From the point of view of architecture, *virtual photography* is thus defined from two sides, documentation on the one hand and artistic design on the other. Furthermore, it is based on the specific architectural way of thinking of understanding buildings not only as a visual or spatial phenomenon, but also as a functional structure whose functionality ("cult"[29]) is always also constituent. How important an understanding of the functional context of a building is when composing a photograph is expressed by Shulman as follows:

> There are no differences in the construction of the images, it is always about finding a reference to the architecture. It is not so difficult to work out the floor plan, location and architectural features. The composition results from the ability to read the floor plan of a room correctly and to establish a connection between the motifs.[30]

Summarizing, the creative spirit cannot be ignored in architectural photography, be it a more artistic or a more documentary approach. And in this respect, despite all due diligence, the subjective is ultimately decisive in architectural photography, and this also applies to the *virtual photography* of virtual models. The artist and photographer Raoul Haussmann consequently juxtaposes a selection of necessary technical decisions with the subjective composition as a whole:

> The choice of aperture, the photographic film material, the speed of the shutter and the correct reproduction of color tones are not determined by rules, but by a more or less strong feeling of the personality behind the camera for the characteristics of the given circumstances. The individual case decides.[31]

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28 Shulman, *Architektur und Fotografie*, 18.

29 Meschede, "Statt Ansichten – Stadt an sich," 87.

30 Shulman, *Architektur und Fotografie*, 122.

31 Henri Cartier-Bresson, "Der entscheidende Augenblick [1952]," in *Texte zur Theorie der Fotografie*, ed. Bernd Stiegler (Stuttgart: Reclam, 2010), 196.

This already gives rise to a starting point, a relationship between architectural design, which outlines the space in three-dimensional form, and architectural photography, which optically defines its projection.

Conclusion

The *visualization of uncertainty* remains a delicate balancing act, as it combines opposing phases of architectural creation: modelling from the first – the design phase – and photography from the last – the documentation phase. The abstraction of the virtual model contrasts with the realism of photography, although they are similar in their shaping design intentions. But it is a matter of negotiating a balance between abstraction in favor of the hypothesis and vividness in favor of the spatial impression.

As a consequence, there are opposing strategies that need to be brought into balance with each other: If the abstraction goes so far that a spatial interpretation, a recognition of the depicted as architecture, is no longer possible, the visualization can no longer fulfil its goal, which is to convey the architectural idea. Conversely, too many additions in favor of vividness lead to the scientific hypothesis being covered up. The great challenge lies in the balance between these two demands, in the weighing up of fidelity to the hypothesis and vividness, i.e. creating a spatial vision that is as close to the hypothesis and as spatially impressive and credible as possible. It is obvious that abstraction increases with decreasing certainty in knowledge, but at the same time there are higher expectations regarding image design. Realistic images are much easier accepted, people tend to believe what they see as soon as it looks real. Abstract images of architecture, on the other hand, are being questioned. This is understandable, as they demand a reflective examination, one's own imagination in the completion of architecture. The composition of visualizations is correspondingly complex, for despite the detailed definition of the methodological principles in modelling and projection, it is architectural questions that control the entire procedure and whose mastery, like architecture as a whole, only develops over time. Shulman's "learning to see" can easily be transferred to "learning to build."

This is because the cooperation between archaeology and architecture offers reflective perception as an added value of visualization that increases knowledge. Both disciplines benefit from the cooperation between archaeology and architectural visualization due to the mutual exchange. The reflection

of the hypotheses in the visualization process provides both disciplines with impulses that would be missing in a purely archaeological visualization on the one hand or a visualization based not on dialogue but only on literature on the other. However, the abstract modelling of hypotheses is only the first step. The equally important, final step is their communication via composed projections, the *virtual photography*.