Epistemic space / Spatial knowledge

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abstract

This paper is the result of a one-year long research on the question of architectural research brought forward at the Lucerne University of applied sciences, department of architecture, in Switzerland. The result of this project is the book *Reasearching architecture.*

The motivation for this research program was the appointment to implement research in the curricula of former Swiss technical schools after the Bologna reform, and the consequent questioning of methods and goals for research, in particular for the department of architecture. However, the general discussions of the schools, as much as an analysis of the state-of-the art of architectural research could not create a satisfactory ground for our school, as too many questions remained not answered. Too many different positions and different takes on the matter, despite the high amount of investigations, conferences and publications devoted to this subject.

Thus the necessity to pursue an in-deep research on what architectural research could be, to get over the simple distinction between *design as research* and *research about architecture*. That is, the distinction between an understanding of architectural design as form of research and an understanding of research that can only take place in scientific disciplines such as building physics or history of architecture. In our understanding, the whole process of design, from conception to realization, has to be considered as research. This lead to the main question, that is: if architecture is research, it appears evident that one has to look for the kind of cognition and knowledge that results from this kind of research. This is what the general discussion appears to be lacking, being too much concentrated on investigations on the nature of the research and on its positioning among science and/or art.

This was actually the same in the beginning of this research project, as it was based on the positioning of architecture between art and science, between myth and logos, but in a second moment we realized that the question of research should be rather posed in terms of what kind of knowledge results from it. This in turn would define the nature of the architectural research and not the contrary. As this knowledge is the result of the architectonic process of space production, it is assumed that space itself is the carrier of the knowledge, thus it can be spoken on the one hand of "spatial knowledge" for the knowledge that is gained in the (repeated) process of space-making, on the other the term "epistemic space", from *episteme* – knowledge, cognition – and epistemology*, as* the science of *how* spatial knowledge is produced, as the knowledge inherent in space, was coined. This knowledge can be decoded only by somebody who himself owns a *spatial competence* based on a spatial knowledge, that is by somebody who can read "space" and the methods and instruments that produced this space.

Scientific research

Still, even if science is not the exclusive reference for an investigation of what research in architecture is, because of its historical and cultural dominance it cannot simply be put aside. In particular it calls for the question on how scientific research produces cognition and thus knowledge, in order to understand the difference towards the production of spatial knowledge.

Looking at the scientific reference it has to be acknowledged, how what appears today to be an *immutable* model for cognition and knowledge, has not been the same before and could still change in the future. A look onto the etymology of words such as "research", "knowledge" or "cognition" shows how these were not always associated with the rational model, but had also more practice-based origins. The term "forschen" (to research in german) in particular, reveals these changes, as the word was used mainly in plural and coming from latin "poscere", it meant originally the search for something and had a juristic background. Corresponding words in other languages appeared only later. French "recherche" in 17th century and English "research" only in 19th century.[1]

The main difference between scientific and architectonic research lies on the fact that scientific research is goal-oriented, methodic and its results traceable and communicable, which architectonic research cannot be. The knowledge produced by scientific research is thus of a different order than the one produced by architectonic research. Furthermore, considering the classic distinction between basic-, applied research and experimental development for scientific research, it appears evident – and many critics have pointed this out – that architectural research resides somewhere between the two first ones, thus remaining in an oscillating position.

A last point that should be mentioned, concerns the "subject-object" question. Scientific research is normally based on a strict separation between a subject that promotes a research and the object upon which the research is done. Another

[1] „Forschung", *Enzyklopädie der Neuzeit*, Stuttgart/Weimar Verlag J.B. Metzler, S. 434

position, that of *sensual research*, postulates the necessity of a merging between subject and object, this obviously does not correspond to the rational claim of scientific research. Generally speaking, any research that is not scientific (discursive) is called intuitive and implies a different relationship between object and subject besides strict separation.
Besides this, there is another difference between scientific and architectural research that is directly related to the above mentioned methodic and traceable nature of scientific research. It concerns what is called "meta-knowledge of second order". Scientific knowledge does not only create knowledge on something but also knowledge on how this knowledge is gained. This is not the case for architecture, were knowledge is the result both of research and experience to a point, where the two can't be separated. Even though science too is not always rational in its procedures, at the end, the result and the methods must be integrated into the reflection and be understood a posteriori. In this sense it is interesting to refer to the work of Ian Hacking and his understanding of (scientific) experiment not only as confirmation but also as a performance of a theory, that is scientific research can take place as the verification of a set theory, but it can also be the result of a not yet rationally defined experiment that would be verified a posteriori. Or in his terms: "Science is said to have two aims: theory and experiments. Theories try to say how the world is. Experiments and subsequent technology change the world. We represent and we intervene. We represent in order to intervene, and we intervene in the light of representations. Most of today's debate about scientific realism is couched in terms of theory, representation, and truth. The discussions are illuminating but not decisive. This is partly because they are so infected with intractable metaphysics. I suspect there can no be final argument for or against realism at the level of representation. When we turn from representation to intervention, to spraying niobium balls with positrons, anti-realism has less of a grip. In what follows I start with a somewhat old-fashioned concern with realism about entities. This soon leads to the chief modern studies of truth and representation, of realism and anti-realism about theories. Towards the end I shall come back to intervention, experiment, and entities." [2] This obviously relativizes the claim of scientific rigueur for every step of a scientific research.
Another relativization of scientific rationalism come from what is called "constructive realism", a movement that asserts that scientific research never depicts reality, but constructs its own reality, which they call "micro-worlds"[3]. In relation to the dichotomy between what he calls scientific realism and its opposition anti-realism, Ian Hacking pleads for a third way.[4]
In this sense, further references that question the "perfect" rationality of scientific research could be made, such as *Action Research* or *Grounded Research*, but these would not add anything to our claim, that spatial knowledge has to be investigated in its own terms and not in reference to scientific knowledge.
This underscoring of the importance of experiment for science has brought some interpreters to go as far as to confront it with design, as for example Glanville: „(Scientific) research (whether experiment or theory) is a design activity. We design experiments, but we also act as designers in how we act in these experiments. We design the experiences and objects we find through experiment by finding commonalities (simplification); (…). Thus, in doing science, we learn."[5]

Cognition / knowledge / performance

Independently from the type of research – architectural or scientific – knowledge is the result of research and experience. From the above mentioned, it results how processes and practice becomes more and more relevant for an understanding of scientific research, acknowledging that science is not just a question of applying or verifying theories. Still, experience remains marginal, in the sense that scientists create an experience on how to formulate a theory or on how to successful construct an experiment, but this experience is marginal for the resulting knowledge. If we now look at architecture, we realize how here experience is much more important and how it is practically impossible to separate between research and experience.
It is interesting in this sense to refer to those investigations, which differentiated between two types of experiences and knowledge in relation to action. Such as Bertrand Russel (but one could refer also to the former investigations of John Grote

[2] Hacking, Ian, *Representing and Intervening, Introductory topics in the philosophy of natural science*, Cambridge: Cambridge University Press, 1983, p. 31
[3] Wallner, Fritz G., Agnese, Barnara (Hg.), *Von der Einheit des Wissens zur Vielfalt der Wissensformen*, Wien: Wilhelm Braumüller, 1997
[4] "*Scientific realism* says that the entities, states and processes described by correct theories really do exist. Protons, photons, fields of force, and black holes are as real as toe-nails, turbines, eddies in a stream, and volcanoes. The weak interactions of small particle physics are as real as falling in love. Theories about the structure of molecules that carry genetic codes are either true or false, and a genuinely correct theory would be a true one.Even when our sciences have not yet got things right, the realist holds that we often get close to the truth. We aim at discovering the inner constitution of things and at knowing what inhabits the most distant reaches of the universe. Nor need we be too modest. We have already found out a good deal.
Anti-realism says the opposite: there are no such things as electrons. Certainly there are phenomena of electricity and of inheritance but we construct theories about tiny states, processes and entities only in order to predict and produce events that interest us. The electrons are fictions. Theories about them are tools for thinking. Theories are adequate or useful or warranted or applicable but no matter how much we admire the speculative and technological triumphs of natural science, we should not regard even its most telling theories as true. Some anti-realists hold back because they believe theories are intellectual tools which cannot be understood as literal statements of how the world is. Others say that theories must be taken literally – there is no other way to understand them. But, such anti-realists contend, however much we may use the theories we do not have compelling reasons to believe they are right. Likewise anti-realists of either stripe will not include theoretical entities among the kinds of things that really exist in the world: turbines yes, but photons no."
Hacking, Ian, *Representing and Intervening, Introductory topics in the philosophy of natural science*, Cambridge: Cambridge University Press, 1983, p.- 22-3
[5] Glanville, Ranulph, *Researching Design and designig research*, 1999, MIT, Manuscript

oder Hermann von Helmholtz), who already in 1911 differentiated between *knowledge by acquaintance* und *knowledge by description*, where the former is a knowledge that we obtain through personal experience and the later a knowledge that we obtain indirectly. Other examples are the differenciation between *knowing how* and *knowing that* by Gilbert Ryle in 1949 (*The concepts of the mind*) or the concept of the *tacit knowledge* by Michael Polanyi (1958). In more recent times sociologist Anthony Giddens makes a distinction between *practical* and *discoursive knowledge*.

These are all attempts to differentiate between knowledge based on experience and a knowledge acquired through research. They help to understand better the case of architecture where normally, both conditions are equivalent.

If we look at the knowledge of architecture, that is based both on experience and research, it could be defined as "invention-knowledge" (*Erfindungswissen*)[6] that is, a knowledge that serves to invent solutions for always new tasks and projects. But how is this knowledge generated and how is it structured? Moreover if architectural research produces knowledge, this knowledge has in some way to be communicated, even if not verbally and even if indirectly. This implies the question of "continuation" or "sustainability" that will be of another order than the communication of scientific knowledge.

Iconic- / pictorial turn

In order to better understand the question on how to define this spatial competence and on how to communicate spatial knowledge, it is interesting to refer to the ongoing discussion about the "image as carrier of knowledge". This investigates on how the creation and interpretation of images produces a "visual knowledge" that is not entirely communicated in words. Taking reference for example to medical images, it appears evident that doctors have to learn how to read certain images and that only through such a "visual knowledge" the information in the image can be depicted and transformed in a diagnosis.

This is one the keys of what is called the "pictorial" or "iconic turn".[7] Still the iconic turn can base itself on a long tradition of the analysis of image and their production, in particular stemming from art history and the tradition of *ekphrasis* (the description of a visual work) but also obviously from medicine. This does not appear to be the case for architecture, where almost no discourse on space has been brought forward the same way as was the case for other central aspects of architecture such as "structure", "form, or "envelope". Still, the same way as we can assume a "visual knowledge" we have to postulate the existence of a "spatial knowledge" that is gained through repeating the cycling process described above and which allows to read the "space" of other architect and to understand how this space was constructed.

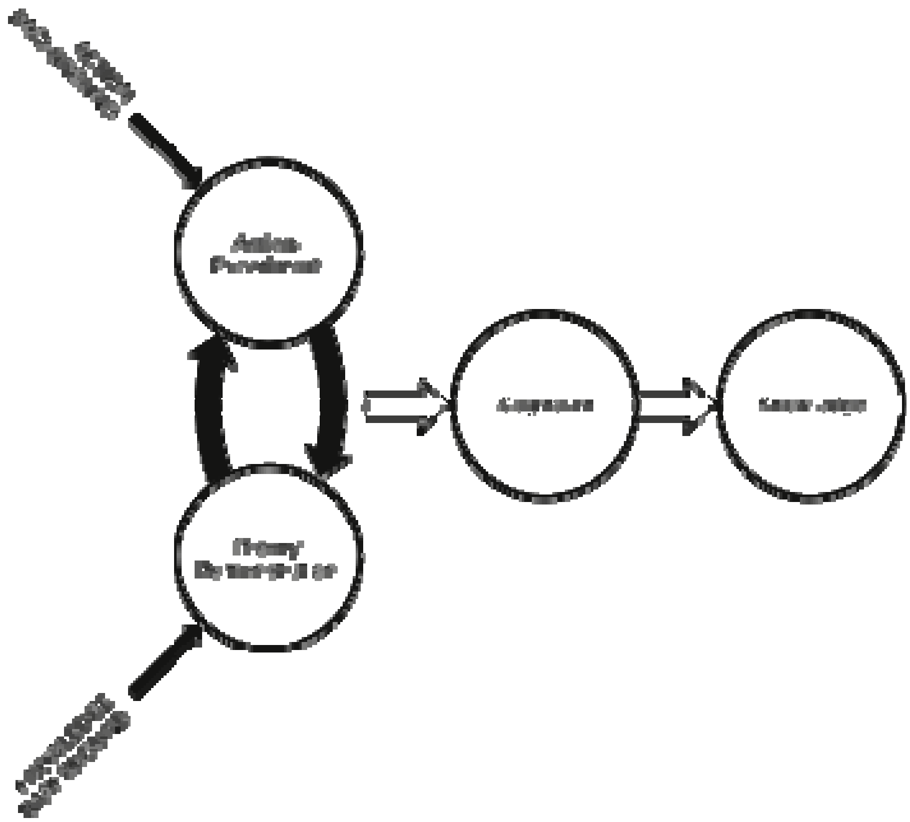
Diagram

In order to investigate and to understand the nature of this spatial knowledge, the way it is communicated and how spatial competence is acquainted, we constructed a diagram that would reflect how knowledge is gained and that could be applied to different case studies.

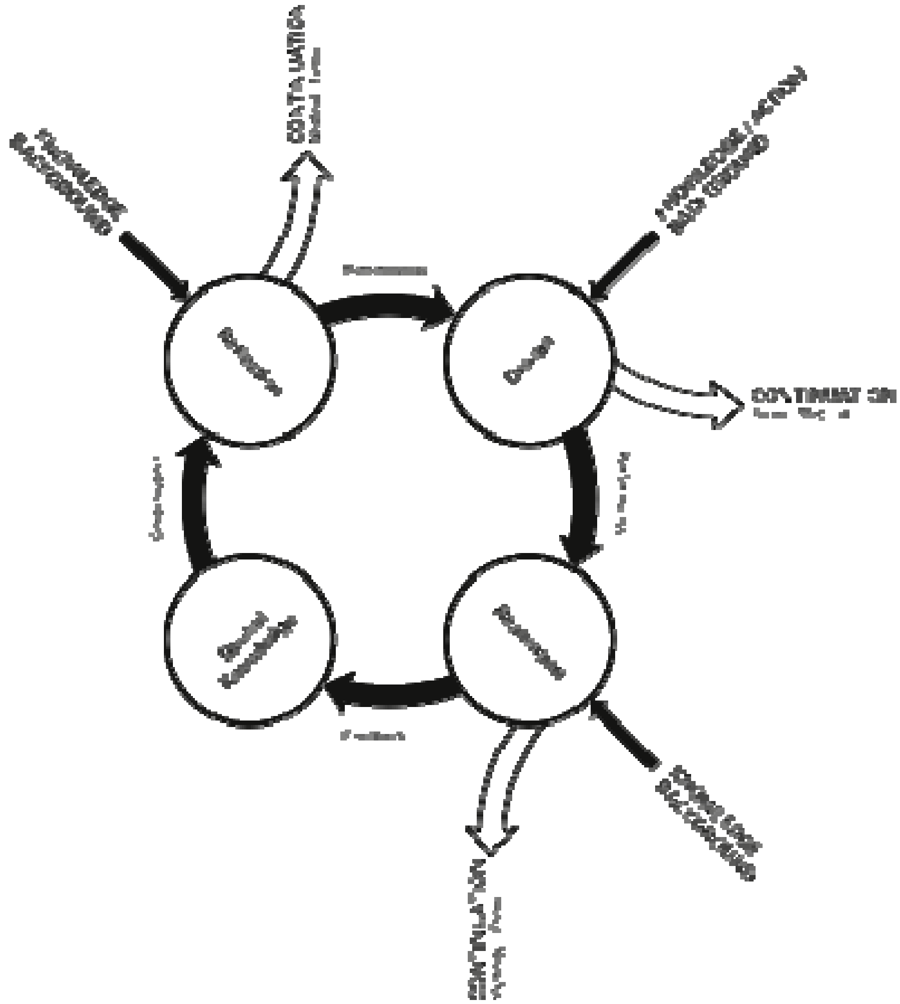
A first diagram illustrates how knowledge is gained in a "normal" scientific research:

[6] „Erfindungswissen", as illustrated by Brigitta Pfäffli, in: Pfäffli, Brigitta, *Lehren an Hochschulen, Eine Hochschuldidaktik für den Aufbau von Wissen und Kompetenzen*, Bern: Haupt Verlag, 2005

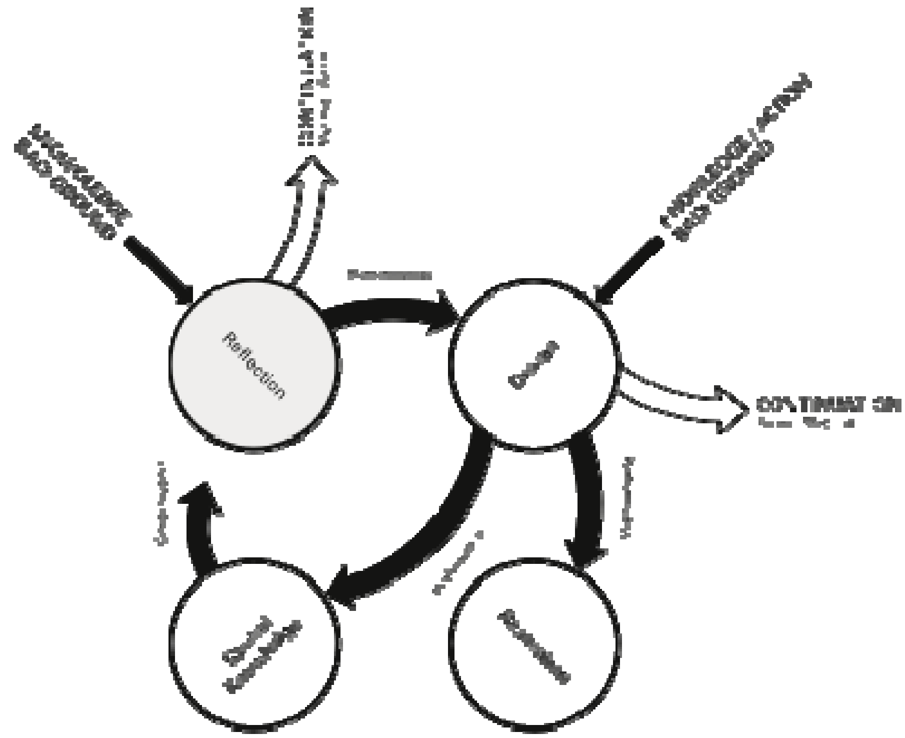
[7] The term „pictorial turn" was introduced by W.T. Mitchell in 1992; the term „iconic turn" was introduced in 1994 by Gottfried Boehm



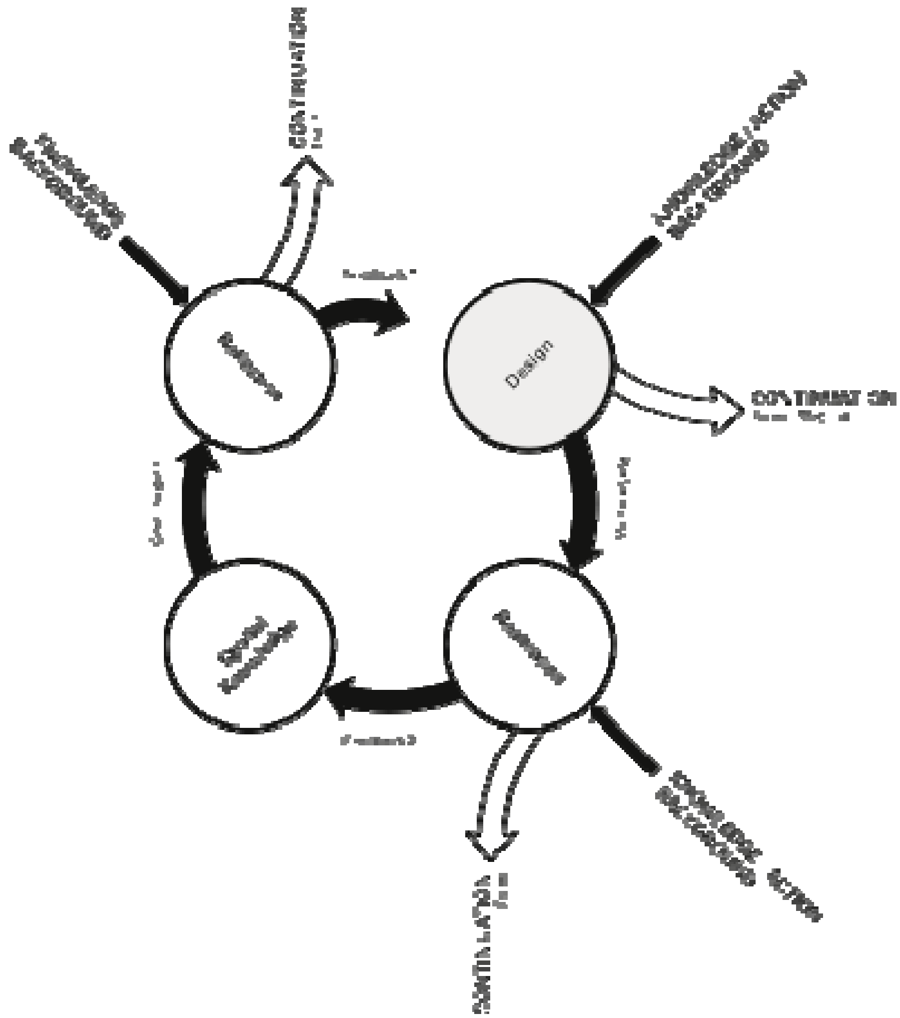
Through the interaction of experiment and theory – in whatever constellation – a cognition is produced that, if it corresponds to scientific criteria, results in a scientific knowledge.
If the same type of representation is applied to architectonic research, we have the following cycling model resulting:



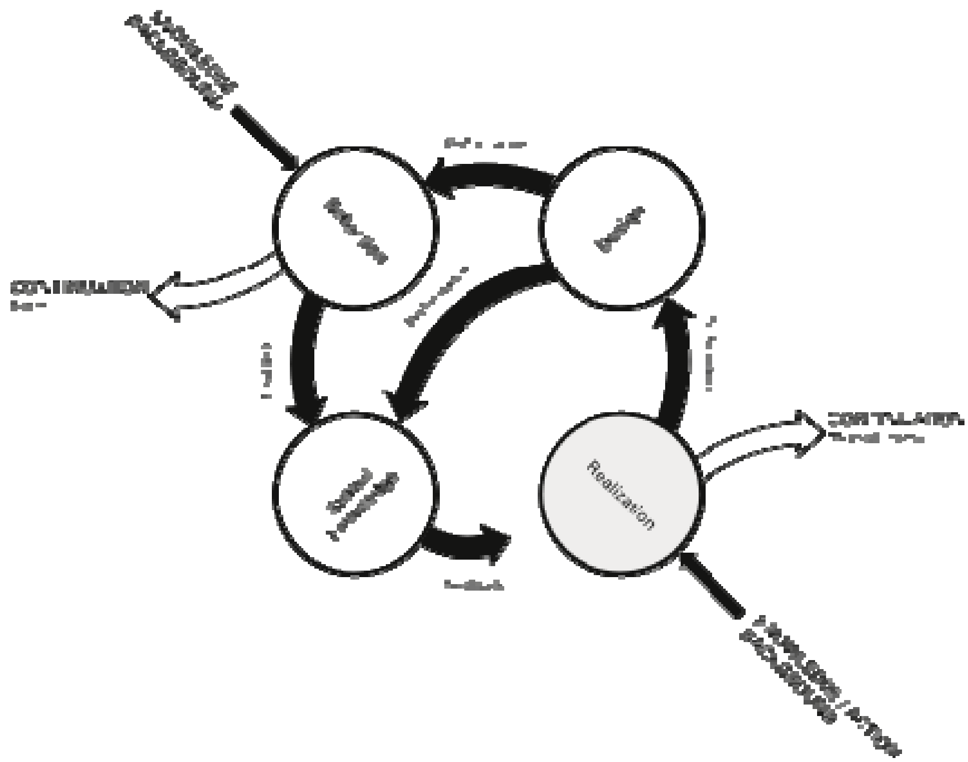
Basically every architect can have his “starting point” in a different node – Reflection, design, Realization – in order to obtain spatial knowledge, he has first to set a goal for his work and to find the instruments to fulfill this goal, secondly he has to run through this process several times acquiring the necessary invention-knowledge that allows him to respond to ever different tasks and projects through his methods and instruments. Thirdly, his knowledge has to be communicated and find a continuation through other architects.



In the case of Peter Eisenman, the cycle starts with his reflections – which are not a theory in the scientific sense, even if they might appear as such sometimes – and proceed over the design, back to the reflection, while realization is less an interest of his work in the sense that there is no much knowledge gained (except for questions of complexity). The starting point of Eisenman's work is a critique of mimetic representation and the attempt to introduce "modernist" thought into architecture. In order to do this, he mainly works on references to linguistics, literature (theory) and philosophy that he tries to implement in his projects (or to implement contents associated or announced by these references). In order to do this he clearly is focused on finding methods and instruments which could help him to do this. Due to the different influences at different times and the consequent shifts of paradigms, his work is particularly "didactic" as it reveals for every phase this quest for a translation. As an overall instrument, the diagram – to what he dedicated a book in 1999, *Diagram diaries* – is what allows him to merge influence and project and at the same time represent his processual design method. The diagram came mainly through the influence of his mentor in Cambridge Colin Rowe (and thus indirectly through Wittkower), already his Phd was based on a diagrammatic analysis of several architecture masters.
Thus we can say that the spatial knowledge of Eisenman resides in the capacity or in the attempt to transfer contents into architecture and in the development of strategies and methods to this end. His spatial competence resides in his capacity to find ways of implement certain contents into the space of his projects (and it is irrelevant whether he is successful or not in that)
The spatial knowledge is communicated through his extensive writing that even if it is not explicitly capable of explaining his work, is an indicator of how his work is structured. The continuation is in the possibility for other architect to implement the same methods and strategies to obtain similar goals (what has been done extensively).



A different take is that of Swiss Pritzker price winner Peter Zumthor, whose point of depart is design, over to realization – with a great care for construction details – and to a reflection in books and articles which is far different from the one of Eisenman, rarely taking reference to his projects and remaining quite "atmospheric" and not theoretic. Zumthors aim is to transfer qualities of what he calls "images" into his realized spaces. In order to do this, in order to anticipate these qualities already in design, he developed instruments such as oversized models in materials close to reality and his sketches, that allow him to proceed further in the process from image to space. He is not interested in theories but has a strongly phenomenological approach. He developed this method of work, which was strongly influenced by his background – education as furniture carpenter, as interior design and ten years of work in the building conservation – further and further, in order to find a way to translate these images in space. This illustrates very well how spatial knowledge is gained through the continuous running through this cycle.
Even though his approach is extremely personal and even though continuation has happened mainly on formal copies – the amount of "Vals"-project that appeared in architecture school for example – his spatial knowledge is mainly to be found in these instruments he deployed for his aims. The knowledge lies less in the texts and articles as in the case of Eisenman, as in the work methods itself.



A last example is the one by French architect and designer Jean Prouvé whose cycle starts in realization. Only what can be produced, implemented and assembled is worth being developed.[8] In his work, Prouvé starts with implementation and subordinates the other creative processes beneath it. This rather unusual approach can clearly be explained by his family situation and his personal background. He derived his knowledge of rationalising production from his constructive and process-oriented design. He continuously refined the processes and repeatedly gained new insight from the constant comparison between planning and implementation. For him, the primary ‘judges’ of the quality of the products were those who carried out the production and assembly – not the later users or even an architect. His insight consequently often flowed into patents, of which Jean Prouvé registered a countless number, acting as a form of communication of his technical and spatial knowledge.

According to Jean Prouvé, knowledge and innovation should stem from the factories, so he resisted any form of theories on his work. When he studied the work of other architects and engineers, he was far more interested in the form of design plans that in abstract, theoretical assessment. He dissected and systemised the buildings and objects of his time and thereby derived an understanding that was directly rooted in practice. Nevertheless, one can still speak of theoretical reflection in Jean Prouvé in the sense of an analysis. His spatial knowledge resides thus in his particular way of working through experiment and model and is communicated through patents.

Conclusion

The example case studies presented here allow us to assess the personal background of each architect, the individual intentions arising from them and the use of specially developed instruments of architectural research and design for that purpose. They also provide information on the possible gain in cognition from the protagonists’ individual creative architectural processes, the character of the spatial knowledge gained from it and its reception.

In an initial overview, it is apparent that personal background has a massive influence on the relevant architecture. In the diagrams, it is possible to see clear distinctions in the individual approaches. Above all, it is the starting point of each process – be it cognition, theory/reflection, implementation or the design – that reflects the different ways in which architecture is

[8] “Mann soll nur konstruieren, was man verwirklichen kann, (...).” Prouvé, J., Huber, B., Steinegger, J.-C., 1971, p. 11

handled. Work with the diagram shows that a hierarchy of points and processes develops within the creative cycle. Not every architect touches on every node within this process with equal intensity and not every background flows into the same influence. Creative action develops around one or two focal points that are the subject of greater concentration.
For Eisenman, theory and design methods are equally important. Zumthor starts the process directly with the design and Prouvé creates prototypes as a means of design, thereby going via implementation. So for Prouvé, the design process is reversed and his creativity takes a different course from the other examples studied here.
It also becomes apparent that the more one or two areas in the diagram are focused upon, the less influence the others have in the overall process. Eisenman is an extreme example, as he is simply not interested in the implementation of his work. By contrast, Zumthor reveals a balanced process in which the focal points lie in the design and implementation, as well as a great interest in reflection and theoretical examination.
The individual education of the architects or a personal interest in a different field apparently allows a more distanced perspective, making it easier to question architectural principles in an unbiased way. Zumthor for instance was trained as a furniture carpenter and worked in monumental preservation before founding his architectural office. Immediately after graduating in Architecture, Eisenman wrote a doctoral thesis on theoretical questions and was greatly interested in philosophy and literature. Only Prouvé has a special status among our examples, since he was exclusively trained as a craftsman, but moved in a world dominated by architecture and art. They all share a perspective on architecture that is broadened by other fields. The situation of the protagonists leads them to question dominant conventions and methods and to continuously test and further develop their own actions in the sense of architectural research.
The instruments of the creative process are developed according to their weighting in the diagram – as well as the nature of their relationships, i.e. their connections. Eisenman mainly works with diagrams he mainly draws from the context of natural sciences. Examples from art history also play a role for Eisenman – above all Colin Rowe, who formulated a new interpretation of diagrams. Very early on, Eisenman worked with computer models and was partially involved in developing the 3D software *FormZ*, which plays an appropriate role in his design work. Prouvé no longer placed craftsman's prototypes and industrial manufacturing techniques at the end of the design process, instead making them early steps in the work process, thereby giving them the role of an instrument. Zumthor developed many conventional architectural instruments further by varying the presentation of initial sketches or the scales of his models to allow atmospheric qualities to be experienced at an early stage.
All the architects presented here (actually in our investigation we treated also the cases of Aldo Rossi and Christopher Alexander) actively seek instruments and methods and test them in an experimental way to achieve their intentions in architecture. They gain cognition by experimenting, which in turn leads to knowledge of one's own working methods.[9]
The question of the reception of the gained spatial knowledge goes hand in hand with the question of the instruments available to an architect for formulating his knowledge. Assuming that verbal communication is only possible to a limited extent, the study presents alternative solutions: Prouvé for instance uses patents as a good way of formulating his knowledge in the form of manufacturing processes.[10] In Eisenman's case, the knowledge is mainly presented using diagrams and theoretical texts, whereby the content of both levels, text and diagrammatic presentations, rarely overlap. Eisenman can rather be regarded as a founder of a poetic theory that is only indirectly communicated, using suggestion and theoretical constructs. His models, which sometimes distance themselves from the constructed building and represent additional project content, are further instruments for communicating knowledge. Such an example is the House X, which is now in the *Museum of Modern Art*. It was built in a way that it only appears "correct" from one position and thereby draws attention to the influence of architectural representation. With Zumthor, oversized models are the main communicators of intended atmospheric properties. At the same time, he uses suggestive books such as *Atmospheres,* in which his projects are not shown themselves, and refers to the origins of his intentions by means of reference images.
Communicating the concrete form and range of spatial knowledge apparently requires an equally large field of experimentation, as well as the development of methods of architectural creation.

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[9] Eisenman's work with diagrams is an example of this. In 1999 he dedicated a book to the subject, *Diagram Diaries*, which included a typological classification of diagrams and an overview of his entire work from the perspective of the relevant diagram.
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