A discussion of knowledge transfer from research to practice and the relationship between knowledge used by architects in their design process and kinds of research-based knowledge.

Knowledge in the making

Inge Mette Kirkeby

This project began when one of my research colleagues, a civil engineer, pointed to his very thorough study of daylighting in buildings and said: 'Here is all that architects need to know about light – why don't they use it?' A discussion followed about what kind of knowledge is relevant, when, and for whom. It ended with the questions: 'What kind of knowledge do architects really use in their design process?' and 'How can we as researchers provide the different kinds of knowledge that are useful for practice?' These questions became the basis of a research project and this paper reports on its studies and discussions.

'What kind of knowledge do architects really use in their design process?'

When knowledge, and different kinds of knowledge, are discussed in the field of architecture, it is common to point out the difference between explicit and implicit knowledge. Implicit knowledge is built up through experience, built-in in practice and exchanged 'without words' in collaborative work and in the master-apprenticeship relation. From the researcher's point of view, however, the study of tacit knowledge is something of a dead end. Research-based knowledge is by definition explicit – verbalised, frequently supported by other explicit means. Implicit knowledge can only be externalised to some extent – and, above all, it is questionable whether it would benefit anybody. Implicit, or tacit, knowledge is rather to be accepted as a characteristic part of professional practice. Nevertheless, a question remains: how can research produce the kinds of knowledge that may feed into the design process? How can the different kinds of knowledge be specified? This paper distinguishes between context-independent and context-dependent knowledge. Context-independent knowledge corresponds with a traditional notion of scientific knowledge – a rational instrumental concept of knowledge as presented in the above-mentioned study of daylighting – and context-dependent knowledge corresponds with various 'soft' kinds of knowledge, such as personal experience, case studies, episodic knowledge etc.

Knowledge from research into practice

These preliminary questions led us to frame the following problem: the relationship between different kinds of knowledge used by architects in their design process and different kinds of research-based knowledge is neglected in architecture. A systematic study, and a thorough discussion of knowledge transfer from research to practice, are needed. What follows addresses this problem, building on a pilot project. It is viewed with an architectural researcher's interest in finding a better flow of knowledge from research into practice.

Empirically, the project is based on six semi-structured interviews with practising architects in Denmark. The interview method was chosen in order to derive first-hand answers to the question about architects' use of knowledge in general. In comparison, observation studies would describe *what* they do, acknowledging that it would not be visible what kinds of knowledge they would use. The interviews were conducted lasting between one-and-a-half and two hours, and were taped and transcribed afterwards. The criteria used for choosing the architects were, first, that they should have considerable experience in architectural design from brief to finished product and that they should represent work in different architectural specialisms: institutional work, restoration, housing, landscape architecture and urbanism. During one interview, it emerged that the architect had been employed by Jørn Utzon when he was young and the experience from this period was in some ways so seminal for his own way of working that Utzon also 'speaks' through the interview. Second, in one way or another, the architects had shown an active interest in research-based knowledge, for example attending lectures where research results were presented or by referring specifically to research material. This criterion helped the project focus upon (research-based) knowledge – if architects known to have an interest in new knowledge do not use or refer to it

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then architectural research has a problem! To some extent, these selection criteria made the group of interviewees rather homogeneous: middle-aged with an above-average interest in research. So the interviews should not be seen as representative cases but instead as 'critical cases'.[1] Some of the limitations in empirical data will be rectified in subsequent stages of the project – in my ongoing research, architects educated before 1968 are compared with architects educated within the last 15 years.

The project draws on the work of different architectural theoreticians, especially Donald Schön whose showdown or encounter with the notion of rational instrumental knowledge opened a much broader understanding of the way practitioners work and think. It also draws upon the work of Bryan Lawson, who was interviewed as part of the project because he has contributed to the field with very thorough work reflecting upon how architects work, think and the knowledge they use. Further, the discussion is influenced by Bent Flyvbjerg's work about case studies, Aristotle's concept of *phronesis* and his distinction between context-dependent and -independent knowledge.

Towards a broader concept of knowledge

The question of how design and research relate to each other is certainly raised among architectural researchers from time to time. With a specialist interest in architectural research, **arq** carries on a discussion about the subject and the discussions show a keen interest in what kinds of knowledge are relevant for the practitioners and how research can contribute with worthwhile knowledge aimed at practice.

'... design primarily concerns itself not with the way the world is or was but the way it might be or should be.'

Our profession is indebted to Donald Schön for breaking away from the concept of knowledge as 'technical rationality'. When reading his book *The Reflective Practitioner*, published in 1983, the reader realises, and the designer recognises, design as a reflective conversation with the situation. And this concept of reflection-in-action narrows the gap between researcher and practitioner.[2] In his last chapter, Schön considers some implications for research. In the context of this article the three most interesting kinds of research are: 1. 'Frame analysis' ('The construction of a role frame is superordinate to and longer lasting than the setting of particular problems'); 2. 'Repertoire-building research' (new design situations 'may nevertheless be *seen as* familiar situations, cases, or precedents'); and 3. 'Research on fundamental methods of inquiry and overarching theories', ('those that some practitioners have learned to use as springboards for making sense of new situations').[3] Through these kinds of research, the researcher produces knowledge that may be valuable in and support the practical design situation.

Since the publication of his book, Schön's work has enriched discussions between researchers and practitioners and the concept of 'the reflective practitioner' has become part of researchers' language so that it is understood without further explanation. This paper is to be seen as a continuation of the discussion and seeks to add another step towards the construction of a frame of understanding that may structure discussions about knowledge in the making.

Bryan Lawson studies the design process, how architects think and what they know (Lawson, 2004 and 2006),[4] and argues for a definition of research as 'original investigation undertaken in order to gain knowledge and understanding'.[5] By adding the word *understanding* to the word *knowledge*, an opening is created for integrating kinds of knowledge that are less hard-core facts than demanded in traditional scientific research. It is important, Lawson continues, to distinguish between descriptive and prescriptive activities in order to stress differences between research relevant for architectural praxis and traditional scientific research. 'There are unquestionably differences', he writes, 'between the act of designing and the act of traditional research.' Most striking of these must be that traditional research tends to be largely descriptive, whereas design tends to be largely prescriptive. Which is to say that design primarily concerns itself not with the way the world is or was but the way it might be or should be.

In what follows, understanding is discussed as a kind of knowledge that differs from mere descriptive knowledge distinguished from facts and rules by being more subject-dependent. Understanding is seen as important for the architect, because the production of architecture demands an ability to imagine how others may use and experience a building. To imagine how it is to be in a certain space involves empathy and a personal understanding from the architect. Gaining understanding is a process which involves interpretation, where you must actively participate to make the understanding your own. The concept of understanding, thus defined, also highlights an important difference between the natural sciences and humanities, where architectural research is often seen as belonging to the humanities. In humanities, you aim to understand the meaning of something, while in the natural sciences you explain the causal connection of something.[6]

'Designerly ways of knowing'

The transfer of knowledge as a main concern for researchers is discussed by Nigel Cross. Because design differs from the two established fields of research – the sciences and the humanities – he says, we have to realise that in his well-known phrase there are 'designerly ways of knowing'.[7] These 'designerly ways of knowing' enable architects to extract 'knowledge' from sources that, for non-architects, look like mere pictures or that, in their opinion, have nothing to do with

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architecture. They also allow that they may extract knowledge that is useful in the design situation without ever verbalising it.

'It is worth considering how research results can come close to the level of abstraction that is in play during the design process.'

In the article 'Use of Episodic Knowledge and Information in Design Problem Solving', Willemien Visser discusses the importance of episodic knowledge. She defines episodic knowledge as particular knowledge not specifically linked to problem solving, understood in opposition to abstract knowledge.[8] She writes:

> *The knowledge used in problem solving, which has been studied most, is abstract knowledge* [...] *referring to types, or categories, of problems and solutions. Recently, researchers have started to discover the importance of problem-solving re-use: the use of 'episodic' i.e.* particular, *experience-linked sources which are at the same abstraction level as the target problem ('cases'), rather than general knowledge structures at a more abstract level.*

This distinction between different levels of abstraction seems important. It is worth considering how research results can come close to the level of abstraction that is in play during the design process.

Peter Carl writes in a letter in **arq** 9.1 (2005) that knowledge relevant for architectural practice is, to a wide extent, a matter of practical knowledge; a matter of the exercise of judgements to find a best possible outcome in ambiguous circumstances. He argues that this kind of wisdom corresponds to the concept of *phronesis* from Aristotle's description of *praxis*. Carl links wisdom (*phronesis*) directly to architecture, where other authors have discussed the concept in relation to other professions. Flyvbjerg relates *phronesis* to planning, emphasising Aristotle's three kinds of knowledge, but with a strong emphasis on the aspect of power.[9] Richard Ruderman, meanwhile, links *phronesis* to political judgment.[10] While I have omitted the power aspect in this paper, Flyvbjerg's analysis of Aristotle and *phronesis* has structured the thinking behind it. I hold the distinction between context-dependent and context-independent knowledge to be more constructive from a researcher's point of view than the distinction explicit-implicit, since implicit knowledge is somewhat inaccessible for research and the ways from explicit into implicit are obscure.

From this brief review especially two aspects will be carried forward. First, the 'gap between researcher and practitioner' will be maintained, as Schön points out, as an important distinction that points back to the problem statement. Second, the concept of context-dependent knowledge (as opposed to context-independent) will play an important role in the following discussion and be used as a container for a number of kinds of knowledge such as 'episodic knowledge', 'practical knowledge' and 'understanding'.

Interviews

I conducted qualitative semi-structured interviews with architects lasting about 90 minutes each.[11] Architects were asked to answer the question: what kind of knowledge or sources do you use while designing? They did not answer as anticipated. I had expected that they would mention, among other things, some examples of architectural research which subsequently could have been analysed and categorised. However, they gave priority to other kinds of knowledge.

Primarily, the architects talked about the importance of graphic representations. They explained how they are able to get a certain kind of knowledge directly from graphic representations, which they can use to advance their own design process:

> *One of the most worn-out books in the office was Scarpa's sketches. I think all his works are in it. They are quite simple illustrations, but what is so interesting is that you can actually see Scarpa's process through the drawings.* (Poul Damgaard)

This illustrates that knowledge is not just a matter of seeing a form which can give inspiration – it is also a matter of getting an insight into a working method; *you can actually see* the process. He extracts something about how to tackle a design problem: a designerly way of knowing.

Johan Fogh refers to the time he worked for Jørn Utzon in a master-apprentice relationship. Utzon brought plenty of books and pictures into the office each day:

> *His world was one big collection of pictures which you could also call sources of inspiration. And when I start a new project, I sit down in different places at the site and I open my inner gallery of pictures to see what kind of house would suit here.* (Johan Fogh)

Utzon communicates design possibilities to his employees through pictures or physical features, and later Fogh uses pictures in a dialogue with the site: as the reflective practitioner. Sven-Ingvar Andersson emphasised that this is not just a matter of copying, describing Le Corbusier's Chandigarh beautifully as 'almost Aztec architecture with those plateaus – it is not imitation of forms, it is an understanding of architectonic means'.

Drawings are important in the process of constructing and sharing knowledge, not only between practitioners working together but also in the knowledge transfer between researchers and practitioners:

> *I am sure that researchers' material would be much more useable if it was enriched with drawings and diagrams. They are good at communicating the most important points. If we can draw a diagram that uncovers the complexity of the task, well then we have almost solved the problem.* (Bjarne Bach)

The quotation shows that Bjarne Bach does not feel the same need that researchers often do to put knowledge into words. He directly relates the more abstract knowledge of the diagram to the specific form in a given project.

Architects depend upon personal experience of buildings and space:

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The feelings and experiences you get from visiting a building you do not get from magazines. Now let us take Asplund's City Hall in Gothenburg – that staircase, the proportions he gave the stairs going up into this light pleasant space – and the tranquillity you get from going up the stairs – you would know nothing about this from looking at a picture. (Asger Juul)

This bodily experience and understanding comes from *being there* and it shows that the idea of knowledge being subject- and context-independent, as found in traditional science, is considered far less important in daily architectural practice.

This is the case not only when imagining a space, but especially for imagining a space in which it is pleasant to be:

Somewhere in your luggage you have some unconscious understanding of relationships, I think. There was this richness of sources of inspiration, and then he [Utzon] *has this deeply rooted intuition for human well-being – there is not one of his buildings that is not filled with places one would like to be – sit down in a corner, or on the stairs or something.* (Johan Fogh)

The architects did not start talking about research-based knowledge on their own initiative. When asked, they commented quite critically and gave examples of research that they did not find to the point. For example one architect, Bjarne Bach, criticised an anthology on architecture and pedagogy: 'too heavy to read and too many words!'

'…researchers need to design their research projects in such a way that the results can feed into the design process…'

Another architect, Johan Fogh, pointed to the limitations of what it is possible to investigate by research:

[…] *you can't investigate the real inner core of our profession by research at all – the synthesis. But next to the core there are a number of tools in our profession concerning materials, light, acoustics and history. Those subjects are open to investigation.*

He specifically refers to word tools. This notion of tools for thinking and design seems to offer possibilities for researchers to reach practitioners. Bjarne Bach says:

The architect has to have empathy and understanding of the activities that are going to take place in this building. But to get them unfolded and differentiated is very demanding […] *it is here researchers may contribute and investigate important aspects.*

All the architects interviewed stressed the importance of analysis:

[…] *during the whole design process you need to be analytical of what you are doing – later in the process when some decisions are made, it may have some big consequences if you have not been analytical enough with your first ideas.* (Asger Juul)

Sven-Ingvar Andersson who, besides his professional practice, was a professor in landscape architecture, says that drawing itself holds a very important aspect of analysis:

The analyses are underestimated. If architects and students travel and take beautiful photos, it is not enough. You lack the drawing, since it contains an element of analysis.

This kind of analysis is a matter of personal insight but, as Andersson continues, this is not enough; the architect also can – and ought to – build upon analysis and insight gained by researchers.

So, although the architects made some harsh remarks about examples of research that they had encountered, they also stressed the importance of analysis, analytical tools and a common language. This emphasises that researchers must continue to examine the common ground between theory and practice. When explicitly asked to mention useful research, for example that conducted at the schools of architecture, however, the architects could produce few examples. From a researcher's point of view this may seem disappointing, but at the same time the architects' answers make it obvious that researchers need to design their research projects in such a way that the results can feed into the design process and bridge the gap between research-based knowledge and practice-used knowledge.

Knowledge and understanding

The interviews reflect how architectural practice relies on kinds of knowledge which transcend mere facts and 'scientific' knowledge. It relies on *personal experience* from specific sites and buildings: you have to have the experience of *having been* in a building, you cannot get the same feeling from a magazine. It also relies on a general understanding of what is 'good' for people: 'The architect has to have empathy and understanding of the activities that are going to take place in this building'. Or to quote another: 'Somewhere in your luggage you have some unconscious understanding of relationships […] this deeply rooted intuition for human well-being'. Here the word *understanding* was used explicitly, connecting with the impetus to architectural research by Bryan Lawson referred to above. To the question 'what is the difference between knowledge and understanding?', Lawson answers that design specifically needs knowledge that lies outside the situation in order to solve it. Design is a curious activity and we cannot say at the beginning of the process, or even during the process, what kinds of knowledge might be useful.

To the subsequent question of how architects can make use of research-based knowledge in design, Lawson answers that it is a question of how we turn knowledge of existing things into ideas about *how things could be*. There is no simple key but research may produce results which help people to develop their own understanding. Lawson mentions Herman Hertzberger's *Lessons for Students in Architecture* as a good example: 'He [Hertzberger] turns knowledge into understanding by saying "this is how I understand it". He gives you a structure'.[12]

Another way of supporting the practitioner's understanding is to produce design tools. Lawson points to the fact that, although there is a huge amount of knowledge about hospitals, architects do

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not use it. He argues that this is because the knowledge 'is not available in a form that they can work with – what we have done is to create a series of tools that enables them to turn knowledge into understanding [...] Behind these tools lies all the research evidence'. He explains how understanding is bound to the design situation:

> *The design process is integrative, and the point I'll make here is that design problems and design solutions do not map onto each other – it is a special thing about design, and scientists cannot understand it – but architects look for it. Architects are trained to see possibilities; trained to imagine possibilities instead of looking for explanations and descriptions. This matter of understanding is to know that all the time you are looking for this idea, which will miraculously turn out to solve these problems. But maybe you recognise some underlying features in the situation and say 'it is a bit like this' – not only a building, can also be nature or a film or – that is the question of expertise*. (Bryan Lawson)

Understanding, as summarised from the interview with Bryan Lawson, has this dimension of carrying something which is closely connected to a specific situation and to the person who 'understands' – context-dependent knowledge opposite general knowledge independent of time and place. Aristotle had already stressed the importance of this differentiation between knowledge that is context-dependent and knowledge that is context-independent.

Aristotle's three kinds of knowledge

Long before Western civilisation gave priority to knowledge produced in the scientific world as an ideal for all other kinds of research and investigations, Aristotle made a distinction between three kinds of knowledge – *episteme*, *techne* and *phronesis*. The first two categories are well known in our daily language as 'epistemological' and 'technical', while the word *phronesis* has sadly gone out of use. Now, perhaps, it is finding a renaissance. In English the term *phronesis* is often translated as 'prudence', although Ruderman argues this translation is not quite satisfactory:

> *It is indeed a 'practical' (as opposed to contemplative) science; but Aristotle distinguishes it from mere shrewdness by associating it with moral nobility, suggesting that* phronesis *aims not at mere life ('security') but at having us live 'well', bringing us closer to our ends as humans*.[13]

So Peter Carl's translation of 'wisdom' may be more meaningful to architects.

Phronesis enables man to make decisions and judgments well. In architecture, *phronesis* enables us to talk about forms of knowledge that are different from, and in a way much richer than, factual knowledge. It also helps us to act and judge and make decisions with prudence and wisdom.

Flyvbjerg explains the main differences between the three kinds of knowledge, which may briefly be summarised as follows. *Episteme* is the scientific knowledge, invariable in time and space and achieved with the aid of analytical rationality.[14] *Episteme* concerns theoretical *know why. Techne* concerns arts and craft. As an activity it is concrete, variable and context-dependent. *Techne* denotes technical *know how. Phronesis* is that which is reasoned and capable of action with regard to things that are good or bad for man. *Phronesis* concerns values and goes beyond analytical, scientific knowledge (*episteme*) and technical knowledge or know how (*techne*), involving 'the art of judgment'. *Phronesis* emphasises practical knowledge and practical ethics.

> 'Techne *denotes technical* know how. Phronesis *is that which is reasoned and capable of action…'*

Thus we find that, first, *phronesis* is concerned with the particular and context-dependent which is given priority over universal rules. Here the 'power of example' may be considered. This is especially interesting in the light of the importance that the interviewed architects attached to specific buildings they had seen – context-bound and particular – as vehicles for advancing their design process. Second, Aristotle argues, *phronesis* is knowledge that helps man to act wisely and make good decisions. There is a strong similarity here with design situations where the solution is not inherent in the starting point, but instead good solutions must be found through an understanding of what well-being of people might be, and thus how an imagined space would feel when you are in it. *Phronesis* according to Aristotle is the most important kind of knowledge, because it deals with how you use the two other kinds of knowledge; whether you use them 'well', or not, from an ethical point of view. What is especially interesting here is that, to Aristotle, although the three kinds of knowledge were distinctly different and one of them cannot be reduced to be one of the others, they were not so self-contained that they could work in isolation. Thus, *phronesis* does not operate entirely on its own but relies on theory and experience as well. 'Unlike theory, it will learn from experience; it will even recognise that reason is sometimes inapplicable to politics'.[15]

Ruderman, whose real concern is political judgment, presents a comparison with architecture:

> [...] *the political philosopher will neither construct ends freely nor ignore practical considerations. For, just as an architect could construct any one of a wide but limited variety of homes to meet our (relatively permanent) housing need, so the political philosopher can design any of a variety of regimes to meet our political and moral ones. Thus, the person of* phronesis *would combine flexibility in respecting different experiences, histories, and locations with a clear grasp of the ends of human nature*.[16]

Although the differences between politics and architecture may seem most apparent at first, there remain common concerns in finding, suggesting and choosing the 'good solutions' in specific situations.

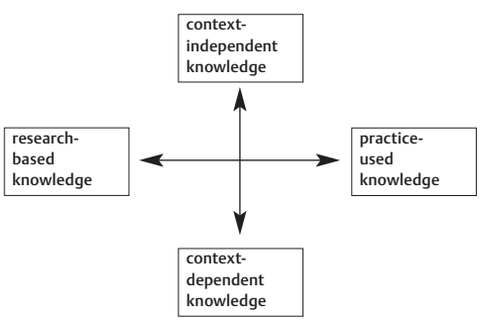
This possible interaction makes it easier to talk about the synthesis in which the architect, in a very

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flexible way, combines different kinds of knowledge, stated as a main activity in design by the practitioners and by Bryan Lawson. However, although it is not a problem for the practitioner how different kinds of knowledge and understanding merge, it is of major interest for the researcher to know more about how they interrelate. Here, Aristotle states that *phronesis*, being the most important of the virtues, gains from both experience and from philosophy and theory. This way of looking upon experience and theory, as well as the general and the particular, has to be tried out to see whether it can guide research to produce more research knowledge feeding into practice.

Towards an architectural knowledge arena

Two major distinctions have been made. First, the distinction between *research-based knowledge* and *practice-used knowledge*. Second, the distinction between *context-independent knowledge* and *context-dependent knowledge*. In order to relate different kinds of knowledge to each other and to stimulate a discussion of how research can serve practice they are combined in an arena of understanding.



North-west quarter: context-independent research-based knowledge

In the north-west quarter of this arena we find the traditional ideal of science: general context-independent knowledge that has monopolised the Western view of what knowledge should really be, like facts, preferably expressed as numbers, or as universal rules to predict consequences, corresponding to Aristotle's *episteme*. Practical examples could include building archaeology, exploring which part of a structure is the oldest. Alternatively, it could describe knowledge about material performance, or research on daylighting as mentioned in the beginning of this paper.

North-east quarter: context-independent practice-used knowledge

This knowledge aims at an unambiguous answer to problems arising during design situations; answers that ease the choice by limiting the field of possible solutions. For example, what is the minimum dimension needed for this beam? What is the maximum tolerable level of noise here? Researchers may choose to communicate these kind of results as guidance. The interviewees clearly state that, in many situations, they rely on such technological research.

South-west quarter: context-dependent research-based knowledge

Here we find knowledge that is neither to be generalised in rules nor described as 'facts', but is rather dependent on a certain context, e.g. the 'power of example'. Such knowledge may be created through the analysis of concrete examples; case studies where the analysis operates at a higher level of abstraction than the concrete case from which it is derived but must be understood in connection with the case itself. It may produce 'understanding' that is subject-dependent in the sense that the researcher cannot be substituted with somebody else – the researcher's interpretation is embedded in the results. The interviews demonstrate an interest in research which provides the profession with analyses, analytical tools and a common language. Examples could include a discourse analysis of texts concerning building conservation to uncover guiding attitudes among those responsible for heritage. The development of design tools is to be placed in this quarter, and so are Schön's three research topics: 'Frame analysis', 'Repertoire-building research' and 'Research on fundamental methods of inquiry and overarching theories'. Further research is needed to determine whether this kind of knowledge might be called *phronetic* knowledge, or whether this label is only to be found between practitioners.

South-east quarter: context-dependent practice-used knowledge

This quarter concerns knowledge that is integrated into the architect's own analysis of the design task; knowledge that the architect develops in a reflective dialogue with the design situation, or carries with him or her from earlier experience. Some parts of this design knowledge correspond to Aristotle's *techne* but they correspond especially to *phronesis*, for example concepts used as design tools, theoretical frames, analyses made by themselves or by researchers. Here we find understanding – which is subject-dependent in the sense that the practitioner has to acquire it actively. Here is also design knowledge embedded in books, magazines, pictures, diagrams that merge with the architect's own experience, preferences and attitudes. Quoting from an interviewee: 'If we can draw a diagram that uncovers the complexity of the task, well then we have almost solved the problem'.

It is important to bear in mind that in the synthesis different kinds of knowledge, considerations merge and, as Ruderman so rightly points out, *phronesis* will learn from other kinds of knowledge. It will take further research to explore how knowledge may bridge the gap between the two latter parts of the knowledge landscape. One might

'…researchers still have some way to go before different modes of architectural research are fully developed.'

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expect that research by design might oscillate between the south-west and south-east corners and soften the borderline.

Conclusion

The article has discussed how various theoreticians are fighting a traditional ideal of knowledge as universal and context-independent (north-west) and how their work opens the discussion for a broader concept of knowledge including context-dependent knowledge and understanding (south-west). The interviews with practising architects underscore the importance of this kind of knowledge which is context-dependent and embedded in examples, or knowledge that is linked to experiences (south-east).

But the fact that the practitioners were rather unfamiliar with ongoing research suggests that researchers still have some way to go before different modes of architectural research are fully developed. To meet this demand for knowledge by practitioners and enhance knowledge transfer from research to practice, we have to consider how to strengthen the south-west corner, how to develop different research methods and research designs which could produce knowledge that is context-dependent, explicit and fulfils requirements about a certain general applicability in new design tasks.

Not least, it would be interesting to develop kinds of research which deliver knowledge to support *phronesis* – the kind of knowledge to which Aristotle gives priority over *episteme* and *techne* because it guides us towards what is good for man, and which is not self-contained but listens to philosophy and learns from experience as well.

Notes

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16. Ibid.

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Biography

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