MAKING A CASE FOR URBAN TIMBER HOUSING – BY RESEARCH, TEACHING AND DESIGN

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ABSTRACT

This article aims to make a contribution to the debate on architectural research and academic education. Although their detailed roles and reflective procedures are still disputed, research and design are becoming more and more acknowledged as complementing sources for architectural knowledge. Design can happen within practice or as independent design explorations, in order to add to more traditional research. In contrast to various other design fields (e.g. service design or graphic design), architecture involves much longer production processes and larger costs, so that the realization of full-scale projects – exceeding pavilions or the like – within academic research is difficult. Lately, education too has received some attention for the role it can play within research. Design exploration within a master studio course has the potential to produce multiple illustrations of what is possible and also relevant for a defined context, but it is independent of everyday practicalities.

As a first part of this article, literature is synthesized into a triangular model of architectural knowledge, joining research, practice, and education. In the case of a research project on urban timber architecture (*Wood/Be/Better*), this model has been tested and modified at The Oslo School of Architecture and Design. An early-stage PhD project set the literature-based framework for a master studio course. Both the process of supervising a broad range of architectural projects and the finished student projects gave important feedback to the research project and added to the limited amount of built and unbuilt reference cases. Quality criteria for research formulated in various academic texts frame the discussion of the suggested model for architectural knowledge, its relevance for wider implementation and ethical concerns.

KEYWORDS

Architectural research, master studio teaching, urban timber housing

INTRODUCTION

Debates about what architectural research is or should be are broad and multifaceted.[1] Especially for research novices, it is challenging to get an overview of the various options for research design, and how they are discussed and assessed. Each research project has to find its own way of relating to a defined context and school of thought, and of framing and answering questions. Also, an increasing number of architectural offices claim to conduct research-based design.[2] Academia is sometimes criticized for self-legitimating and practice-irrelevant research. Research-based design within offices, in turn, can lack academic rigour[3] and is usually not shared with a greater audience or even documented internally and transferred to the next project.[4] Time and money constraints[5] can limit the depth of such research. Financed by the offices, the gained knowledge has to contribute to competitive advantage and is most often only disseminated in the form of built projects.[6] At the same time, academic education is discussed controversially, as researchers are merited for published work, but not for teaching. In a recent Norwegian newspaper article, it is described as "career suicide" to use time and energy on students – meanwhile universities earn money for each student finishing a course successfully.[7] Teaching funding seems to even cross-subsidize research activity in some cases.[8]

However, scholarly arguments and precedents for a methodological research framework integrating theory, practice, and education exist.[9] This article claims that a combination of academic and "designerly" methods[10] involving activities within research, practice, and teaching promises to produce knowledge that is relevant and applicable as a contribution to all three mentioned fields. The combined benefits can go beyond isolated activities and discussions. For an ongoing research project on urban timber housing, academic research and master studio teaching have been harnessed as mutually beneficial sources of architectural knowledge, also giving access to information released during design processes. Results of this research will be useful for the future design of urban timber housing, as well as for raising awareness for the relevance of new urban timber housing typologies and a broader understanding of sustainability linked to the use of timber as a construction material. The PhD research objective, methods, and first results are described briefly in this text and discussed more in detail elsewhere. This article focuses on a contribution to the debate on architectural research and academic education. It includes literature studies that contextualize the suggested approach for research, teaching, and practice within an ongoing discourse.

This approach is then discussed on the basis of current PhD research and an affiliated master studio course at the Oslo School of Architecture and Design. Criteria for good design research formulated in various academic texts structure this discussion. The European Recognition of Professional Qualifications Directive,[11] from 2005, is referred to here, since it serves as a base for the set-up of architectural education in Europe and at The Oslo School of Architecture and Design (AHO).

THEORETICAL BACKGROUND

Hats and Triangles: Three Sources for Architectural Knowledge

> Is there a research landscape appropriate for assessing complexity, and flexible enough to fathom scholarly and artistic reasoning, rationality and intuition, objectivity and subjectivity?[12]

Many scholars have argued for the complementary potential of research and design, harnessing their respective inherent approaches to knowledge production. While research and design have common traits, they are also fundamentally different: Although implying quite distinct activities, research and design are related in their way of processing disparate information "towards a comprehensible, or desired, end".[13] Both seek to identify a problem and to find solutions for it. But while research *searches* – that means analyses and systematizes – past and/or present phenomena in order to answer a question with generalizable knowledge and/or applications, design *generates* proposals for artefacts or interventions as future answers to an existing or anticipated problem. Thus, research works descriptively and design acts prescriptively.[14] Science can identify, analyse, and solve things that "are", with methods validating the results. This implies a focus on existing phenomena, thus on past and present. However, scientific research does not exclusively focus on things that exist already. There has been an inventive, creating component of scientific research for a long time as well, such as the development of new chemical compounds. Design, too, can invent, shape, and construct things that don't exist yet, and as they "ought to be", directed towards future scenarios.[15] David Salomon consequently argues that design and research, in the context of architectural research, can both be seen as hybrids, applying quantitative as well as qualitative methods, and producing "objective truths" as much as "personal fictions".[16] The complementary strengths of a positivist and a constructivist approach, of "rational problem solving" and a "reflective practice", can contribute to multifaceted "designerly ways of knowing".[17]

In contrast to design practice, scientific research tries to isolate aspects that then are researched in depth, aiming at generalizable and repeatable or applicable results with external validity.[18] In contrast, due to the unique context of every design tasks, in practice design results must not be offhandedly repeated or copied.[19] Architectural projects are complex and touch on a broad thematic variety, and their quality is measured on the successful consolidation of a whole range of at times conflicting requirements.[20] So how can these contrary approaches be beneficial for one another?

> I don't think you can design anything just by absorbing information and then hoping to synthesise it into a solution. What you need to know about the problem only becomes apparent as you're trying to solve it.[21]

As Richard MacCormac states, design does not function by first gathering information and then transforming it into design. Instead, knowledge gaps appear in the process of understanding the design task and searching for design solutions. This suggests that design can, just as scientific experiments might do, inform research areas. As much as in research as in design, processes may happen in a less ordered and linear way than presented afterwards, and both might use similar ways of experimenting and constructing logic on various levels. Design knowledge is often intangible[22] or tacit[23] and applied intuitively through design activities. As suggested by Steadman, research can "help designers to be more effective in their decision making … by widening their knowledge of options in design".[24]

Recently, yet another field has come to awareness as an area for knowledge production. Architectural education can both benefit from research input and feed back into research in turn. In fact, theory, practice, and education are jointly responsible for shaping the field of architectural design[25] and should exploit possible synergies. According to Wortham, studio teaching can be a research activity with "multiple contributions – to the academy, to education, and to the serving and reshaping of society".[26] Multiple design solutions as architectural speculation produce "if-then propositions". Dunin-Woyseth and Nilsson see a "new practitioner" species emerge that unites the qualities of "professional practitioners, of educators, and of field-specific researchers". These have the potential to contribute to a "more robust, self-confident, and dialogue-oriented field of practice and inquiry in architecture and design".[27]

This statement addresses three fundamentally important criteria for research assessment that are referred to throughout a broad range of texts on architectural research, with slightly varying wording and weighting.[28] The rigour (or robustness or reliability), relevance (or significance), and communication (or accessibility) of all research endeavours should be ensured – be they predictive, descriptive, prescriptive, speculative, or even fictional.[28] Without taking a stance on current alternative currents in architectural research here, I would like to emphasize the importance of some common values allowing for a discourse across disciplines (and sometimes just across the hallway in one institute). They can make all the difference between mere *fact-finding*[30] and *understanding*,[31] or between individual artistic development and something with a value for others, too.[32] A range of means to these ends are listed here – with an awareness that the relevance of each varies with different perspectives and might make sense in one context, but not another,[33] and acknowledging that such a list is never complete.

Concerning doctoral theses, the current Bologna Directive puts more emphasis on learning to be a researcher than on producing new knowledge. Nevertheless, the relevance of research question and results will at least be on the list again when applying for research funding or grants. Predetermining results as new, original, and a substantial contribution[34] by moving the field forward or by allowing for new or substantially improved insights[35] might be naïve or restraining. But setting out purposively,[36] with clear goals,[37] contributes not only to the significance of the work,[38] but will also add to research rigour and ease the communication of a research contribution. Even though often concealed in the final format of a doctoral thesis or research presentation, the way to gaining this clearness might be "messy" throughout the whole process.[39] One way to make an impact on society more probable is to address current questions that are important to and applicable by practitioners.[40] But also in other approaches, a certain degree of generalizability[41] must show the results' interest beyond the actual case. A reflective critique[42] might lead to understanding in addition to new knowledge,[43] and also support research communication.

Research rigour refers to a consistent and systematic[44] way of processing information, reducing it to data, leading to knowledge and ultimately understanding.[45] Research that becomes informed and inquisitive[46] in this way needs adequate preparation[47] and problem setting.[48] Proceeding methodically,[49] with appropriate methods,[50] increases the validity and reliability[51] of

the research. Positivistic, quantitative approaches rely on measurable, explainable, and repeatable results more than qualitative, interpretive methods that are committing to different, less defined assessment criteria and which might evoke intense discussion.[52] However the individual research approach is framed – making use of more conventional methods or moving away from them, relying on one school of thought or combining methods – a clear account of the research practice strengthens its validity.[53]

A "bricolage" or mixed-methods approach allows for pragmatically picking and mixing research methods that promise to produce the most relevant answers to the research questions, across academic paradigms or schools of thought, and methodological categories.[54] Also called triangulation, a combination of different ways to collect and to analyse data (e.g. from different perspectives, or by using multiple tactics[55]) promises a more stable, holistic, and objective base for research with the aim of increasing credibility (reliability and also relevance).

Finally, the communicability[56] of research, evident in its effective presentation,[57] ensures its accessibility for others. As referred to by John Forester,[58] Jürgen Habermas lists the following expectations (as opposed to rules) towards pragmatic communication: it should be comprehensible, sincere, legitimate, and true. While the first two aspects address form and intention, the latter two could be linked to the discussion of relevance and rigour.

According to Nigel Cross, "the best examples of design research are: purposive, inquisitive, informed, methodical, and communicable. This requires articulation and shared knowledge within and across the field. This, again, requires articulate communication of explicit knowledge."[59] Publication, but also conference presentations and academic lectures, exhibitions, or prizes indicate the research's importance to a wider audience.[60] Peer reviewing processes prior to publication again guard research rigour.

Figure 1 illustrates a synthesis of the assessed literature into a model for the production of architectural knowledge. It joins the three elements of research, design, and teaching in order to increase the effectiveness, relevance, and reliability of the research results: research can inform practice with relevant questions and contribute to better-informed decision-making, and result in efficiency and innovation gains.[61] Design on its part can inform research questions. Design also informs education with state-of-the-art aspects of

architectural conception, construction, and processes. While education can contribute to research by offering an increased capacity to produce a range of examples for which there is often no time or money in research, it can also benefit from the communication of questions of general concern and of first-hand knowledge. This is also a form of dissemination of research knowledge, which then will be transported further to practice, when students enter their professional careers.[62]

The questions addressed further in this article are:

How can design research, but also education and practice, benefit from one person wearing different hats, that means shifting between the roles of a researcher, a designer, and a teacher? How can this model contribute to research credibility (rigour and relevance) by means of triangulation? How does it affect research communication?

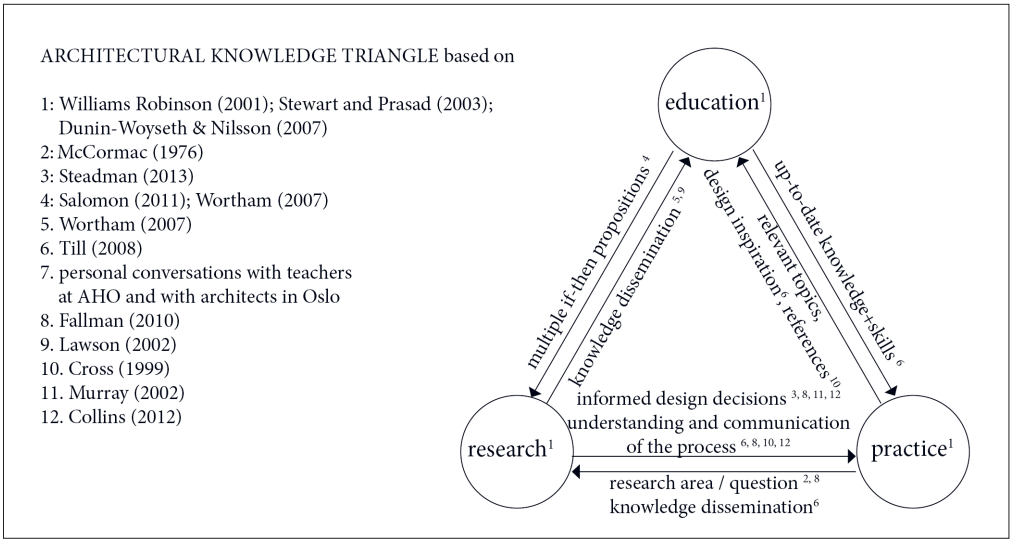

Figure 1. A synthesis of literature on architectural knowledge production involving research, practice, and education. Ute Groba, 2016.

METHODS

A Take on Design Research

The general triangle of architectural knowledge production introduced before has been developed through a study of literature on sources of architectural knowledge, design research methodologies, research and design, research and practice, the combination of research and teaching, as well as research-related design studios, and finally on assessment criteria for research. For the application in an actual case, it has been adapted to a PhD project on urban timber housing (see the section on results). Design, as differentiated by Fallman,[63] can happen within practice ("the real") or as design explorations ("the possible"), to add to more traditional research ("the true"). In the described case, design explorations were to happen within a master studio course. The researcher thus had a more indirect, partly collaborative role in the design process through discussion and supervision.

Suggested modification options for the general triangle – based on the experience and reflective process around the described master studio teaching and research – form part of the discussion. While the main focus lies on the research contribution of master studio teaching, a short account of advantages for education is given, too. The European Recognition of Professional Qualifications Directive 2005 lists eleven points on which to base architectural education. They are also part of the ambitions of The Oslo School of Architecture and Design.

MAKING A CASE FOR URBAN TIMBER HOUSING: A MASTER STUDIO COURSE AT AHO

Thematic Background

In the light of growing environmental concerns, building dense urban housing up to four floors in timber promises to have ecological and practical advantages.[64] It is also eased by current Norwegian building codes and by new timber products. Nevertheless, only few recently built examples exist in Norway. So what are the range, and the architectural potential of these timber typologies?

With decreasing energy consumption during the use phase of buildings (operational energy), the material aspect (embodied energy) gains importance.[65] As numerous studies show, timber as a construction material has clear environmental benefits.[66] However, the potential reduction of CO_2 emissions by replacing concrete and steel with timber construction is limited in a global

perspective. Other aspects, beyond the empirically measurable, have to be explored, too, offering a more holistic view of sustainability. The "loveability" of our built environment, as phrased by architect and professor Dietmar Eberle (in an interview with Peter Andreas Sattrup[67]), leads to longer lifespans and better caretaking of buildings, increased value, identification, and well-being. A positive experience of urban density depends fundamentally on architectural quality.[68] However, an objective and universal definition of architectural quality is not possible[69] and often eschewed by academics. Yet architectural quality is seen as part of sustainability and vice versa (as for example recognized by the German Sustainable Building Council in its new version, 2017, and by the Green Building Council Denmark, 2017).[70] In order to move from a subjective to a discursive perspective (or intersubjective – as Forester[71] refers to Habermas, also described as "mutually … understandable" by David Wang[72]) – sorting aspects into categories promises to be helpful (e.g. into properties, value, coherence[73]) and is therefore applied in this study. Based on literature studies, the notion of quality is deconstructed into preferable properties of urban density, housing, and timber construction.[74]

Several aspects of architectural quality, sustainability, and prefabrication are seemingly contradictory, and prioritized differently among stakeholders. These relate in varying degrees to the building's geometry and to the social conditions that this urban form fosters. They include rationality and diversity, coherence and individuality, community and privacy, spaciousness and compactness:

The discussion of rationality and variety addresses the contradiction between repetition as often associated with prefabrication and mass production, and spatial diversity as an important quality for a positive experience of urban density. Coherence and individuality are two aspects of dense housing that can be conflicting or complementing, referring to a visual wholeness and consistency, and the human need to mark one's own territory and to express one's individuality. Privacy and community are not necessarily mutually exclusive. Advantages of living in a community are many, but should be balanced with possibilities to retreat. While compact building volumes relate to a reduced consumption of space, energy, materials, and possessions, spaciousness is associated with a good home and can support a stimulating spatial experience.

Can dense timber housing provide rational variety, allow for coherent individuality, offer privacy within a community, and invent spacious compact-

ness? As part of the PhD research, these questions were used as a filter for a pilot analysis of four reference projects. Seventeen low-tech design strategies to achieve a consolidation of these contradictory requirements were revealed.[75] These include all three scale levels that have been used for the discussion of architectural quality: urban form, architectural strategy, and detail design. Although derived from timber projects, the design strategies are valid for any other building material, too. So what is the specific role of timber in this context?

All of this forms the background for a master studio course, where urban density had to be negotiated with qualities on urban, architectural, and detail levels, and relationships between the construction and the experience of spaces were to be explored. By transferring the design strategies identified in reference projects to a new context, their general applicability is tested. Moreover, a range of new precedents is added to the few existing current projects in this category, illustrating possibilities that might exceed what is built or buildable today and inspire future development.

The hypothesis that the combination of low-rise high-density housing with prefabricated timber construction is relevant for present and future urban areas in Norway can only be investigated on the basis of the few existing reference projects that correspond to all mentioned parameters. These two aspects of a building (urban typology and building material) mark the two extremes in a hierarchy of urban elements[76] (urban scale and detail scale). In contrast to urban typologies, research on timber construction most often has a technical focus. Can they be researched in combination in spite of this? Although the choice of material and construction method was found to also have an impact on urban quality (urban scale),[77] typology and material most obviously come together in a built project (building scale). The creation of new precedents for a Norwegian context promises to reveal both further information and new or more detailed questions. Time limits, financial restrictions, and workforce restraints complicate the planning and building of full architectural projects as a source for research by design. Nevertheless, involving education and design into research can create suitable conditions to simulate design processes for realistic and approvable architectural suggestions for a Norwegian context.

COURSE SET-UP

In order to explore the aspects described in the section above through the students' projects, the course input was directly related to these questions and challenges. "A series of lectures by academic researchers, engineers, producers, architects and OBOS (the largest Nordic cooperative building association) shed light on a broad range of relevant themes – some contradictory, some complementary. These include quantitative and qualitative aspects of urban density; timber technology and Norwegian timber tradition; fire and sound requirements; various timber construction products and possibilities for prefabrication."[78] Some of the lecturers additionally offered expert supervision in short workshops after the lectures. Moreover, a lecture about the research background of the task introduced the students to the design strategies derived from reference projects,[79] making them explicit – without prescribing them for their own projects, however. Although architecture design tutors often deny conveying specific design methods, Curry found this to be especially useful for novice designers.[80] At AHO, master studies beginners and students with their last course before the diploma project meet in the master studio courses. In the described case, there were especially many novices.

The lectures were complemented by analyses of reference projects for low-rise high-density housing (most not in timber) and of different options for timber prefabrication. A day trip in and around Oslo and a study trip to Vorarlberg, Graubünden, and Zürich allowed a direct experience of reference projects for low-rise high-density housing and timber construction. All of this input had to be documented by the students, by lecture reports, written presentations, and photo collages.

An introductory two-day task at the wood workshop was meant to kick-start imagination together with a feeling for wood as a construction material, and to encourage the use of working models to develop the projects (which indeed happened). A realistic setting for the studio projects is provided by a collaboration with OBOS, an important housing developer in Norway. Rather than defining the course's content, OBOS suggested a relevant site where matching considerations are in progress in reality. The students worked in groups on a revision of the master plan. After discussing the suggested alternatives critically, the class voted for one version to continue working on. This master plan was divided into sites for the individual projects that then got distributed by drawing lots. Students were allowed to work alone or in pairs.

The student projects had a broad scalar focus, with attention focused on the urban context, the architectural strategy, and detail solutions.

Supervision was provided by two fix teachers and by workshops with experts. A series of interim presentations structured the semester and allowed for discussions in the whole group. The final review was joined by an external reviewer, who also contributed during the final evaluation of the projects. This could be seen as a form of peer review, with a focus on the conceptual and constructive rigour of the projects.

COURSE RESULTS

Course results include a new master plan for Mortensrud in Oslo (sent in to Oslo Municipality for consideration in an ongoing planning process, Figure 4); twelve projects documented in drawings and models in various scales, illustrations, and renderings (Figure 5); but also documented learning content in the form of lecture reports and reference project analyses made accessible for all AHO students (Figure 3); conceptual models and texts (see Figure 2); and individual project-related investigations (e.g. on the air-cleansing capacity of plants; on traffic noise blocking; on the suitability of different typologies for the different sites; or on multistorey buildings without elevators on steep sites). All of the students handed in, and all students passed. The course results (see also Figures 6–8), in addition to the course framework and accompanying tasks, are documented in a course book.[81] They have also been exhibited at AHO WORKS, a biannual event at The Oslo School of Architecture and Design. Minna Riska, partner at MDH arkitecter, and external examiner for the course, commented on course layout and knowledge production at the final review:

> Generally, the quality in the projects developed in this course is very high. It is quite exceptional that we can discuss the projects on so many levels – urban plan and piping in one session!
>
> It is also remarkable how the studio is laid out, with the collective development of an urban plan and a "site lottery".
>
> Some sites are challenging, and many turned that into an advantage for a very articulate project.
>
> Discussions in a review like this are a project in itself. A last possibility to produce knowledge.[82]

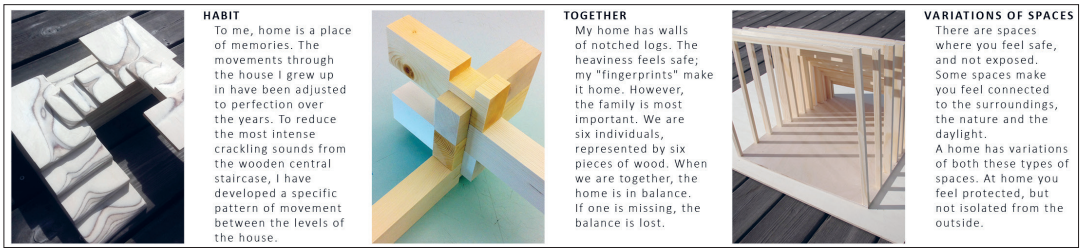

Figure 2. Results of a two-day task at the wood workshop: "A prefabricated sense of home." Helene Offer-Ohlsen, Marie Callin Østern, and Ingri Heggebø, 2016.

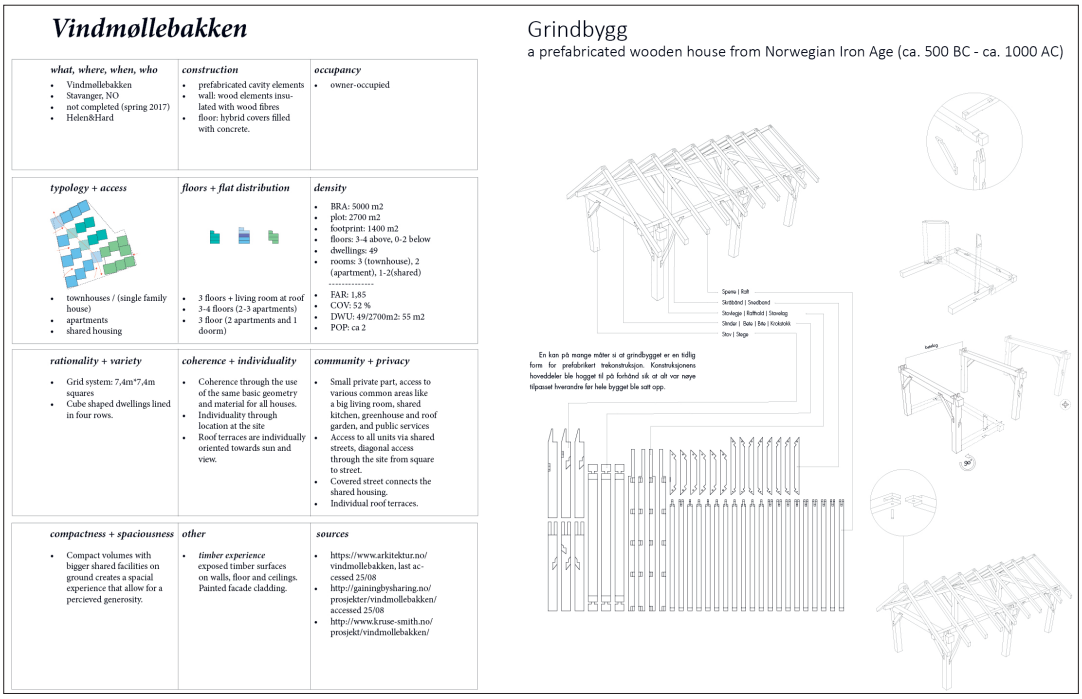

Figure 3. Reference project analysis. Silje Træen, 2016. Timber construction system analysis. Jon Erik Dybedal Brekken, 2016.

Figure 4. Cut-out of the suggested master plan for Mortensrud. Master students at AHO, 2016

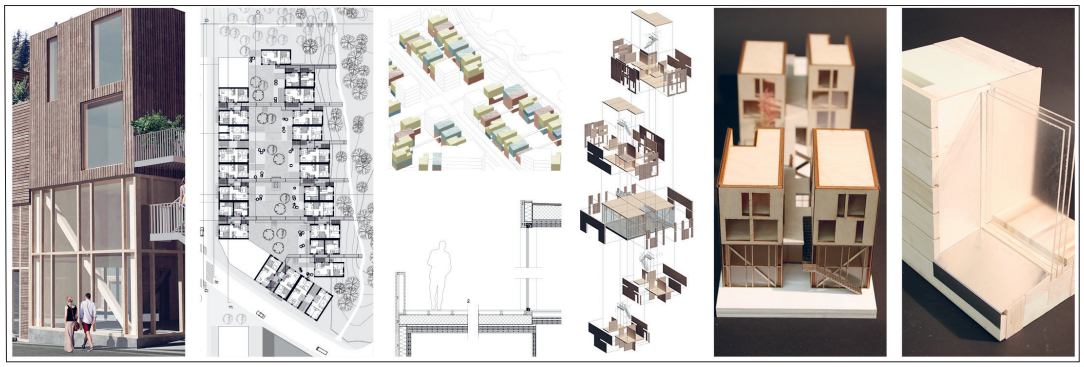

Figure 5. "Urban Belt Mortensrud." Oda Frøyen Nybø and Ingeborg G. Svalheim, 2016.

RESULTS FOR THE RESEARCH TOPIC

A (not yet published and only sketched shortly here) reflection on the course's contribution to the research topic takes up the question of how urban typology and timber as a building material are related. Criteria supporting a positive experience of urban density were examined more in depth and found to address three main fields: location-related factors (functions and connections), form of the built mass, and social composition of a neighbourhood. In each field, timber construction was found to be able to make a difference, most importantly in the third field. Not surprisingly, there is no causal link between "good" urban density and timber construction, but a mutual influence. Neither is timber the only suitable material to achieve these qualities nor always the best. Nevertheless, timber construction can support the achievement of desirable characteristic on various scales. This is

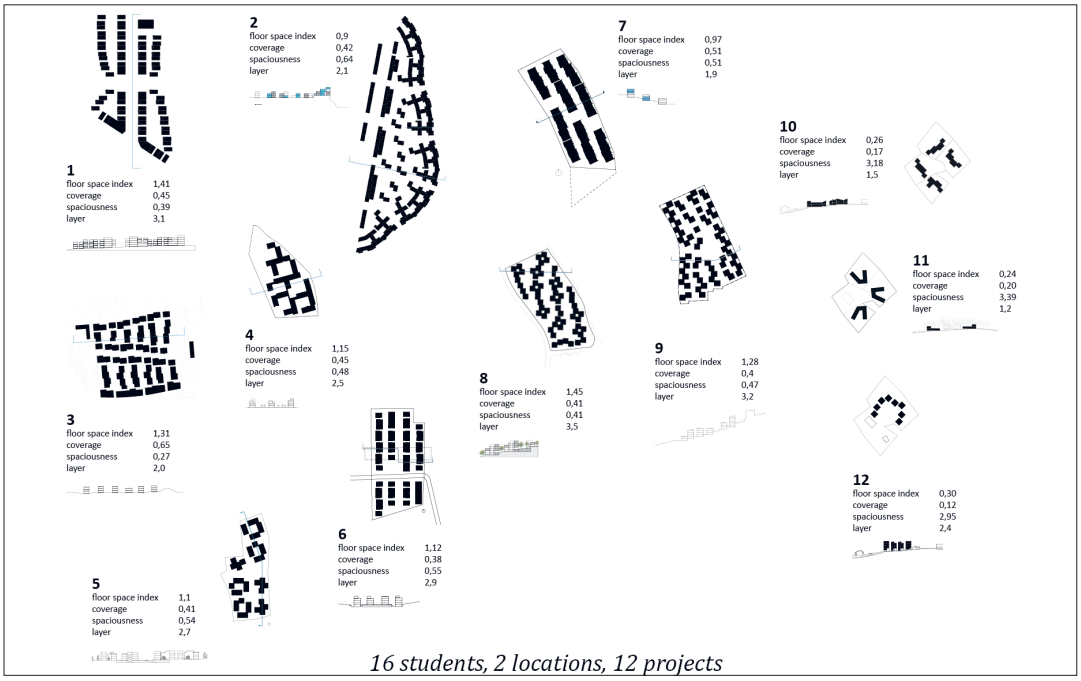

Figure 6. Mapping the students' projects, assessing urban pattern and density. Ute Groba, 2016.

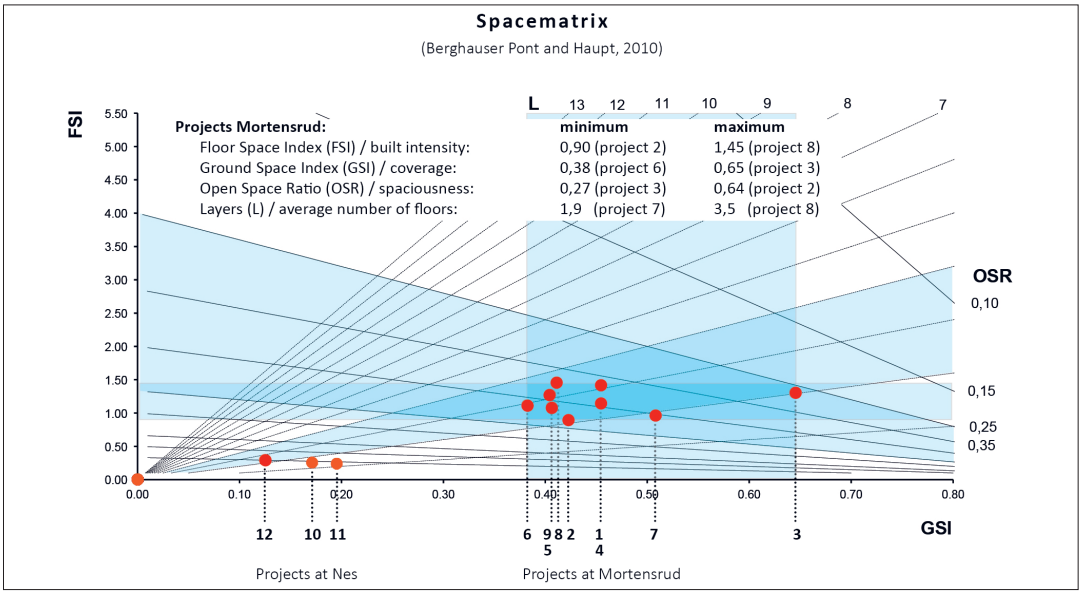

Figure 7. Mapping the students' projects, assessing different density indicators in a Spacematrix scheme (kindly provided by Berghauser Pont). Ute Groba, 2016.

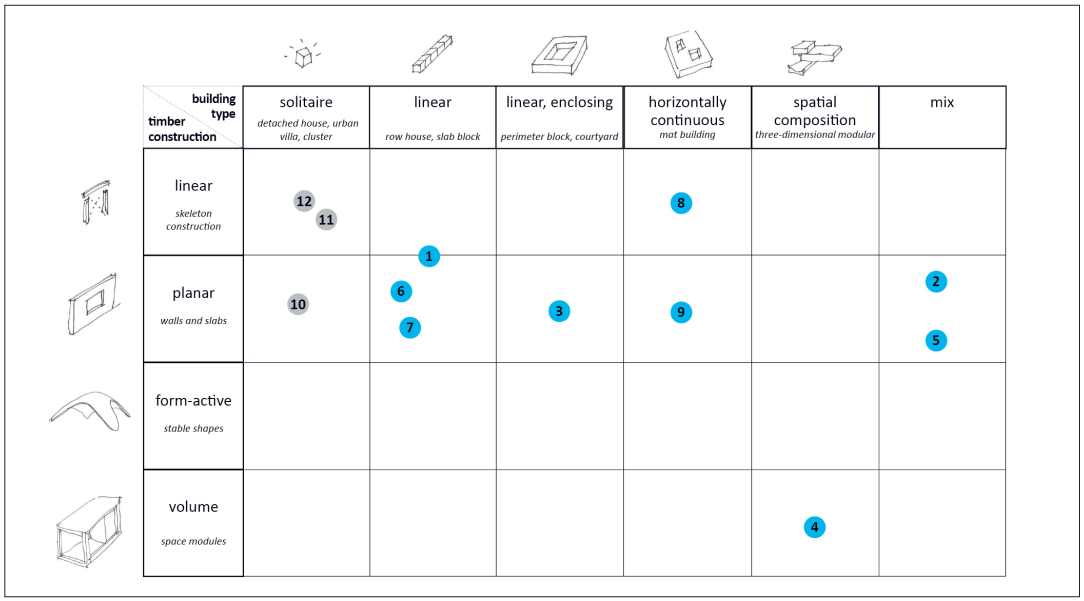

Figure 8. Mapping the students' projects, assessing building type and construction aspects. Ute Groba, 2016.

especially the case for aspects that support user diversity and stable neighbourhoods: dwelling variety, dwelling flexibility/adaptability, and options in different price segments. Here, the workability of timber plays an important role (weight, size, no drying time, off-the-shelf products and tools, prefab options, etc.), as well as different price options (e.g. exposed massive timber elements that allow for housing a "raw" building without any facing layers, where the construction itself also provides the final surfaces). The described range of urban typologies also makes demands for constructive decisions: constructive clarity eases later changes; free spans maximize adaptability; the positioning of ducts and shafts affects flexibility; fewer horizontal or vertical overlaps ease sound- and fire-related issues, especially when exposing the construction. All five main arguments (a timber contribution to a mix of functions; to visual diversity; to greenery woven through neighbourhoods; and to user diversity and stable neighbourhoods) can be illustrated by the course's student projects. With this reflection, the equal-weighted consideration of urban qualities and material influence comes to an end in the research project.

The design of urban timber housing can be enhanced by an awareness of potentially conflicting, potentially complementing requirements across scales, and by a conscious integration of the described qualitative aspects into the project. If applied consciously, timber construction choices can have an impact on urban level. These qualitative aspects complement the view on sustainability that for a long time has been dominated by empirical factors (technical, practical, economic, and ecological). Based on academic literature, they allow for a more conscious, grounded, and explicit inclusion of semantic arguments into discussions with clients, developers, municipalities, or consultants. This also implies a focus beyond rashly assumed sustainability criteria for the use of timber, which will be developed further in the remaining part of the thesis.

REFLECTIVE PROCESS AROUND A PHD SET-UP

The following paragraphs address the reflective process around the overall research set-up that happened during the teaching period. Although including personal reasoning related to the presented research, the paragraphs illustrate how the triangular model shown in Figure 1 supported decision-making: the specific function of one research component was identified so that it could be replaced by a better-suited one.

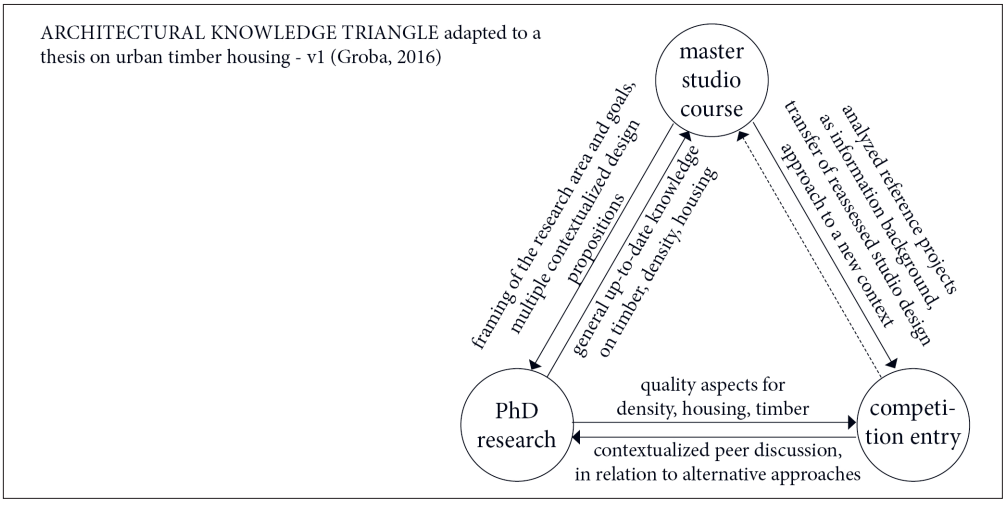

Figure 9. Architectural knowledge production within a thesis on urban timber housing (v1). Ute Groba, 2016.

In a first adaption of the triangular model shown in Figure 1, literature studies were linked to master studio teaching and to the design of a competition entry (Figure 9). The general knowledge extracted from literature was to get contextualized in the master studio projects. A synthesizing reflection on the design parameters and the actual design results was intended to culminate in the design for yet another context defined by the competition brief. The design and its motivation would be discussed by a professional jury, alongside alternative approaches handed in by other practitioners. In this way, the competition entry would both provide insights gained during the design process, provide an illustration of the materialized research results, and function as a "probe". To probe means to "examine something with a tool, especially in order to find something that is hidden".[83] Accordingly, the competition entry would work as a device to "search into or examine thoroughly; question closely"[84] the reception, discussion, and acceptance of the suggested combination of typology and construction by peers (competition jury) and eventually the public. I generally see the format of a competition entry as a promising choice when including design into architectural research for several reasons. A design task defined outside the research projects strengthens the relevance of the design work, as it relates to a real physical context, programmatic need, societal concern, et cetera. The entry will not stand alone but be compared with and discussed alongside other entries. The competition jury's role might be compared to peer reviewing, providing professional assessment and critique. Finally, the limited time frame of a competition seems to fit a PhD project well.

So far, so self-convincing. While "Life is what happens to you while you're busy making other plans",[85] research sometimes takes other turns than originally intended, too. In the described case, reasons for a turn were a reoriented research focus, opportunities, and practicalities:

Most importantly, after refining the research questions, design speculation did not promise to yield as many new answers as exploiting existing conditions in a selected range of buildings. These hold not only information about their built constellations, but also realization processes and user experiences. Although a first reflex often is to use tools or techniques one is familiar with,[86] like a trained architect might be familiar with designing a competition entry, I personally became increasingly drawn to exploring "researcherly" ways of knowing more in depth. While there is a certain probability of designing (research-informed) competition entries later in my career again, I wanted

to seize the opportunity (= funding) to immerse consciously into unknown waters to gain a firmer understanding of more established research crafting. It also became clear that cases were relevant for my projects that I have special access to – through personal contacts, my native language, and through my working experience with one of the projects. Some practical issues added up to this: the envisaged competition did not seem as relevant anymore after reframing the research focus, and working with it would have consumed the time and attention I needed for arriving at an adjusted research design.

The revised version of the personalized research model from Figure 9 now includes case studies instead of the competition entry (Figure 10). Leaning on Daniel Fallman and Erik Stolterman,[87] the research components represent "the true" (literature research), "the real" (design practice manifested in built projects), and "the possible" (student projects as a result of design education). Instead of discussing the potential of this adjusted version for my personal research endeavour, I would like to zoom out to a more general view again.

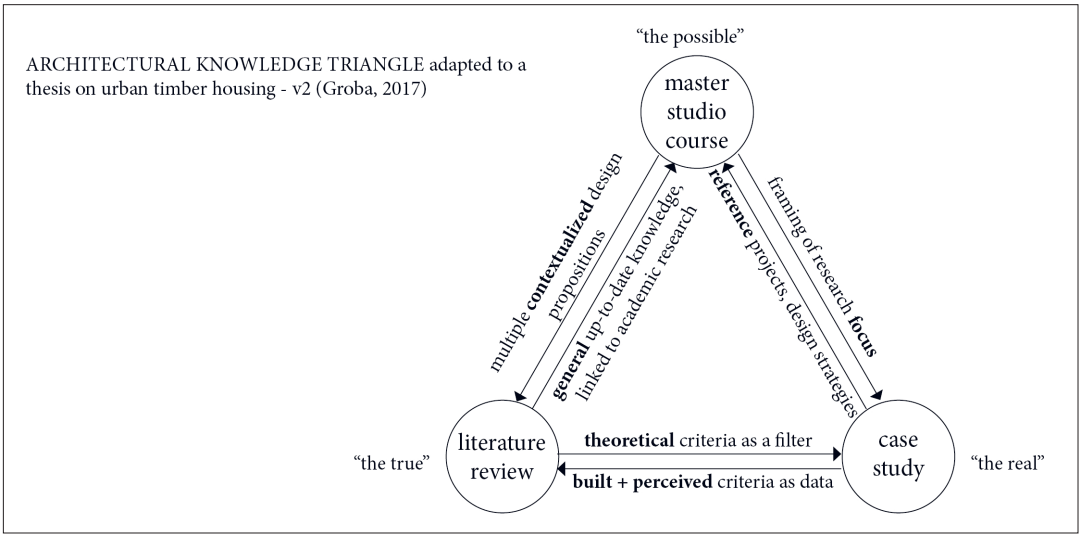

Figure 10. Architectural knowledge production within a thesis on urban timber housing (v2). Ute Groba, 2017.

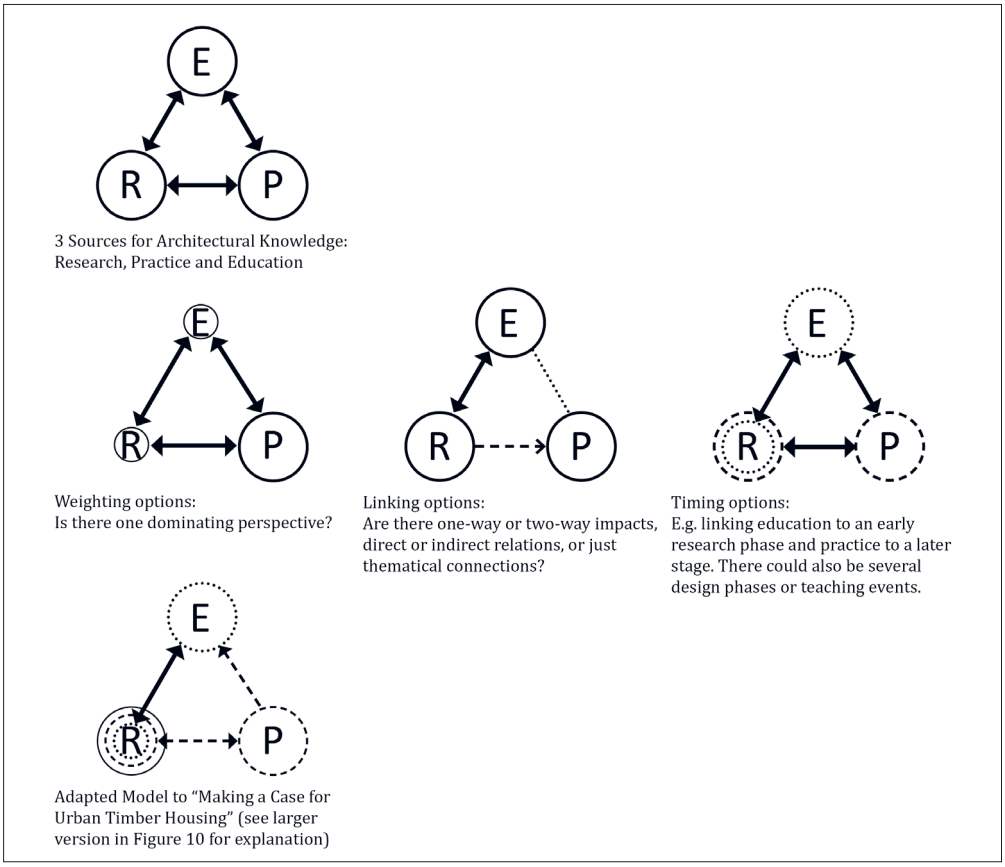

Figure 11. Modification options of a model for multimodal architectural knowledge production. Ute Groba, 2017.

DISCUSSION

Dead Ends and New Traces

Rather than seeing the redesign of the model set-up as a flaw, it shows the strength the model can have already in early research phases and especially for doctoral theses. When still framing and reframing the research area and approach, the visualization of research components and their relation to each other can support reflection, communication, and discussion of the research set-up.

A series of sketches shows how the model might be adapted to other research frameworks (Figure 11): it can weight the contribution of each element differently; it can take the researcher's main perspective into account; it can describe the relations between each element in a more nuanced way; and it can visualize a connection to different stages of a research project.

Sketching the model in this way is useful for gaining clarity about the components and their role in relation to each other in a research project. Its simple visualization format supports the communication and discussion of a research approach or of different options.

Last but not least, it symbolizes the complementary value of three sources of architectural knowledge; acknowledging that they might each reside in their disciplinary corner, but that they can (and should) communicate with each other in various ways to release their synergetic potential.

Figure 12. Synergies between research and education: mutual feedback. Ute Groba, 2017.

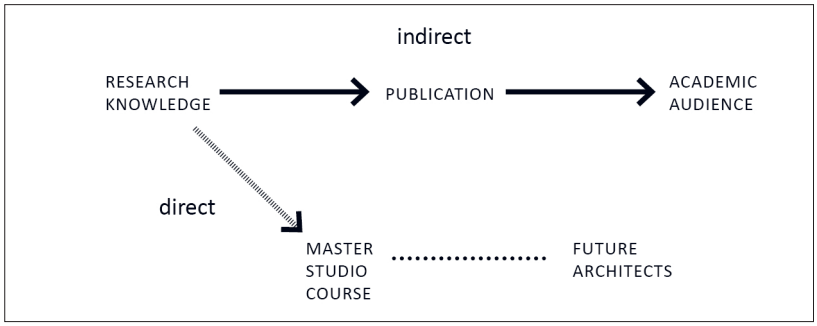

Figure 13. Synergies between research and education: additional dissemination and impact. Ute Groba, 2017

MUTUAL BENEFITS AND POTENTIAL CHALLENGES

> Often in competitions the winning scheme is the one that tells the client something … that is terribly important to them and was not in the brief. Although we tend to admire designers for their solutions, it is often their ability to find the right problems which distinguishes good from adequate or poor design.[88]

Harnessing academic research and master studio teaching has had many mutual benefits in the presented PhD project's initial stages already. As explained more in detail below, the most important advantages are the mutual feedback between research and teaching activities (Figure 12), additional knowledge dissemination and areas of impact (Figure 13), increased depth and breadth of both research and education, and the master studio course offering laboratory-like conditions for a multitude of design explorations (Figure 14).

In order to be productive for the PhD thesis, the preparation of the master course required a clear formulation of research goals, methods, and anticipated outcomes. These have to be relevant for the design of student projects (and thus probably also for practice) – and, if nothing else, convincing and easily communicable. The need to communicate content, goals, and questions clearly in a phase when they were not yet settled fuelled the reflective process and gave it an audience outside the PhD student's mind and apart from supervisor meetings. Every researcher knows how congenial ideas can sound in one's own head – and how they slip through one's fingers when

Figure 14. Synergies between research and education: multiple design explorations. Ute Groba, 2017.

intended to be put down on paper. Sometimes it is necessary to tell a line of thought to someone else in order to be able to put it together in a consistent way.

The immediate transfer of researched knowledge from academic to student is much more direct and efficient than publishing a thesis that might only be read and shared by few. Undoubtedly, the quality control by means of peer reviewing and approved admission to the thesis defence has an essential function ensuring sound and coherent research contributions and is not to be questioned here. But up-to-date information acquired through literature studies and specific investigations are a side product of PhD research that can be of great value to students. Education is enhanced by anchoring the transfer of knowledge and understanding in academic grounds. This is a very direct impact that research can have on future architects and thus on society. It is both a chance and a responsibility to use this opportunity at its best.

In the described example, it facilitated taking various aims for architectural education into account that are defined in an European Directive and that are part of AHO ambitions, such as considering both aesthetic and technical requirements in the design; and developing concepts on urban, human-related, structural, and detailed levels.

Not only by giving access to relevant knowledge can ties to research give teaching more depth, but also by relating student tasks to actual academic discourse. Conversely, knowledge gaps on the researcher's side can be filled by inviting relevant lecturers, or by even inviting lecturers with contrary or complementary research backgrounds, to debate a topic of interest (as was the case in the presented research project).

For research novices coming from practice, so-called "research by design" might be the most tempting option to embark on, and "designerly ways of knowing" are an important contribution to architectural knowledge. However, it can also be challenging for young researchers to firmly defend this approach in front of colleagues and peers committed to more conventional research.

Teaching can offer a perspective in between research and design – with framing (course brief), communication (course lectures), and discussion (course review) of a research problem on the one side, and stepping in and out of multiple co-design processes through student supervision on the other. In this way, the teaching role can be an alternative way to gain access to insights from design-led processes.

Multiple design explorations can add to the breadth of research, for example by exploring the interaction of different design strategies, or by applying them in various contexts.

Due to financial and time restrictions, PhD-related architectural research has difficulty involving real building processes. But – as well as the design of a competition entry by a researcher experienced as a practitioner might do – a multitude of consciously developed student projects can reveal, develop, and test relevant design strategies for early design phases, when the architect's influence on a project is at its peak. This link between research, testing through design, and having access to more hands and brains through an educational context might also happen in a comparable way in the engineering sciences. More than just offering an increased workforce to the PhD researcher, students can contribute with a multitude of ways of seeing a research problem or design task.[89]

Decoding tacit knowledge (or "knowing-in-practice"[90]) contained within existing reference projects can serve as data for the research project but also feed into the student projects. The student projects increase the available precedent data and make research results visible and communicable as an alternative or supplement to text.

However, one has to be conscious about the circumstances of the projects' development, as frame and goal of the course have the same source as frame and goal of the PhD research. Rather than being a neutral source of informa-

Purposive	Objectives: - Explore the potential of a combination of dense housing and timber construction to make it discussible - Produce and disseminate knowledge for the design of dense timber housing - Bring the relevance of dense timber housing to broader attention, raise awareness, initiate discussion
Inquisitive	Identified contradictions explored by: - A project review - Lectures for the master studio course and following discussions - A revised master plan providing sites for the student projects - Master students' design projects
Informed	Sources for knowledge: - Literature studies - Precedents - Technical information - Lectures and conferences - Discussions, some with experts; final review with external reviewer - Design challenges when theory meets context - Peer reviewing of publications
Methodical	Development of tools: - Definition of a filter to extract relevant properties from literature (scale related criteria) - Development of a method to assess precedents (contradictory pairs of criteria) - Extraction of design strategies to achieve a consolidation of these contradictory requirements (urban form, architectural strategy, detail design)
Communicable	Knowledge transfer: - Formulate course goals, discuss students' projects - Communicate research content to students - Exhibit and publish course results (AHO WORKS and course brochure) - Articles, Essays, Papers, Symposium talks

Figure 15. Quality criteria for design research developed by Nigel Cross, applied to a research project at AHO. Ute Groba, 2016.

tion, the new precedents have to be seen as a result of collective explorative research. Also, sources of course input and design assessment (possibly from the same person) are to be decided consciously, as they might result in bias around the design projects. Other issues that might render rigour and relevance of the design studio questionable[91] make criteria for good research also valid for good studio teaching in this context.

The better prepared and the more explicitly framed the task (similar to a laboratory set-up), the more relevance the students' works will hold as actual research results. Nevertheless, ethical issues have to be handled with care, as the first duty of a teacher is the teaching, not the research. A strong focus on the research contribution must not lead to exploiting student labour for personal or institutional interests.[92]

RELEVANCE AND RIGOUR

The application of theories, hypotheses, or design strategies within a master studio course is an advantageous opportunity to test them on their repeatability, transferability to other contexts, and thus generality.[93] Their communicability is an essential premise for this endeavour.

In the following overview (Figure 15), criteria for research quality formulated by Cross[94] are used to list the research contributions by the master studio course. They will be complemented by other elements of the PhD project not addressed further here (case studies).

CONCLUSION

Architectural Research as a Joint Venture

Based on literature studies and personal experience, this article argues for mutual benefits and synergies when joining academic research, practice, and teaching as important sources for architectural knowledge. As an illustrating example, a doctoral thesis and a master studio course conducted jointly at AHO are described and discussed.

The respective roles and mutual influences of these components are illustrated by a triangular model, linking research, practice, and education together. Tying a PhD project and master studio teaching more closely together can have multiple advantages for both parts, as in the described case at The Oslo School of Architecture and Design. It allows for mutual feedback and input between research and teaching, it increases breadth and depth of both

realms, it offers alternative ways of accessing knowledge unveiled through design processes, and it increases the dissemination and impact of architectural knowledge.

For research, the teaching component was found to be fruitful even at an early research stage, when the supportive effect on research framing processes can be more important than actual design results. If it is set up accordingly, the master studio course can function as a test field for design hypotheses or strategies, where consequences, combined effects, or suitability for different contexts can be explored. Actual design results are potentially more relevant in later research stages, as multiple if-then propositions or illustrations of possible scenarios.

Several iterations of the triangular model show how it can be adapted to other research projects to release synergies in different project stages. As architects seem to have a preference for visual communication,[95] accompanying the reflective process and visualizing a research concept to support its communication are seen as important strengths of the model.

Both Wang[96] and Fallman and Stolterman[97] mention a broad variety of accepted design research approaches and methods. Instead of claiming that any design activity can be research, and thus equalizing different disciplines or scholarly research and teaching and their distinct importance, their complementary strengths should be nourished and drawn on for more integrative and holistic results of architectural research. Although the actual methods applied might be similar, each research activity has its own purpose, internal logic, and intended outcome. Each investigation must thus be assessed in its own right, with a notion of rigour and relevance specific to the particular case.[98] It might be necessary to become aware of differing or overlapping terminologies or methodologies to recognize common ground.[99] Communication across disciplines and institutes (or sometimes just across a hallway) is thus of key importance.[100]

Linking education to design research has the potential to increase research relevance and rigour and can offer additional communication arenas. Taking up different positions in the role of a researcher, teacher, and designer may strengthen one's standpoint by way of triangulation. Complementing academic research and "designerly ways of knowing",[101] "teacherly" ways of doing design research thus yield various opportunities to produce and to en-

hance architectural knowledge. These possibilities can be explored without exploiting students as mere workforce and without limiting the researcher's role to serving the ends of practice or education.

NOTES

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[48] Fallman and Stolterman, "Establishing Criteria of Rigour and Relevance".

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