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Research by Design – a research strategy

Abstract

The idea of an expressive component in research is important to the architectural industry. The expressive element - the possibility of expressing the qualitative aspects of the world and adding something new to the existing through experiments and proposals - is characteristic for the field.

All research environments, in the science tradition and in the humanities, have their characteristics. On the one hand, they live up to certain common scientific and methodological criteria - originality and transparency - and on the other hand, they have different practices, using different methods. Research is 'coloured' by traditions and professions, and research in architecture should be coloured too, taking into consideration that the practice of architects stretches from natural science and sociology to art and that the most important way in which the architect achieves new cognition is through work with form and space - drawings, models and completed works. Probably all good design is informed by some kind of research - research-based design. But can research arise from design?

Keywords: Research by design, architectural practice.

Research in architecture

In short, research is systematic inquiry whose goal is communicable knowledge. All research environments, in the science tradition and in the humanities, have their characteristics and traditions as to how research is carried out. On the one hand, they live up to certain common scientific and methodological criteria – originality and transparency – and on the other hand, they have different practices, using different methods.

Natural science involves producing explanations: exact and universal knowledge, mostly concerning the physical world, which can be observed, tested and proven. The scientific ideal is to produce explanations which have enduring validity and are produced in a systematic, empirical and objective way, which means moving from observations of specific instances to formulations of general laws. Still, even in natural science, it is widely accepted that new scientific propositions often result from inspired guesswork rather than inductive reasoning.

The Humanities predominantly concern mankind as the central research question and consist of academic branches such as Metaphysics - theology, philosophy etc. and The Arts - literature, architecture, music etc. The goals for these are not exact universal laws but more or less an interpretation of the particular and singular. Some research disciplines in the humanities are based on empirical evidence, but mostly, the humanities are based on previous writings and generally accepted arguments, theories and philosophy. In that sense, research in the humanities is generally subjective in character, and fundamentally, there is no such thing as objective knowledge in this field of research (Archer, 1995).

Research as a broader field includes experience other than that which is gained from science. Cognition is not the same as knowledge, and scientific cognition is not the only way in which we acquire new knowledge and insight. By far, most of our cognition is acquired physically by imitating or repeating, through actions and movements, by making mistakes, and feeling pain or pleasure. A fairly small part can be formulated as theory and can therefore be scientifically generalised. In essence, cognition and experience are of a personal nature, but they can also be objective and true. Conversely, theory, which is basically objective and true and often defined by time, is in the process of being replaced by a new theory.

Research in Architecture is a part of all this, generally finding its requirements in the humanities tradition but not always doing this comfortably as the subject itself ranges from natural science and sociology to art and because the most important way

in which the architect achieves new cognition is through work with form and space: drawings, models and completed works.

Research in architectural history, technology etc. normally works comfortably inside the humanities way of thinking with aesthetic practice as object for scientific study and not as equal agent in the production of knowledge. But this thinking tends to sever the production of knowledge from the architectural process and from the influence of a dynamic material (Bertram, 2010), and when research goes into architecture itself, the investigation often needs other means of expression and methods, challenging the academic tradition of systematic writing and, hereby, often opposing the academic environment.

If research in the humanities is fundamentally based on knowledge involving evaluation and interpretation, architectural research has the same possible objectivity as the humanities, and therefore, the risk run by bringing in experiments, tools and methods from the practice of architecture should not be alarming as long as the use of these is done systematically, and new insight is expressed and communicated in a way that is useful to others.

Material-based research

Architecture is bound to materials and this gives research in architecture a specific material focus. Knowing the materiality and the context of the place is necessary to build. To be able to change the properties of materials by melting, blending or burning them was basic research carried out by craftsmen when experimenting and inventing. Developing, cleaning and changing the qualities of raw materials into bronze and iron was closely connected to functional needs but was often the starting point of aesthetics: a search for beauty. The beginning of research was the experiment in a material, the invention and the experience through handicraft – an interaction of mind, eye and hand. Science, art, technology and crafts were closely interrelated and connected with the use of the materials – stones, wood, clay, metal and glass. The purpose was the same unity of utility, durability and beauty which has been described as characteristic of architecture by Vitruvius. In fact, it is the same unity which characterises knowledge production from prehistory and renaissance to modern times.

In *A Search for Structure*, Cyril Stanley Smith (1981) writes that it is misleading to divide human actions into art, science or technology for the artist has something of the scientist in him and is engaged in both:

I started with scientific analysis of atomic and microscopically visible structures in solids, but I had been drawn into the study of these forms because I enjoyed looking at them. Eventually my brush with finer art led me to see that the understanding of such structures required more than calculation, and I have learned not to be ashamed of the intuitive-pictorial approach which as a young scientist I was taught to abhor.

One of the differences between architecture and research disciplines such as literature, languages and history in the humanities is that these fields are not bound to materials or experiments or concerned with producing new products. Architecture concerns production of the new, and the material is a main question. Architecture, and its practice, is held by the media of its invention, and the practice-based tools and methods have a large and independent significance: a material focus which involves sketches, models, material experiments and completed architectural works. This material sketching creates a relation between the representation and reality in architecture and is the primary place for intellectual reflection and development of the profession. The ambiguity of the drawing's theoretical potential and its role as a generalised and functional notation system maintain the special relation between reflection and creation - which is the method of architecture.

Architecture is in the most fundamental way about how ideas are embodied. This inherent focus on the material and the practice of making permeates architectural thinking, its concepts and its language. A traditional understanding of the architectural drawing as a language of communication, a means of representation is seeded with the knowledge of the skills and workmanship of making. To draw, or in other ways to make, the material evidences that are fundamental to the practice of architecture is to interface with a knowledge of building technology. Architecture is shaped by its tools and the dimensionalities of its media. The flatness of the paper, the rectilinearity of the parallel rule and the set square dominate architectural practice, its intellectual traditions as well as its building. These tools correlate directly with the conditions for building. The set square implies the drag of gravity and the plumb line of the constructor; the parallel rule emphasises the cut of the horizon. In our work we are concerned with the means by which architectural practice changes as new digital tools become ubiquitous in architectural making (Thomsen and Tamke, 2009).

The special role of the tools and methods is obvious today with the revolution in the tools of the profession radically changing the design process from sketching to production. Today, the tools interface directly with the means of production, creating new ways of thinking industrialisation and new ways of involving research-based knowledge. The new tools collect large amounts of information into a design model, which is able to connect this knowledge directly to design and hereby imply a new, holistic approach to design: a change of the mind set among practitioners. The new tools might even re-establish relations between designing and the material, bringing unity to the planning and building process, which we lost in the division of labour but have admired from the master builders of the cathedrals.

Design Processes

Design is the means by which the architect poses a question and develops complex solutions. It is a reflective practise in which critical assessment, comparability and evaluation takes place through sketching, through the continual weaving between problem and solution in an iterative movement between inquiry and proposal (Thomsen and Tamke, 2009).

In the design process, or the sketching, the architect tests, selects and rejects solutions assessed on the basis of a programme, professional knowledge and how they relate to a certain context. In many ways, the design process is similar to a research process, searching for new products or knowledge but working in the designer's language, drawings and models, rather than the written word. Drawing has always been used by architects in the form-giving process from idea to realisation. The drawings or sketches are representations of cognitive processes and drawings can visualise things in another way than words – with the precision of words, or more precisely, but also open to interpretation. This process of sketching is not just a linear process in which ideas shaped by the designer's mind find their representation in a drawing. The drawing is active: it 'talks back' and forms a 'discussion between hand and brain' in which the drawing becomes the dialectic tool and moderator for insight and knowledge. The sketching involves art, beauty and intuition, parallel to objective and material requirements. In that way, the design process never becomes strictly methodical, systematic, repeatable or objective. And in that way, the intention should not be to turn the design process into research but to investigate how new knowledge can arise and be generalised from designing.

Research by design

According to Christopher Frayling (1994), Research in art and design – research in architecture – can be organised into the following three categories:

Research into art and design is the most straightforward research practice in art, design and architecture. This is historical, social, technical, material research, with countless models from which it derives its rules and procedures.

Research through art and design is a material-based research, development work and action research: practical experiments in laboratories resulting in reports and step-by-step diaries, clear about what is being achieved and communicated through the activity of design process.

Research for art and design is development work whose end product is an artefact, where the thinking is embodied in the artefact and the goal is not primarily communicable knowledge in the sense of verbal communication.

Research by design is research through design, using the expression especially developed from the Dutch practice at The Faculty of Architecture in Delft (V.A., 2000). The concept has been used about the various ways in which design and research are generally interconnected when we produce new knowledge about the world through the act of designing.

An attempt to define research by design has recently been made by a working group under the research committee at EAAE 1:

Research by design is any kind of inquiry in which design is a substantial part of the research process.

In research by design, the architectural design process forms a pathway through which new insights, knowledge, practices and products come into being.

Research by design generates critical inquiry through design work that may include realised projects, proposals, possible realities and alternatives.

Research by design produces forms of output and discourse proper to disciplinary practice, verbal and non-verbal that make it discussable, accessible and useful to peers and others.

Research by design is validated through peer review by panels of experts who collectively cover the range of disciplinary competencies addressed by the work.

¹ Working group under the research committee at EAAE: The European Association of Architect Educations. The working group consisted of: Jorgen Hauberg, Pieter Versteegh, Johan Verbeke, David Vanderburgh, Johan De Walsche.

Often, the research process starts with a research question, passes through a methodological reasoning and then arrives at a new, true or possible answer or solution. Research by design suggests a practise somewhat in the opposite direction, where research may arise from design - from the proposal, model or experiment to the generalisation and rationalisation by consciously extracting rules about the object of the research process - nomothetic research.

Research by design intends to bring in expressive and systematic tools in the research process and concerns the direct relationship between analysing and the proposing. It endeavours to incorporate and develop the working method of architects - the searching spatial sketching in a specific material - in the environment of academic research and development. Through research by design, concordance is sought between the methods of research and a form-giving, experimental design practice.

Research by design is research that produces knowledge through the architect's tools and working methods. It investigates the research inquiry from the practitioner's methods and acknowledges practice as a mean of gaining new knowledge.

Research by design does not assume a separation of subject and object and does not observe a distance between the researcher and the practice. Instead, the artistic practice itself is an essential component of both the research process and the research results (Borgdorff, 2005). This creates a research tradition which stands outside the artefact while at the same time as standing within it (Frayling, 1994).

Research by design suggests an agreement between architectural practice and research process and methodology, as both can fundamentally be said to consist of the following elements:

Basic perceptions: philosophical, ethical and theoretical perceptions, norms and values regarding the surrounding world, the role of architecture and the object itself (architecture). These are a prerequisite (paradigm) for the research process and may be discussed and, in part, advocated possibly as basic research.

Investigation: analysis, criticism, selection, problem formulation... i.e. the process in everyday life.

Programme: the actual problem, the definition of partial assignments and goals in an overall programme (rules and norms). This can take the form of strategic research.

Proposals - (product) development work: a concrete, spatial proposal as a possible reply to the programme; this is the experimental and partially independent aspect of the analysis.

Subsequent rationalisation: argumentation, theoretical explanation of the proposal and subsequent testing in practice, if applicable.

Communication: presenting the material in the form of a text, a drawing, a model or an example that explains the correlation between the components of the methodology in a manner that is consistent, reasoned, made probable and cannot be contradicted.

If we think the field of architecture beyond the single project or unique piece of work, it is possible, also in this way, for research to arise from design: To move between the descriptive (the purely describing), the ideographic (the unique and exceptional), the nomothetic (the argued, rule setting) and the proposal, which in the end is based on the ethic argument. The method has been called back-casting, in which the ending picture is described first – here also as a spatial thing. This could be architecture's contribution to a comprehensive research strategy – a strategy which is both normative and directed towards the future, and a strategy which introduces a holistic approach to design as well as research.

Proposal and Experiment

The question of the role of the proposal in research is a particular aspect of the whole discussion. Preparing proposals is one of the options within architectural research; an option that is already available within categories such as applied research and action research. Research-based proposals or proposal-based research can add a creative, experimental and expressive element to research and contribute to theories, rationalisation and generalisation about the object.

Within architectural research, there is a tradition for concrete, alternative, spatial, building and urban - proposals which include an accessible contemplation of the experience and cognition achieved through the physical work. The following books are examples of this tradition: Palladio's: 'The Four Books of Architecture', Ledoux's: 'Architecture', Schinkel's: 'Collected Architectural Design', and last but not least, Le Corbusier's: 'Œuvre Complète'.

We could even include some of the visions, projects and books that have followed and exist in this area between architectural proposal, theories and manifestos. Archigram's projects deal with architectural issues without providing research answers, but something more than an idea is created. The same applies to Peter Eisenmann's: 'House X', Venturi's: 'My Mother's House', Raimund Abraham's: 'Unbuild' and John Hejduk's: 'Mask of Medusa'.

Palladio and Le Corbusier were both great contributors to the phrasing of the programmatic basis for their own era of architecture. They were not architectural theorists, although both were well-versed and experienced in history, but practising architects who undertook to generalise their own experience and presented visions, proposals and completed works. Palladio's *Quattro Libri* and Le Corbusier's *Œuvre Complète* and other written works are not research in our understanding, nor were they intended to be. However, they have contributed significantly to the collective cognition of the profession. This merely serves to point out that the real or most comprehensive development work is carried out in concrete, architectural practice and that this characteristic of the field should be included in the academic research environment to the extent possible.

Quality assessment

The distinction between research and practice has often been discussed. The argument has often been that works of architecture are themselves synonymous with research activity, and that the act of publicly exhibiting, installing, manufacturing or distributing the works constitutes publication (Archer, 1995). The position in this paper is that research might also be expressed in other ways than words but is different from architectural practice – especially by the degree of generalisation and contemplation, with research explicitly looking for values that go beyond the individual case – in search of general and normative aspects.

According to Henk Borgdorff (2005), art practice-as-research can be distinguished from art practice-in-itself as follows:

Art practice qualifies as research if its purpose is to expand our knowledge and understanding by conducting an original investigation in and through art objects and creative processes.

Art research begins by addressing questions that are pertinent in the research context and in the art world.

Researchers employ experimental and hermeneutic methods that reveal and articulate the tacit knowledge that is situated and embodied in specific artworks and artistic processes.

Research processes and outcomes are documented and disseminated in an appropriate manner to the research community and the wider public.

A current example of artistic research is the Danish doctoral thesis from The School of Architecture in Copenhagen (Bjerrum, 2007). The criteria set up by the assessment committee might be useful when discussing research by design.

The committee has discussed a number of criteria that it thinks must be met before work can be classified as artistic research work:

It must be substantiated that the experimental work with the material has been an unavoidable necessity for the formulation of new insight or cognition, not just a supplement to or an illustration or subsequent rationalisation of theoretical work.

Artistic research or basic architectural research must differ from the normal production of work by being subject to a specific methodology and systematic procedure.

The tacit cognition must be expressed so that it can be communicated, discussed, queried and made useful to others. The work must include an accessible contemplation of the experience and new cognition achieved that result from the work with the subject matter.

The formulated contemplation cannot consist entirely of the architect's own philosophical interpretation of own work but must be of a systematic and general nature that makes it useful to the profession.

Our perception of the nature of cognition is often linked to language and its argumentative structure. In the world of research, it is generally accepted that cognition must be expressed using language in order for it to be communicated and controlled. New knowledge must result in a written product. There is no reason to oppose this but rather to keep a tiny chink open. Scientific and artistic cognition exist side-by-side in our culture. One speaks to the intellect through linguistic concepts and the other speaks to our senses: our physical experiences. We say that art gives us concept-free cognition. As architects, we are familiar with this concept-free cognition. We often position ourselves between science and art because both form part of our work and we can analyse and explain a work of architecture quite extensively. However, we have all found ourselves in front of a particular work that speaks to us in its own silent language – a visual language. This is a fundamental part of the nature of architecture and a collective experience in our field. This experience comprises the superiority of the building and the proposal compared with the comment, the generalisation and the theory about the work.

Does this imply that the comment or the linguistic, drawn or modelled generalisation or theory is inappropriate or irrelevant? On the contrary, it is of great importance in its own right, the more so as it opens up the tacit experience to a discursive field.

However, the comment does not replace the architect's work with form or the work's own language.

In architecture as well as in the society, there have always been revolutions or shifts in paradigms. If we think of architecture today, such shifts must concern globalisation and the impact from climate changes. But, there is also an ongoing revolution in the tools and processes of architecture, which contributes to a holistic and open approach to design, information, production and materials, and which reaches out for a connection between the academia and the profession.

Research by design calls for such a holistic approach to practice as well as to research.

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