Research as Support for Design Practice

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In this article the author presents a tentative paradigm for architectural research based on his experience from research within work- space design. He makes a distinction between empirical, critical and constructive research. He finds that critical research by case studies and constructive research by experimental work with prototypes are possible ways. As an illustration of case studies he briefly presents a study of the 'Konsum Building' in Stockholm.

Theme WORKSPACE DESIGN

IS THERE ANY GENERAL KNOWLEDGE in architecture? – For many people the aim of research is to find general answers to more or less eternal questions. Are there any questions of that kind in architecture? And is it possible to answer them in a general way?

We have a number of recurrent questions but the answers are more problematic. A general knowledge about construction principles and other prerequisites for the erection of buildings is of course possible to get. We can also work out some standards based on studies of basic human activities. It may also be possible to find some general principles for perception by laboratory experiments even if contextual and cultural aspects always have an impact. But this knowledge is worthless without the competence to use it in appropriate combinations in different situations. And if looking at the results this knowledge seems to be specific for each kind of situation.

But is there not any general knowledge about the phenomen of architecture? Is architecture completely exposed to actual functions, cultural circumstances and sites? In the history of architectural theory we find many attempts to identify general principles for architecture. In most cases it is easy to show how closely bound they are to a specific culture and period. No set of principles has been more generally acknowledged over time. As Scruton has shown most theories are

not even theories in a scientific meaning. There are few or no links to earlier theoretical attempts and very few arguments for the chosen principles. They are in fact doctrines. (Scruton 1979, Lundequist 1993)

If there are no eternal principles, what decides architectural design? Nobody denies that there is a continuity. A reasonable answer is traditions (Polanyi 1964, Rolf 1993). Decisions in design processes follow rules within a number of what might be termed *architectural games.* These games can be more or less established. But they are not deterministic in the meaning that they lead to a specific result. They present a consistent set of possibilities, and the games can be played more or less skilfully. It is also possible to combine different architectural games.

This process is very complex. To find out what games should be used in which combinations architects try to link the actual design situation to other experiences by using analogies and metaphors. Architects are not fully conscious of the ways these processes follow, or have at least difficulties to articulate them. The architectural games are part of the architects' tacit knowledge (Polanyi 1964, Rolf 1993). The rules and the way to play are often taken for granted and just used. The architectural games are in a way part of our given life form. But how are they developed? By new combinations actualized by new missions or contexts, but also by reflection-on-action and critical examination. (Piaget 1972, Israel 1972).

The search process is guided by a principle which might be characterized by the concept of *family resemblance* (Wittgenstein 1978, Johannessen 1993). It is a kind of associative chain that links brothers and sisters together in a family. The links can be compared with the fibres of a rope. As there is no continuous fibre in a rope, there is no specific quality common to all members in a family. Still they are connected, and this kind of connection can help in the finding of a solution.

Empirical, critical and constructive research

Can research play a role in this development? Yes, but not traditional empirical research, confronting theories and data, aiming at general answers to eternal questions. We may also talk about two other kinds of research, *critical* research as a confrontation of values, and data and *constructive* research as a confrontation of values and theories (Galtung 1977, Caldenby, Walldén 1986). Both critical and constructive research are possibilities to be examined. I will start by discussing critical research, and return to constructive research later on in the article.

What use can we make of critical research? What methods can be used? What methods are there? In human and social research there are five conceivable methods – 'surveys', 'archival analysis', 'experiments', 'historical studies' and 'case studies' (Yin 1984, Westlander 1992). They are appropriate for different kinds of questions.

'Surveys' and 'archival analysis' may answer questions on *who, what, where, how much* and *how many,* and 'experiments' questions on *how* and *why.* Common to all three is that the expected answers must be very precise and the number of categories limited. This is not the case in critical research. It is characterized by questions on *how* and *why,* which cannot be answered very strictly. The answer to these needs are 'historical studies' and 'case studies' which have a lot in common.

How can case studies be carried out? Procedures and documentation that guarantee the quality of the facts presented, and the analysis made, are of course important. But the choice of questions to be answered is more fundamental. The aim of case studies is not to achieve as comprehensive descriptions as possible. It is necessary with a focus. To answer the questions a multitude of methods may however be used (Yin 1984).

What is the focus of case-studies in this context? It is to relate the real understanding and use of a building to the ideas behind the design.

To be able to do that we need concepts to describe different modes of human-environment transactions. And we need concepts to describe what is happening during the design process.

The impact of buildings

Buildings may be regarded as structural answers to functional demands. *Coherences* can be established by closeness and visual contacts. *Demarcations* can separate people and activities. The social effects can be reinforced by the general organization of space, the relative position of different rooms and their connections to entrances and other parts of the communication system (Hillier, Hanson 1984, Hillier 1993, Marcus 1993).

But there is always more than one structural answer to functional demands. It is also a question of appropriate form. The role of form is to make the functions obvious so that people in the building can make use of it. A building can never be used and appreciated as expected if it cannot be 'read'.
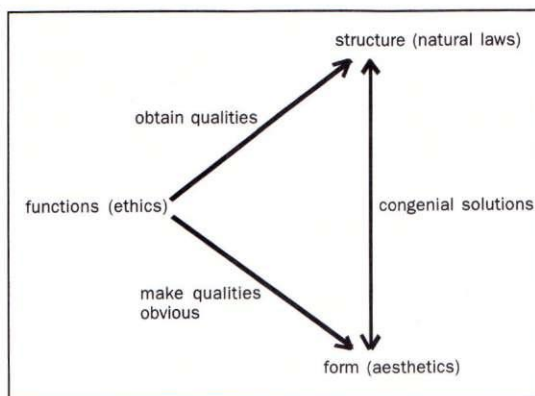
But form is even more important than that. Buildings play an important role as an intermediary for the whole culture. They consolidate our thinking and values. A culture without physical representations is difficult to imagine. This cultural influence is reinforced by the long life-time of buildings. It makes them more independent of specific short-run cultural events than other artifacts.

Some of the qualities given to buildings are *deterministic*. People are not given any choice and have to adapt to them. These transactions between humans and their environment may be called responsive. Most of them are however *relative*. The transactions are dependent on the indiviuals' interpretation, evaluation and conscious operations (Stokols 1978). The real outcome can not be foreseen. A building is a stage for many different occurrences over time. There are also other means to realize social qualities, e.g. organizational and instrumental, that can be used as complement or compensation. Such interventions may also change the whole context.

Design processes

Design processes can be described in many ways. Most models mirror the decisions-makers' ambition to control what happens. Distinct phases concluded by a decision that predominates the rest of the process is the objective. This perspective is not relevant in our case. We are looking for qualitative steps and they cannot be bound to a time-scale. Designers go forward and back again in a rhythm which varies a lot between different design situations and designers.

My conceptualization is inspired by the Austrian physician Hertz who influenced Wittgenstein (Janik, Toulmin 1973). He meant that reality, even in physics, is so complex that we have to choose a perspective to be able to study anything. And out of that we construct mental models that guide our research.

He put up three conditions for these models. They should be consistent and logical without contradictions. They should be comprehensive to all relevant data. They should be as unsophisticated and elegant as possible. This third principle is often called Occam's razor (Alchourron, Bulygin 1971).

I mean that these three conditions are relevant when designing artifacts. I have also found that they represent the most important qualitative steps in the real course of design (Lundequist, Ullmark 1993).

The conceptual step

I call the first step the conceptual one. As we normally cannot catch all demands and restrictions we must find some order to put them into, and by that relate them to each other. This kind of order can be found in the architectural games. But it is not enough with general principles. And we do not use other buildings as prototypes in a simple way. We need something in between. I call this 'formats'.

What is the relation between formats and architectural games? Formats are more specific sets of rules inside an architectural game. To live up to Hertz's first condition they should be consistent and logical, but that is not always the case in practice.

A format can be compared with a piece of music with a theme that opens up for a range of variations. But to use a format is not only a question of interpretation and performance. It is necessary to choose among the variations and combine them in a useful and interesting way. Formats are nothing unique for architecture. Corresponding structured ways to come up with the first concept can be found in many other areas of design.

In the architect's work the trial-and-error of formats is a physically tangible activity. It is made by drawing or making primitive models. Different functions are symbolized in a simple way, and these symbols are put into the structure of the format. It is a question of *naming* and *framing* (Schön 1983), and the format stands for the framing.

The constituitive step

The second qualitative step is called the *constituitive* one. It corresponds to Herz's second condition, correspondence with all relevant data. As it is not possible to consider all demands and restrictions from the start, the relevance of the chosen format must be tested. By these tests new possibilities may also appear and actualize other demands. In this stage function often follows form.

These tests mostly result in radical modifications of the conceptual solution. Sometimes the format does not survive. A step backwards is necessary. But this is not the same as starting from scratch. Much can be learnt from the first conceptual work. A number of modules are often identified and simplify the new pattern-matching.

This step is socially different from the conceptual one where the professional designers always dominate. During the constituitive step users play a major role questioning and examining the solutions critically. They also learn to know the format and can ask for more open or different ones. The media used to present the solutions is very important for the outcome of this process. (Mächs, Skans 1995)

The consolidatory step

The third step is called the *consolidatory* one. It corresponds to Herz's demand for distinct and elegant models. The really important relations should be emphasized, and empty formal expressions avoided. As long as the solution is quite close to the format this is quite easy. If it has been much deformed during the constituitive step it is more problematic. Sometimes it is necessary to go back again and try to find a more functionally congenial format.

Another reason for reconsideration could be demands for increased generality and variability. The original functions are often time-limited and the building cannot be as tailor-made as asked for in the short run. So, sometimes less appropriate formats and solutions must be tried even if the actual users are satisfied with the original one.

It is also a question of bringing the detailed design in accordance with the format, and with the need for an identity corresponding to the activities or operations that will go on in the building. To do that symbols or metaphors can be used. Corporate image is a concept used within this area.

Critical case-studies

What conclusions can be drawn from this conceptualization? What questions are most
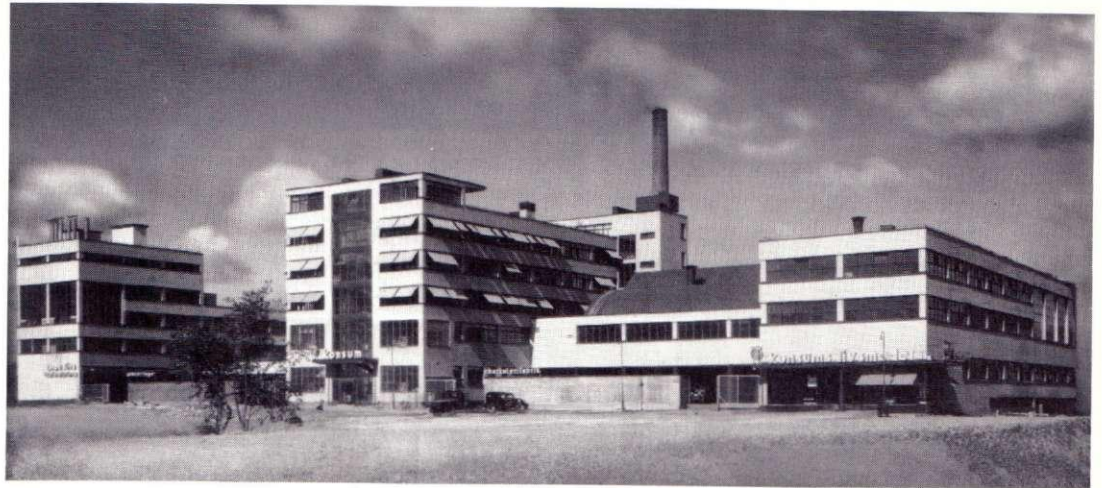
The Konsum building

The Konsum Building as an example of the use of formats

Luma light bulb factory, Stockholm.

The original format

The Konsum Building in central Stockholm was erected in 1933. It was designed for a number of smaller factories and stores that served the co-operative shops (Hillberg 1995). The 'format' was influenced by an 'architectural game' for industrial buildings initiated already at the turn of the century in USA. The most well-known architect associated with this game was Albert Kahn who worked for Ford (Brunnström 1990). He was not only interested in architecture, but also in modern production concepts.

The architects responsible for the Konsum Building went to USA and studied these pioneer factories and met the architects. A few years before this project they designed the Luma Building for the production of light-bulbs. Here the layout was formed as an 'E' with a main block and three wings. Production took place on the upper floor and packaging and delivery on the bottom floor of the main block. The parts were produced in the eastern wing and the middle wing was used for workshops and other service facilities. The western wing contained entrance, locker rooms and restaurant, and at the top a glazed test-room.

These design principles may be recognized even in the Konsum Building although the operations were quite different. Each part of the building was however more adapted to its specific functions. The number of storeys was different and some functions were distinctly expressed in the design. Nevertheless it is still possible to talk about the same format.

The main characteristic of this format is the slender block that maximizes daylight and closeness to windows. Through the window bands and the formal emphasis on staircases and elevators a dynamic expression is achieed. This corresponded to the ambitions of the co-operative movement at that time. It is a question of proportions, blocks in relation to space between, height in relation to breadth, window area in relation to walls etc. There are clear rules, but also freedom for the architect and his/hers fellow designers.

The decline and genesis of a new format

After a few years a series of major functional changes were actualized. As long as the internal communications system and the common middle wing were respected and worked as planned the building was able to well accommodate these changes. However, when new entrances, new locker rooms etc were built up in the main block and in the other wings the original format suddenly lost its influence. Each enterprise started to solve its problems without consideration to the whole. The clear principles for use and change were replaced by anarchy.

During the fifties and sixties the building degenerated seriously, and in 1976 it was radically reconstructed. Of the original enterprises only the factory for cured meats and provisions remained.

The ambition was however neither to go back to the original ideas nor to offer this factory better conditions. The building was transformed into a modern office building. A completely new format was introduced, and almost nothing of the old characteristics remained.

For the factory this meant that the earlier vertical organization of production, where the carcases were transported up to the top of the building and the meat after cutting and processing step by step was brougt back to the bottom floors by help of gravitation, did not work any longer. It was replaced by a horizontal organization disturbed by the new main entrance hall for the offices and a number of new shafts. Some operations, for example the cutting, were forced down to the cellar without access to windows.

urgent if we use case-studies for critical research? The formats play a key role. We know that the first attempts in a creative process tend to characterize the whole work. So, a better understanding of formats is necessary. We have to study the themes and examine the range of variations. It is also interesting to find out what differences there are between the repertoires of different architects. In this way we might be able to identify different traditions and architectural games.

The identified formats should then be confronted with the real understanding and use. Different views and rules for using and changing buildings should be investigated, so that the logic and ability of the format to communicate the original ideas can be found out. Out of the different perceptions of buildings a critical discussion about considered aspects in formats would also be possible. And new concepts that facilitate the communication between architects and users might come up.

A third area to investigate is different ways to achieve generality and flexibility. Are there from time to time formats and solutions that correspond better than others to general needs? Or is perhaps a distinctive character and an interesting form more important for the future value of a building. To what extent are people prepared to overlook functional imperfections if a building carries an interesting cultural message?

Constructive knowledge by experiments

But critical research may not be the only possible kind of architectural research. What about constructive research? Is it possible to make more comprehensive experiments within architectural research other than basic functional and perceptive studies? We know that prototypes can be of great value for practice. There are many historical examples of this, railway stations, hospitals, flats etc.

If design of such prototypes can be regarded as research has been discussed many times. The main problem is that the way from demands and restrictions to a solution cannot be followed and controlled in detail afterwards. There are always a number of subjective choices that cannot be rationalized. But this objection can also be applied to engineers and other kinds of designers working with research. But it is not. The reason is that their work is seen as an application of scientific models. But as shown many times this is not the case (Schön 1983). Their values and perspectives also affect the solutions.

So, we have a choice. We can either stop constructive research where not all conceivable alternatives are able to be set up and compared with the suggested solution. Or we can try to find ways to secure the quality by organized critical procedures.

Conclusions

Research can be very useful as support for architectural design. Through critical case studies it is possible to acquire a deeper understanding of the relations between values expressed in architectural games and the real effect of buildings. In this way we can be more conscious when making decisions in design processes. But even if we are able to identify a number of recurrent architectural games and criticize them we must realize that they are bound to contexts and culture. Far reaching conclusions about appropriate architecture must be avoided.

By means of experiment it is also possible to gain constructive knowledge. The results would be more or less elaborated models or prototypes. Such experiments could however never be fully controlled, because all conceivable solutions cannot be set up. Rules that secure a thoroughly critical examination of both the design process and the results are necessary if such work would be able to be considered as research.

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Bibliography

Alchourron C. E., Bulygin E.: *Normative Systems*. Springer Austria 1971.

Brunnström L.: *Den rationella fabriken. Om funktionalismens rötter*. Dokuma Umeå 1990.

Caldenby C., Walldén Å.: *Forskning om arkitektur och gestaltning*. G16:1986 BFR Stockholm.

Ehn P.: *Work Oriented Design of Computer Artifacts*. Almqvist & Wiksell 1988.

Ehn P: "Setting the Stage for Design as Action". *Nordisk Arkitekturforskning* 1992:4.

Galtung J.: "Methodology and Ideology". *Theory and Methods of Social Research*. Vol 1, 1977. Ejlers Köpenhamn.

Granath J-Å.: *Architecture, Technology and Human factors. Design in a Socio-Technical Context*. Industriplanering CTH 1991.

Hillberg S.: *Konsumhuset i Stockholm*. Industriplanering KTH 1995.

Hillier B., Hanson J.: *The Social Logic of Space*. Cambridge University Press 1984.

Hillier B.: "Specifically Architectural Knowledge". *Nordisk Arkitekturforskning* 1993:2.

Israel J.: Inledning i svensk översättning av Piaget: *Strukturalismen*. Prisma Stockholm 1972.

Janik A., Toulmin S.: *Wittgensteins Wien*. Doxa 1986.

Johannessen K.: *Wittgensteins senfilosofi*. Filosofisk Institutt Universitetet i Bergen 1993.

Kolb D.: *Postmodern Sophistications – Philosophy, Architecture and Tradition*. University of Chicago Press 1987.

Lundeqvist J.: "Arkitektur och byggnad". *Tidskrift för Arkitekturforskning* 1991:4.

Lundeqvist J.: "Om designteorins uppkomst". *Nordisk Arkitekturforskning* 1992:4.

Lundeqvist J.: "Modernism, postmodernism, dekonstruktion, kritisk regionalism". *Nordisk Arkitekturforskning* 1993:3.

Lundeqvist J., Ullmark P.: "Conceptual, Constituent and Consolidatory Phases" i Törnqvist A., Ullmark P. ed.: *Appropriate Architecture*. Industriplanering CTH, Industriplanering KTH 1993.

Marcus T.: "On re-discovering space". *Nordisk Arkitekturforskning* 1993:2.

Marcus T.: "Buildings and Social relations" i Törnqvist A., Ullmark P. ed.: *Appropriate Architecture*. Industriplanering CTH, Industriplanering KTH 1993.

Molander B.: *Kunskap i handling*. Daidalos 1993.

Mächs A., Skans M.: *Arbetsplanering och kunskapsbyggande*. Industriplanering KTH 1995.

Patton M. G.: *Qualitative Evaluation Methods*. Sage Publications 1980.

Piaget J.: *Strukturalismen*. Prisma Stockholm 1972.

Polanyi M.: *Personal Knowledge*. Harper & Row USA 1964.

Popper K.: *Objective Knowledge*. Oxford University Press 1972.

Ramirez J.: *Strukturer och livsformer*. NORDPLAN 1993.

Rolf B.: *Profession, tradition och tyst kunskap*. Nya Doxa 1991.

Simom H.: *The Science of the Artificial*. MIT Cambridge 1969.

Schon D.: *The Reflective Practitioner*. Basic Books USA 1983.

Scruton R.: *The Aesthetics of Architecture*. Princeton University Press 1979.

Steen J., Ullmark P.: "Planning for good working conditions". *Proceedings International Conference on Theories and Methods of Design*. Projekteringsmetodik CTH, Projekteringsmetodik KTH 1993.

Stokols D.: "Environmental Psychology". *Ann. Rev. Psychol.* 29:1978.

Stolterman E.: *Designarbetets dolda rationalitet*. ADB Umeå Universitet 1991.

Ullmark P.: *Förändringsarbete*. DUP NUTEK 1996.

Westlander G.: *Om context-orienterad analys. En metoddiskussion med anknytning till organisationspsykologisk forskning*. Arbetsmiljöinstitutet undersökningsrapport 1992: 28.

Winch P.: *The Idea of a Social Science and it's Relation to Philosophy*. Routledge & Kegan Paul 1988.

Wittgenstein L.: *Filosofiska undersökningar*. Bonniers 1978.

Wittgenstein L.: *Om visshet*. Thales 1992.

Yin R.: *Case Study Research. Design and Methods*. Sage Publications 1984.