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# MAKING EXPLICIT IN DESIGN EDUCATION: GENERIC ELEMENTS IN THE DESIGN PROCESS.

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## ABSTRACT

Designing is a complex, personal, creative and openended skill. How can teachers help students in learning to design?

For the most part, performing a skill is an implicit activity. Learning and teaching, however, are largely explicit actions.

In this paper it is stated that designing is learned by doing and by making explicit what and how to do. For being more explicit, it is important to take into account the design at hand, architectural principles, methods or styles and the design process.

Based on literature research on the design process and the differences between novices and expert designers, and experience in practice, generic elements in the design process are defined, to work with in design education.

The elements are generic in the sense that they are always part of the design process, they lay beyond the complex, personal, creative and openness.

The expectation of making the design process more explicit with generic elements, is that teachers can train the students a more structured and focused way on the design process and that students will gain a better understanding of, become more skilled in and gain more efficacy in the design process.

**Keywords:** Design process, generic elements, design education.

## INTRODUCTION: DOING & MAKING EXPLICIT

Designing is a complex, personal, creative and open-ended skill. Dreyfus en Dreyfus (1986) labels the design process as 'unstructured': "The most common

kind of problem area, 'the unstructured', contains a potentially unlimited number of possibly relevant facts and features, and the ways those elements interrelate and determine other events is unclear". Lawson (2006) describes: "The designer has a prescriptive rather than a descriptive job. Unlike scientists who describe how the world is, designers suggest how it might be". And: "the very essence of their job is to create the future, or at least some features of it".

How can teachers help students in learning such a complex, personal, creative and open-ended skill, like designing?

In short, in this paper an intertwined hypothesis for design education is stated:

- 1) Students learn to design by doing, by practicing the whole skill of designing a lot of times
- 2) Making explicit 'what to do' in designing and more specific making explicit the design process will help students in learning to design.
- 3) There are generic elements in the design process, which teachers have to be aware of for training students and making the design process explicit.

Traditionally the 'designerly way of thinking' (Cross, 2007) is learned in the studio. Architectural designing is learned in a kind of 'master and apprentice' system, or in educational terms: in a process of learning-by-doing. To help the student in the process of doing, the teacher and the student talk about a design project at hand.

Schön (1985, 1987) describes this dialogue between instructor and student. The student designs and presents a (provisional) result; the instructor looks it over and intervenes in relation to the understanding of the student and the problems at hand. The student tries to grasp the meaning in what the

instructor is telling and showing him and translates his or her understanding into a new design result.

In general, performing a skill like designing, is for a large part an implicit activity (Dreyfus and Dreyfus(1986), Lawson (2006) and Ryle (2002) and others). Experienced designers often don't know explicit what they do, they work implicitly. Schön (1985, 1987) calls this "knowing-in-action". However, in the process of designing, learning and teaching, making explicit is also an important factor. Dewey (Logister, 2005) sees knowing in a certain degree supporting action. In knowing we understand the relation between our actions and the consequences. Better understanding these relations helps to act more focused and thoughtful, more intelligent. Especially in unknown and new situations, it is important to use this understanding.

When it is accepted that making explicit is an important aspect next to and interwoven in the process of learning-by-doing, immediately the question raises: "What to make explicit in educating design?"

Concerning the communication in the studio, Schön (1985, 1987) distinguishes at least two levels: in and about the design process. It's an intertwined process of language and meta-language. The language is about doing architecture: by drawing and explaining the teacher talks about architecture. The words do not describe what is already on paper, but are parallel to the process of drawing. The meta-language is about the process of designing. It's describing features of the process demonstrated and introducing reflection on the action of designing. To be more defined four levels in the dialogue between teacher and student can be distinguished: (1) the design at hand or the design product, (2) personal and general architectural design principles, in which architectural knowledge is made applicable, and (3) design methods, or the differences in (personal or cultural) approaches, and (4) the design process.

In the studio the main issue for students to learn, is the design process. They have to become experienced designers. They learn by doing, by working on a 'case study', a design project. And in

doing so, they learn at the same time, to apply principles, based on general and personal knowledge. Also, implicitly or explicitly, a teacher or student can follow a method.

This study will focus on the design process.

The 'designerly way of thinking' or designing skill, which students have to make their own by doing, is described by Schön (1985) as: "the repertoire of routinized responses that skilful practitioners bring into their practice". Schön (Goldhoorn, 1991) concludes that designing is a very complicated process: it's about different kinds of knowledge, a personal system of preferences has to be developed, there are different areas of evaluation and it has its own language of sketching and modeling. For experienced designers this process is not divided in separate steps and actions, but the process is an undivided whole with 'automatic moments', common uses and moments of reflection and exploration.

However, to a certain degree, it is possible to analyze, describe, construe, define and explicate this process. The purpose of this investigative study is to obtain more insight in what 'making explicit the design process' means, or -in other words - what the content of the dialogue could and should be on the level of the design process, from an educational point of view. Therefore a basic framework of generic elements in the design process is distinguished and defined.

The expectation of making the design education and the design process more explicit by defining and using generic elements, is that teachers can train the students a more focused and structured way on the design process, with the design at hand as a kind of case study.

For students, being more explicit in the design process will be helpful in the overall confusing process of learning. In respect to this, Schön (1985, 1987) talks about the paradox of education in the design studio. The implicit, grounding didactic in the studio is the idea that the student "is expected to plunge into the studio, trying from the very outset to do what he does not yet know how to do, in order to get the sort of experience that will help him learn what designing means."

## RESEARCH METHOD

Distinguishing and defining generic elements in the design process is a twofold and intertwined process of literature research and experience in practice.

Starting point and foundation for defining generic elements is what researchers have written about the design process, like Schön (1985,1987) in describing what happens in the studio, and more general about the design process, like Darke (1979), Dorst (2003), Lawson (2004, 2006) and Cross (2007).

Next to grounding the generic elements in the design process, it is important that they are defined from an educational point of view. Therefore literature on differences between novice and expert designers (Eastman, Newstetter, & McCracken, 2001) is studied.

Furthermore, the generic elements are developed in a process of experimenting and testing in practice. In two courses, students are trained explicit in the design process and the design process is made explicit during the training. In structuring the education by and focusing on the generic elements these elements are developed further in working with them, in a process of learning-by-doing.

Like in a design process, in the process of developing the generic elements, criteria to be met by these generic elements were intuitively known at the start

and becoming more clear and conscious during the process.

## COURSES

In two courses - a third year Bachelor and a first year Master - doing and making explicit are intertwined. Students are trained in different, relatively short design tasks (every two weeks a new design task starts, later on in the semester, the students get seven weeks for a design task). The design process is studied explicitly more general in seminars and more specific in reflecting on the personal design at hand in the dialogue between teacher and student and in a reflective text on the design process, to be written by the student.

Besides the common goal of learning to design, both courses have a different ‘own’ focus: in the Master course “Van gezet tot meester” (‘apprentice-master’) the students are trained in educational skills, in the minor “Archineering” the students are trained in designing with a focus on the material aspects of the architectural design.

In the courses, the understanding of the design process, the skill in designing and the self-efficacy are measured as much as possible, by using questionnaires (see fig. 1) at the start and the end of the course in an intervention group as well in a

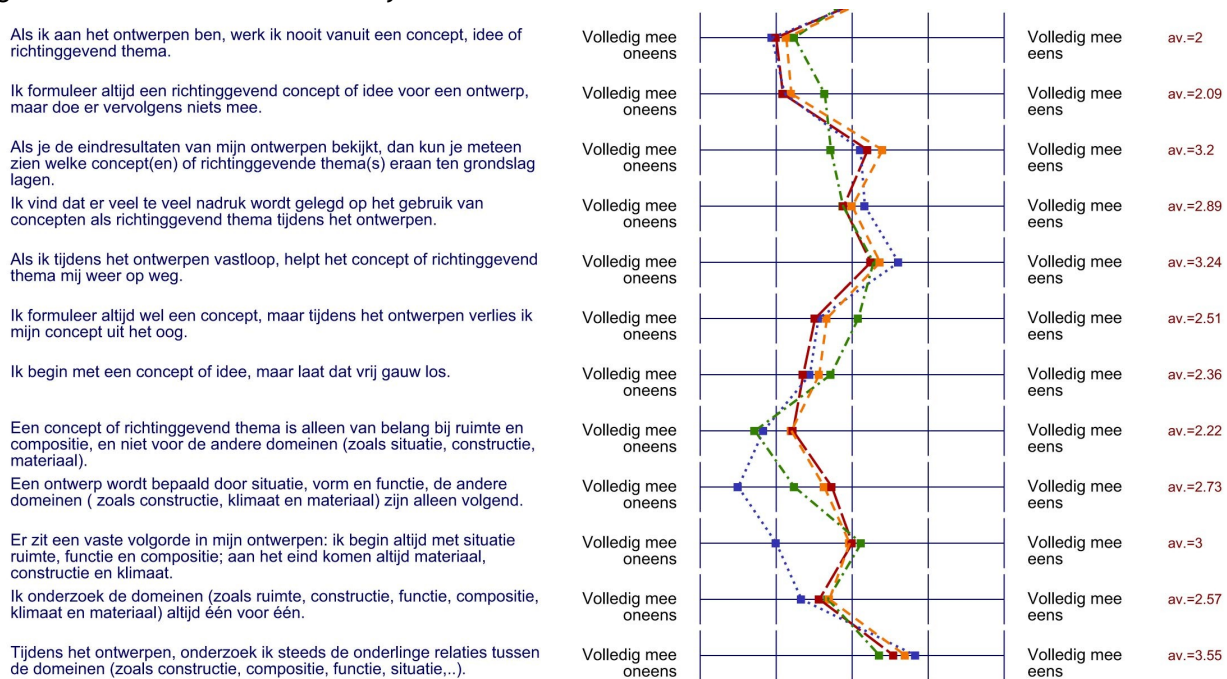


Figure 1. Results questionnaire

control group, and by mapping the understanding of the design process, and by comparing small design tasks (3 hours) in the intervention group. Focus of the measuring is the working with the generic elements.

The results of this testing will be subject of another research study. For now, it's interesting to know that the first results are promising.

In this study, the focus is on defining and describing the generic elements, as developed from their basis in literature on the design process and differences between expert and novice designers and the experiences in practice in both courses.

## RESULTS: GENERIC ELEMENTS

*“Beginning with situations that are at least in part uncertain, ill defined, complex, and incoherent, designers construct and impose a coherence of their own.*

*Subsequently they discover consequences and implications of their constructions - some unintended- which they appreciate and evaluate. Analysis and criticism play critical roles within their larger process. Their designing is a web of projected moves and discovered consequences and implications, sometimes leading to reconstruction of the initial coherence - a reflective conversation with the materials of a situation.”* (Schön, 1987)

To come up with a workable educational framework, with generic elements, those elements have to be met a few requirements or criteria.

The generic elements have to be a balanced result between the process of expert designers and the aspects students have to learn to become such expert designers. Students don't have all knowledge and skills expert designers have. Training those aspects has to be essential part of learning to design. Besides training students in certain skills and knowledge the design process has to be described in a way that it helps students to get grip on the process and to get an overview. Often students are 'drowning' in the chaotic work.

Also for teachers the generic elements have to give overview in coaching a complex process as designing. In practice, it's really easy to forget some aspects in the dialogue with the student. Knowing more explicit

about the design process should lead to a more structured way of teaching and curriculum.

Furthermore, the elements have to be generic in the sense that these elements are always part of a design process, no matter how personal, complex, open-ended and creative the process is.

## EXPERIMENTING WITH A GUIDING THEME

Designers often start with exploring data and features of the given problem. But relatively early in the process they shift their attention to possible solutions. Simultaneously with the exploring of data and features, designers explore ideas and directions to solve the problem. Analysis and synthesis occur simultaneously. Cross en Dorst (Eastman, Newstetter, McCracken, 2001) describe the design process as a co-evolution of solution and problem spaces: “Since ‘the problem’ cannot be fully understood in isolation from consideration of ‘the solution’, it is natural that solution conjectures should be used as a means of helping to explore and understand the problem formulation.”

Designing, in the words of Schön (1985, 1987), is a way of ‘experimenting with a hypothesis’. Designing is working within an ‘endless’ number of possibilities to come up with an internally coherent and consistent whole. One has to find an order to create this coherent and consistent whole.

## EXPLORING AND DECIDING

The process of experimenting with a guiding theme can be described as a process of exploring and deciding, of diverging and converging. It's a process of balancing between at one hand opening up possibilities, seeing new ways, discovering alternatives, and on the other hand reducing possibilities, evaluating and making decisions. In designing, designers explore, they discover possibilities and impossibilities, testing them on their implications and learning about the problem at hand. Kees Dorst (2003) compares designing with learning. A designer looks in different ways at the design problem and experiments with different solutions. By doing this, the designer learns a lot: he collects more and more information about the problem at hand and about the possibilities to come up with a specific design. It's a process of thinking, experimenting, and learning from the results, a

process of sketching, modeling, and critical rethinking the results, a process of continually changing and developing until a satisfying solution is found. Schön (1985) compares the process of designing with a dialogue: “When moves function in an exploratory way, the designer allows the situation to ‘talk back’ to him, causing him to see things in a new way - to construct new meanings and intentions.”

In relation to the notions exploring and deciding interesting notions can be found in research on creative processes. Poincaré (Csikszentmihalyi, 2004) stated four characteristic stages in creative processes: (1) preparation, a period of intensive work, of conscious searching for an answer, (2) incubation, a period of working in the unconscious, (3) illumination, a moment of ‘seeing the light’, the ‘eureka’ and (4) verification or evaluation, a period of elaboration, conscious work, testing the new conceptual ideas. Also Dijksterhuis (2007) refers in a similar way to the creative process; there have to be periods of intensive, conscious work and there has to be time for taken distance and for letting the ‘smart unconscious’ work.

Besides the unconscious, the conscious also plays a role in deciding: the processes of decision making are directed by a guiding theme or imposed order and by criteria.

Schön (1985) concludes about the decision-making process: “the designer evaluates his moves in a threefold way: in terms of the desirability drawn from the normative design domains, in terms of their conformity to or violation of implications set up by earlier moves, and in terms of his appreciation of the new problems or potentials they have created”.

In the process of exploring and deciding, differences are shown between expert designers and novices (Eastman, Newstetter, & McCracken, 2001). Expert designers are more open in their exploration. In general students are working more linear and more focused on one solution. Students believe good designing is coming up with good ideas, expert designers concern themselves with the realizability of ideas and evaluate ideas based on informed decision-making analysis.

In our experimental courses, the students are trained

in exploring, by studying alternatives about and during a lot of activities in the process of designing. The intention of studying alternatives is not to make ‘perfect’ alternatives and compare and choose between them rationally by a list of advantages and disadvantages; the intention is to learn about the design task and possible solutions and to discover all kinds of (im)possibilities and (dis)advantages. Often, the chosen variant is a new ‘super’ variant, a combination of things, discovered in studying alternatives. By studying alternatives and variants you learn about possible choices and the situation at hand.

Focused on the process of deciding attention is given to the role of the guiding theme and criteria in the process of decision taking and to the process of decision taking as a combination of rational, conscious and unconscious thinking, of intensive work and taking distance.

#### **GUIDING THEME**

During the process, designers come up with a guiding theme or qualities. The designer expects that the chosen guiding theme or qualities will lead to an interesting and good design solution. Working with this guiding theme or statement brings about coherence and consistency in the design process and result. Using a guiding theme in a complex and open situation helps in making choices, and it gives the design its character or identity.

Different researchers and designers name and describe the qualities in their own way. Schön (1985, 1987) concludes: designing is “a situation of complexity and uncertainty which demands the imposition of an order”. He also speaks about a hypothesis, constructing an order, giving meaning and ‘naming and framing’. Darke (1979) calls it a ‘primary generator’, a relatively simple idea. This idea is ground for making choices and analysing what are the important aspects in the design. Lawson (2006) concludes as characteristic for the design process: working with two or more ‘primary generators’. Other names used, are patterns, ideas, paradigms, concepts and guidelines.

Expert designers use strong guiding themes. They explore the guiding themes or concepts more rigorous and profoundly then starting designers.

Because they have more experience, they more easily choose a relevant analogy (Eastman, C., Newstetter, McCracken, M. (2001).

In every characteristic building, in 'pieces of architecture', guiding themes can be seen. Often people will talk about it in their own words or interpretations, but in main line they will describe a common theme. Examples of characteristic guiding themes are the lack of perspective of the Jews in Germany in the Jewish museum in Berlin by Libeskind, the uplifted landscape in the university library in Delft by Mecanoo, the geometric harmony in the museum of arts and crafts in Frankfurt by Richard Meijer and the human eye in the arts and science center in Valencia by Calatrava.

In our courses, mostly, the guiding theme or statement is to be chosen relatively fast (in a few days or hours). Sometimes, the guiding theme is free to be chosen, sometimes, the student has to choose a guiding theme within a given category, e.g. an archetype, a story, or some climate or material fascination.

In working with a guiding theme in this way, three things are aimed for. Firstly, students learn to play with different kinds of guiding themes and with a guiding theme on a more general level: by doing the same with different guiding themes, hopefully, a process of transfer is starting. And students will learn to distinguish different guiding themes and their sense / significance in different design contexts and tasks.

Secondly, the focus is on working with the guiding theme and understanding its role in the design process: students learn to hold on to the guiding theme. It's a process of continuously (re)focusing on the guiding theme. What is the central issue? What does this guiding theme mean for all different aspects? How does it help in the design process to make a consistent and coherent design?

Thirdly, the students learn to develop a guiding theme, by elaborating on it. They have to learn how to translate it into a design result, by discovering all kinds of possible means and tools to 'make it expressive'.

## **CRITERIA**

In the process of experimenting, choices and decisions have to be made. The guiding theme is an important instrument in the decision-taking process. However, more criteria are used, partly subjective, partly cultural, partly 'objective' set. Schön (1985, 1987) refers to this set of criteria as a system of preferences.

Because of the relatively large number of criteria and aspects playing a role in the designing, the process of designing is one of compromising and trade offs. There will always be criteria, contradicting to each other. Sometimes they can be avoided, sometimes they can be solved, sometimes they emerge in a field of tension, making the design solution more interesting.

Criteria can be clear, and they can be implicit: Schön (Goldhoorn, 1991) concludes that the process of evaluation is grounded in 'not formulated' criteria. The designer has to be able to recognize the good and appropriate results, without being able to explicit all the criteria, without knowing concrete what the criteria are.

In comparison, expert designers explore more possibilities and information. In doing so, their decision-making is based on more considerations. Because experts have more experience they have a better feeling for distinguishing relevant and irrelevant information (Eastman, C., Newstetter, McCracken, M. (2001).

Examples of criteria are making a building strong, stable, and waterproof, designing a clear, easy recognizable entrance and routing in a public building and functional requirements given at the start of a project. Often, the criteria consist of the - during the years- collected knowledge about architecture and building. Frequently, they can be formulated in rules of thumb, like 'the height of a beam should be 1/20 of its span' or 'the space around a staircase should have at least more or less the same dimension as the staircase itself'.

Training students in working with criteria, means asking them to come up with information, requirements and so on, on all aspects, within all domains. During the process, criteria have to be

discovered and named.

Often, this kind of information is given in lectures and literature, however, for students it is difficult to apply this information in the design process and to distinguish the degree of importance.

### **DOMAINS**

Architecture is about making space with material, for functions and within an urban and societal, historical and philosophical context.

In line with this 'working definition' we distinguish 5 main domain groups: (1) space, form and composition, (2) material, construction, structure and climate, (3) function and movement, (4) urban context and site, and (5) social, historical and philosophical context.

In architectural designing a designer makes statements in all different domains, even if he doesn't do it intentionally.

The choice for 5 domain groups is a matter of discussion; depending on personal and cultural preferences different choices can be made. In fact Schön (1985) distinguishes more domains. By distinguishing 5 domains groups, based on a more or less general definition of architecture, it is tried to come up with a 'common sense' and relatively easy to remember order.

More important is that the design process takes place in and 'between' the domains. It's about working parallel in the domains and moving across the domains. The guiding theme or qualities are mostly chosen within one or two domains, the criteria are found in all domains, and the exploring and deciding takes place within all levels of scale and meaning or domains. Here we see by far the complexity of the design process.

In comparison to expert designers, for students it is difficult to work parallel in and across different domains. Students work often in a linear sequence. Most expert designers make more transitions, they move more across domains, cycling forth and back (Eastman, Newstetter, & McCracken, 2001).

We guide the students through the domains by asking them to design in one to two domains for next time. Besides that, we use - in a relaxed and flexible way - a scheme (fig. 2) with all domains on it. Students have to look at and fill in the scheme frequently

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space form  
image composition

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material  
construction climate

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function use ritual  
movement

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urban context  
site

---

social historical  
philosophical context

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*Figure 2. Domain scheme*

during designing, to discover things, like in what domain they are mainly working, which criteria in each domain are to be found and what implications decisions in a specific domain has to other domains.

The linearity in working in the different domains can be seen, in the way students draw their sketches and drawings. Often students study a long time on space, composition and function, mostly the material part is not drawn - and with that the implications are not seen. Taken the material aspects too late into account can cause problems later on. And, even more important, the chance to come up with a really integrated design, can be missed. For example, a student decided to design a meditation centre as a 'tower of thoughts' with spaces like boxes hanging in the tower. Naturally, the structure will be an important element in structural point of view, for holding the boxes in place. But also, the structure could function in holding the stairs and other elements for climbing to the different boxes. And it could be an important part in the composition.

### **WAYS OF THINKING**

The process of experimenting, of exploring and deciding includes a lot of different actions or ways of thinking. All these actions take place next to each



other and interwoven with each other.

Without the intention to make a perfect order and complete list, a number of main ways of thinking can be distinguished:

- collecting and analysing relevant information, seeing implications,
- associating, metaphorical, analogical, imaginative and ‘out of the box’ thinking,
- logical and practical thinking,
- abstract thinking, distinguishing main lines and side issues,
- reflection-in-action, questioning and critical thinking,
- paradoxical, dialectical thinking,
- evaluating, valuing ideas, means, and criteria,
- archetypical thinking, thinking in patterns and examples,
- ‘physical’ thinking, sketching and modeling.

Most of the sub skills are related to one or more of the generic elements. For example collecting and analysing information and reflection-in-action is related to exploring, the paradoxical way of thinking and evaluating is related to the criteria, the archetypical way of thinking is related to the frame of reference and ‘physical’ thinking is related to the ‘designerly’ language of sketching and modeling.

Despite the fact, that in the process of designing, the ways of thinking often aren’t at all clear to distinguish, for students it can be helpful to make them more explicitly.

This can be done by naming and explaining them, by training in short general exercises and by paying attention to them during the assistances.

For example, instead of forcing your idea and form on the design, learning the process of ‘reflecting-in-action’: recognizing the new and unexpected, seeing and discovering new possibilities, being open for what happens, when sketching and modeling.

### **SEQUENCE IN TIME**

As stated before, in this paper two notions are distinguished: the design process and different design methods and styles.

Mostly, when talking about the design process, the description is based on sequences in time, like

analysing, evaluation and syntheses. In fact, there seems to be no general timetable for designing at all. The design process is an interactive, iterative and recursive process. The differences in sequence are caused by personal and cultural differences and differences in the situation at hand. Together with differences in the chosen guiding themes they form the different design methods.

Van Bakel (1995) has done research on individual differences in architectural design processes or ‘strategic working styles’. Designers develop a habitual way of doing things, of solving problems. They develop a predetermined way, depending on their personality and preferred design approaches. Jormakka (2008) distinguishes methods on a cultural level in architectural designing: (1) nature, geometry, music and mathematics (2) accident and unconscious, surrealism (3) rationalism (4) precedent and typology (5) responses to the site, regionalism and contextualism and (6) generative processes, superposition and parametric design. Jormakka describes for each design method the authority, an imposing order, the techniques and the expectations.

It is stated here, that, however, methods differ in mixture, sequence and emphasis, the generic elements are always recognisable in these personal and cultural design approaches, styles and methods.

We deliberately differ the sequences and focus points. For example, one of the ‘two week tasks’ is designing spaces and material in a scenario, using a book or film as guiding theme. Function is only mentioned in the end: ‘this space could be used for...’. Another ‘two week task’ is focused on a mobile home, to be used in very cold and very warm environments, so the climate will be a leading factor for the design.

For students this is, especially at the start, confusing. Mostly, they are used to pay a lot attention to function and analysis in the start of the design, now they have to work in a different way. Aim is to learn students, that there is no general fixed sequence, that the sequence in the design process is much more a matter of personal and cultural determined preferences and habits and that working parallel and across the domains helps a lot in designing.



### **A FRAME OF REFERENCE OR LIBRARY**

The frame of reference is a reservoir of knowledge in the designers mind, or in the words of Hertzberger (1991) a library or collection. This library contains what is often called precedents or references. A reference is (a part of) a design; it serves as an example.

Nigel Cross (2007) concludes that the knowledge designers are using, is embedded in the artificial world. The collected knowledge is analysed and stored in images and diagrams. Designers built up a library, for use during the design processes: within which the examples are used, tested to the situation at hand, rejected, and transformed, and so on.

Schön (1985) concludes: "Usable knowledge often takes the form of examples of knowledge in action, in terms of which the practitioner can then see the next similar situation." And: "Practitioners need to build up a 'library of the mind', each element of which contains a *use* of a theoretical perspective to make sense of a practice situation."

In the reference projects, different kinds of knowledge are coming together. Thus, references are important examples not only for the different aspects, but also for the integration of all these aspects in one solution.

Traditionally, the faculty of Architecture in Delft works with the plan analysis (Leupen, Grafe, Körnig, Lampe, 1993). By analysing and studying architectural and urban designs, students develop a 'frame of reference'.

When not trained, students often use examples as 'pictures', in an inspirational, but superficial way. However, the next steps in studying examples are (1) analysing different aspects, like routing, space, structure, (2) analysing the relation of these aspects to each other and especially to the guiding theme, in terms of goal and means and (3) generalizing and distinguishing patterns in the different examples. In the end, really knowing these examples leads to a kind of archetypical thinking.

Studying examples, can help students in their own design (process) and helps the students in applying knowledge and theory.

Relating the frame of reference to the design process, more specific relating the analyzing of

'example' projects to the means to be explored in the design at hand, can help the students to discover more architectural knowledge and principles. For example, a student, working on a meditation centre, with as guiding theme becoming calm by being in and moving across the space, analyzed the projects of landscape artists (no function, only space and material) and discovered the spatial and material means, which can be used.

### **THE DESIGN LANGUAGE OF SKETCHING AND MODELLING**

Sketching and modeling are a kind of thinking out loud. They are the physical expression or externalization of the thinking process, the language designers use.

Schön (1985) called designing a reflective dialogue with the situation at hand. Every step in this process has implications and consequences in different domains and can bring about new insights and problems. In the process of sketching and modeling, the designer becomes aware of the implications of a choice; what it means in reality. Sketching and modeling are the processes of making choices, formulating, reformulating, and evaluating. Making thought expressive in the sketch and model the designer explores possibilities and discovers new insights and new ideas; through the sketching and modeling the design process unfolds.

Often the process of making explicit and expressive on paper or in material brings about discoveries; the thought appears to be different, when coming into in reality.

In our experience, students are sketching and modeling not enough, they seem to think that designing is a 'thinking process', and drawing is for presentation.

In our education we focus on sketching ('it doesn't matter how it looks, do it' and 'in doing it, you will learn it') and we focus more especially on sketching three-dimensional.

For example, in designing a small exhibition pavilion, the students use a story (book, film) as guiding theme and start with drawing perspectives of the spatial sequence. Only, after doing that, they are allowed to draw plans, sections and so on.

### INTENTION AND MEANS

Finally, like the general description of the design process as ‘experimenting with a hypothesis’ at the start of this overview of generic elements, another general description can be used, with the notions intention or goal and means or tools.

Developing a goal, an idea or guiding theme, designers explore the means and tools to achieve this goal. In the end, a design can be defined by its character: the intention and the means used, form a coherent and consistent whole.

Depending on the project, the means or tools are to be found in all domains.

Examples of means are the structure functioning as a divider in space and routing, lines of sight as a tool to relate the interior of the building to the surrounding landscape and a glass façade to make as minimal a border as possible between inside and outside.

For students, it can be helpful to see the design in terms of intention and means. It structures a complex, personal and open process by a simple question: ‘What tools do you need to achieve this goal or guiding theme?’

For example, when calmness, and quietness is the guiding theme for the design of a meditation centre, students have to study, what they mean by this notion and what the means are for achieving this in the design. Calmness can mean being without distraction; a ‘minimal art’ design in space, material and texture can be the tool. Calmness also can mean showing the contrast between activity and quietness: a ‘baroque’ outside and a ‘minimal art’ inside are the tools. And calmness can refer to the process of becoming quiet and calm; the routing and sequence of spaces are the tools.

### CONCLUSION AND DISCUSSION

Designing is working within an endless number of possibilities to come up with an internally coherent and consistent whole. One has to find an order or *guiding theme* as a hold during the design process and to create this coherent and consistent whole. Also, a lot of, often implicit and paradoxical, *criteria* are involved.

In main line, designing is a process of experimenting,

characterized by *exploring and decision-making*. This process can be described in a more detailed way. A lot of (paradoxical) *thinking ways* are involved. The process takes place in different *domains*, like space, material, site, function and social context.

Another important feature of process of exploring and deciding is the interactive, iterative and recursive *sequence*.

The design process can also be described in terms of *intentions or goals and means or tools*.

The design process is inseparably embedded in a broader context: a *frame of reference* and a *language of sketching and modeling*.

In figure 3 the generic elements are schematized.

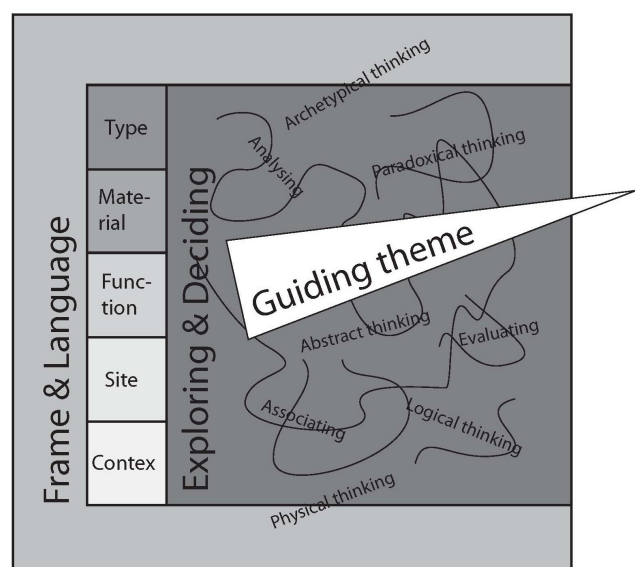


Figure 3. Generic elements

In this research study, these generic elements are defined for using in an educational context. Starting with the statement that learning to design is a matter of doing and making explicit (or becoming aware) what and how to do, the generic elements are distinguished and defined by studying the design process in research literature and by a process of experimenting in practice.

The broader goal of this research is to come up with information about learning to design, to create a more ‘conscious’ education.

Teachers are designers, who do their job mostly implicitly. The most obvious to start with in teaching, is improvising in commenting the design at hand on that moment: more or less like architects brainstorm together and comment each other in practice. However, teaching is not the same as

talking like architects; at least, it is more than that.

Giving attention to the design process, next to talking about the product at hand, means not only talking, for example, about the choice to be made on that moment (about the position of functions to each other, about the kind of material and structure, and so on), but also about the process how to make choices (by exploring alternatives with their implications and (dis)advantages, by taking into account the guiding theme and criteria and by making preliminary conclusions and taking time, 'waiting' for reasons and information from the further process, and especially from other domains).

Designing is a complex, personal, creative and open process. Using generic elements as a layer beyond the complex, personal, and creative can help to obtain overview, to gain insight in the whole process. Experimentation has to show: however, the expectation is, that knowing explicitly in main line about the design process and working explicitly with the generic elements in the design process, will lead to more understanding, for students and teachers. For students, knowing in main lines explicitly about the design process and being trained in designing a lot of times, will help to get grip on the 'open, personal, complex, creative'. It will, hopefully, lead to more understanding, skill and efficacy. For teachers, focusing on the generic elements, will give a better understanding about what students have to be trained in and what has to be paid attention to in education. Making explicit the design process will help in structuring the curriculum and within a design course to train the whole designing skill and all different sub skills.

The intertwined process of defining the generic elements by literature research and experimenting and developing with them in practice, will be continued in a process of testing. The results of this testing will be subject of another research study. For now, it's interesting to know that the first results are promising. The first preliminary results of the testing shows more understanding for the design process: for example, students do see more the usefulness of holding on to the guiding theme and working in and moving across all domains.

For now, some interesting lines begin to emerge.

In our courses an interesting discovery was made about the length of the design tasks. Often, it is said that students need time when they design; the idea is that they need time to think and work. However, in both intervention courses, the differences in design results, between the three 'two week' design tasks and the 'seven week' design task, is not really that much as to be expected, taking into account students have 3 x more time.

In the short design tasks, there is simply no time to think a lot about small details and other side issues. It seems that - in the 'extra time' - students are more circling around, are deciding less fast and overall doing not more exploring or more detailing. Students discover this difference themselves as well. A student concluded that using the time in the 'seven week' assignment for reconsidering the guiding theme, 'to be more original or creative', was consuming valuable time for elaborating and detailing the project.

Doing more design tasks in shorter time and doing longer, more structured tasks, seems the conclusion to be made. Short design tasks for learning the whole design process in main line and longer design tasks for elaborating more profoundly. Working with the generic elements could be helpful in giving more structure.

Paying attention to or training sub skills can be helpful. For example, in our course a student was doing a really good job in analyzing the design task, in defining a guiding theme and in talking about the design: the space and material are described vividly. However, sketching, modeling and presenting the design is a much more difficult story. Firstly, making three design tasks in six weeks, helps the teacher to recognize more clear the problem: it is not an accident, it happens every time. Instead of a student facing this problem each new project alone, now it is possible to pay attention to this problem in the dialogue between teacher and student: to name it, and to work on it.

When we started working with the generic elements in the courses, we were careful with the domain scheme. It was mend for helping the students and there was a chance that students would experience

it as too compulsory. However, it appears to be useful: it helps students in working in all domains and across those domains.

Not only for the student, but also for the teacher it is difficult to pay attention to all aspects, even more in a context of a small amount of time given for assistances.

The scheme is a tool for obtaining overview and for taking into account all relevant aspects with all kinds of implications to work on. So, the scheme can be used by the student and by the teacher.

The idea behind the generic elements is, that there is a common language for students and teachers, while developing and working in their own method or style. The generic elements are defined as a layer beyond the different styles and methods.

Teachers can train students more explicit in the generic elements and can make clear their position in the field of all design methods: do they have a specific design method, how does it relate to the design process elements and so on. For students, making explicit the position of the teacher, the differences between the methods and the similarities or generic elements can help in obtaining a more clear overview and understanding in an otherwise confusing environment, where teachers tell, they do the same - being a designer -, yet often seem to talk different languages or more specific different methods and styles.

Mostly, the curriculum is based on the design products: learning goals, descriptions how to work, assistances and so on are 'in the language of' design products. This also applies for the choice and extent of the design tasks: starting with a relatively small building, like a house, the extent of the tasks grows over time, to tasks like a library, a housing block and bigger.

However, learning to design is learning a way of working and creating. To a certain extend, the products are only the means in the process of learning to design. Being more explicit about the design process, becoming aware of the generic elements could help in designing a curriculum, much more focused on what student have to learn: the design process.

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