

THE DESIGN PROCESS

Between imagination, implementation and evaluation

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INTRODUCTION

Design can be understood as a collection and combination of different physical and mental techniques. On the physical side, there is the formulation, translation, and presentation of possible approaches to various artefacts, such as drawings and models. On the mental side, there are comparisons, interpretations, definitions and evaluations of such artefacts.

The implied link between physical and mental operations is often neglected in educational settings. This deficit may be illustrated by two exemplary situations from the typical academic environment:

1. Brainstorming: sitting before a blank page, the student is assured: "I just need an idea. Then I will implement it."
2. The group critique: The students' works are lined up along a wall. Sitting in the front row, a panel of lecturers and faculty members critiques the works. Not one student says a word.

In the first scenario, the student assumes that brainstorming is mostly mental. This mental task must first be completed before the solution may be materialized in the physical world. The student believes: "No artefact without an idea first."

In the second scenario, the teachers assume that their knowledge and experience may be simply communicated in the form of a verbalized critique. They believe: "Without expertise, there is no standard of excellence."

These statements demonstrate that both teachers and students starkly differentiate between physical and mental operations. This is directly linked to the over-valuation of verbalized concepts and appraisals and an unequal allocation of value judgement skills between students and teachers.

Material

The thesis presented above shall be illustrated in detail by introducing some basic didactic elements used in design classes. Among those elements there are typical tasks, sequences of assignments and different communication-scenarios. All elements were used over years in several design-studios in landscape architecture and urban design at the Berlin Institute of Technology

and at the University of Kassel. They were subject to an intensive reflection and adaptation.

Results

1. If design incorporates both mental and physical operations, ideas and implementation cannot be separated within the design process. Design education should therefore encourage students to experiment with as many different viewpoints and working methods as possible. This is linked to exploring different presentation techniques. In a broader sense, perspectives of other related disciplines might also be included. A hands-on, discovery-oriented working method is to be established, in which potential solutions may arise in the 'translation' between different referential frameworks.
2. Students are most definitely in a position to evaluate their own work. They develop and defend their own positions - at the same time, they are confronted with a variety of different opinions. Encouraged to articulate their opinion, their assessments are often sharper and more sophisticated than those of their teachers. Through their involvement in quality assessments, theoretical and practical topics (explicit and tacit knowledge) may easily be linked.

Conclusions

Tasks, assignment sequencing and communication scenarios influence the role-playing behaviour of students and teachers. They generate a starting point from which a professional self-image is to be established. To develop and refine the learning process in design education, it is important to us to discuss typical didactical elements and the underlying educational objectives.

APPROACHES TO DESIGN

According to Cross (1984), the design process may only be insufficiently captured with words. "Only a relatively small (and perhaps insignificant) area of that system of knowing and conceiving which makes designing possible may be amenable to verbal description. (...) The way designers work may be inexplicable, (...) simply because these processes lie outside the bounds of verbal discourse: they are literally indescribable in linguistic terms."ⁱ Despite these substantial limitations, the following two positions seek to approach the concept of 'design.'

Designing between Variation and Evaluation

Rittel (1992) identifies planning assignments as 'wicked problems,' distinguished from 'tame' ones, which offer clear descriptions of the problem and checkable answers. By contrast, wicked problems cannot be precisely or conclusively defined, because their definitions and possible solutions are closely linked together.ⁱⁱ

According to Rittel, two processes may be distinguished as part of the design practice: the designer generates alternatives and then selects especially suitable applications from a set of alternatives. Both steps continuously alternate during the design process.

The Design Process as a Collection of Techniques

Operations such as summarizing, arranging, positioning, composing, ordering, structuring, embedding or creating hierarchies, constitute physical or mental actions depending on the linguistic context. If design concepts are used in combination with a mental image, they illustrate thoughts to be transmitted by using a familiar physical operation. Without this metaphoric use of words, the mediation of mental images would barely be possible.

Obviously different languages and their respective usage do not make sharp distinctions between operations and concepts. Referring to Kemp (1974), Gänshirt (2007) describes the development of this twofold meaning by coining the term "Disegno." "Disegno" describes on the one hand the practical facility of drawing, on the

other hand, the power of the intellect to imagine "new worlds in and of themselves."ⁱⁱⁱ

Ehrlich (1999) implies that there is no differentiation between physical and mental operations during the design process, and that the two operations are equal: "Design is only possible through the activity of the body and the use of the senses."^{iv}

Design solutions developed during an investigation, are in constant interplay between representation, evaluation and variation. For Reinborn and Koch (1992) „a division of labor between thinking and drawing develops, as the graphic fixation of ideas creates new creative conditions for solving problems."^v

To conceive and to represent thus cannot be distinguished sharply from one another. Ehrlich (1999) suggests that "the *idea* of a design achievement and its subsequent materialization (...), may not be seen as independent entities (...)."^{vi} Idea and materialization do not exist in "chronological or hierarchical relationship to one another."^{vii}

Synopsis

For Rittel, the focus of design lies with the evaluation and decision-making process: "The reasoning of the designer or planner appears as a *process of argumentation*."^{viii} Furthermore, the production of alternatives is linked to value judgments. This point of view disregards the development and investigation phase in the design process.

Ehrlich, on the other hand focuses on conceiving and representation as a process in the development of design solutions. He remains flexible on how physical and mental operations may be combined, and on what basis a design solution may be evaluated.

In a synopsis of both approaches, two components of the design process may be specified. These include:

- on the one hand techniques and skills for the generation of ideas,
- and on the other hand criteria for design evaluation.

The learning experience in school as starting point

According to Reinborn and Koch (1992) designs are developed "in a difficult, indeed often tenacious process of alternating inspirations and failures, which arise from a mental and conceptual chaos. (...) This fluctuation between intuition, conceptual ideas and reflections thereon, which may lead to failure and the rejection of ideas (...) should not irritate (...)."ix

The functioning principle and cognitive design strategy outlined here require a willingness of the student to accept a solution without first having a clear objective in mind. However, an analytical design study rarely proceeds as linear and goal-oriented. Mistakes, misconceptions and setbacks are an inevitable part of the design process. Palmboom (2004), for example, notes that "in a sense, design means discovering the creative error and deviating from the straight and narrow at exactly the right moment. There are no fixed patterns down in the gap, just countless potentialities. Only by discovering, selecting, using and interweaving this vast range of possibilities does one - eventually - reach something self-evident which legitimises the design to the outside world. This fascinating game requires a high degree of boldness, as well as patience."x

However, the functioning principles and cognitive design strategies learned in school are predominantly goal-oriented. They are well defined and usually have clear evaluation criteria. This learning experience at first contradicts the idea of employing an 'aimless' design practice. The necessary willingness to constantly question and revise personal design strategies can become rather tiresome and discouraging for most students. Only a small number of students are able to independently develop their own design strategies. The majority of students should however be encouraged by means of a gradual introduction to the design process.

In this paper, we will take a closer look at both components of the design process described above, and link each with didactic elements. The first section presents approaches to finding ideas and initiating their outworking. The second section presents scenarios for the management and evaluation of design proposals.

I. IDEA GENERATION AND REALISATION

Theoretical point of departure

Archer (1984) couples the ability of cognitive modelling with individual forms of expression: "Indeed, we believe that human beings have an innate capacity for cognitive modelling, and its expression through sketching, drawing, construction, acting out, and so on, that is fundamental to thought and reasoning as is the human capacity for language."^{xi}

If one follows Archers view, the techniques used to solve a spatial problem constitute an essential part of finding a solution.^{xii} Without these techniques, it is not possible to illustrate, examine or modify complex spatial situations. Reinborn and Koch (1992) describe the design process as "interplay between head and hand, between contemplation and cogitation of possible solutions, as well as sketching and drawing initial conceptions." Within this approach to working, "the abundance of mental solutions (...) must continuously be "saved" in the form of a sketch on paper so that (...) the head has space for new ideas and suggestions."^{xiii}

In order to communicate and verify a solution, it must be visualised. Frequently, this is done in the form of sketches, drawings, perspectives, models and explanatory texts. Specific techniques and methods of representation are associated with every medium. These include e.g. projection methods, drawing and modelling techniques or the tools of software applications. They determine the range of investigative possibilities for a particular solution.^{xiv}

Palmboom (2004) describes the interpretation and manipulation possibilities affiliated with the medium of drawing. For him, "(Drawings) are more than just illustrations of ideas or concepts. They contain a composition that can be searched for its unsuspected capabilities."^{xv}

Representations of a spatial design are almost always spread out over different media and representation methods. Evidently, no one medium alone can capture the entirety of a design. In order to examine additional features, a design must first be translated into another representational language. With each translation, only certain aspects will be preserved; others will be altered or even lost. At the same time, other possibilities for representation and

adaptation become available. They allow the design to be varied and developed in an entirely new light.

Palmboom (2004) describes the interaction between different media by emphasizing the relationship between words and drawings: "During the design process there is an extremely complex chemistry between the words and the images. This is not a matter of carefully regulated one-way traffic - there is no clear recipe to be followed. (...) There is a gap between the words and the images, in which uncertainty and ambiguity must predominate - for one word can give rise to various images, and one image can be put into various different words."^{xvi}

Task-Sequencing

To substantiate the premises described above, a typical series of design tasks, or classroom assignments, are outlined as follows.

The actual assignment is divided into manageable steps over the course of the semester. All steps are sequentially built up over time. They are regularly processed, reviewed weekly, discussed and completed. All assignments are handled individually or in groups of two or three students.

It is often helpful to begin with a brief introductory assignment that presents the given design problem in a simplified, playful and casual manner. The corresponding formulation of the design problem should be provocative and stimulating. The processing time is limited, thus forcing the students to react quickly and to form their own perspectives. The results of the assignment help formulate and anticipate the goals of the semester, and may always be referred to over the course of the semester.

In the first third of the semester, the students develop master plans for an area in a competitive working atmosphere. A design competition is established in which a jury of students and teachers select the best plans. These are then subdivided into smaller areas to be developed in more detail. In this way, the students' individual work is collectively interrelated. Through this overall approach, the need for adaptation arises. Students learn to adjust their individual concepts to fit the bigger picture.

Within the overall process, the repetition of similar processes is averted. At the same time, excursive assignments are suited to unexpectedly interrupt the predetermined schedule. Such excursive assignments could be short, impromptu exercises, so-called „Stegreife,“ which help provide diversion and enrich the design process with fresh new ideas. Such exercises may focus on a specific aspect of the greater design problem, but are not necessarily linked to the main task at hand. Relevant aspects may be investigated in isolation from existing commitments. These include:

- Exercises dealing with design concepts (borders, collage, order, structure, material,...)
- The collection of thematic, on-site impressions, such as light and shadow, structures, site use, typical places for the area, borders...
- The identification of structures and their subsequent translation into landscape architectural or urban design patterns.
- Exercises that anticipate pending design questions (typology, access and infrastructure, ground plan organization, ...)

Working techniques and variations on the theme

All design assignments are inevitably linked with certain media and presentational techniques. Over the course of the semester, various techniques will be introduced and tested out for each thematic design assignment. Some assignments call for the rapid translation of the design concept into different media. The inclusion of different model building techniques, digital and manual visualization methods, or photographic abstraction allows for a broader examination of the design problem. At the same time, “happy accidents” and shifts in meaning enrich the development of the design.

In essence, multiple variations need to be developed for all assignments. In this sense, selections can be made from a larger pool of possibilities during the evaluation and decision-making process. The variations document the development of the design process over a series of steps. They allow the designer to move back and forth within a seemingly hopeless design path and to rediscover or reanimate previously neglected solutions.

II. EVALUATION

Description of the practice

According to Rittel (1992), evaluation is an essential part of the design process. The established method of evaluation and selection for architects and planners at the college level is demonstrated by the 'critique.' Students present their design ideas in the form of models, sketches and plans. Following the presentation, a panel of 'critics' reflect on the state of work and give advice and feedback on how to proceed. The panel usually consists of professors and invited guests.

In order to protect themselves from particularly harsh critiques, Harvard Graduate School of Design students compiled a list of 160 possible responses, which they published on-line under the name „Blowfish.“ For example, proposal No. 10, boasting the caption "Postmodern simulation," suggests reacting with the following line: "Leaf through your sketchbook and then look up and say, "I'm sorry, that's not in the script. What page are you on?"

Obviously, the confrontation that arises between students and professors during a critique is perceived as role-playing. All suggested reactions deliver their punch lines by questioning the typical division of roles between teachers and students.

This described communication setting is characterized by a highly asymmetrical distribution of roles. Only the students who are presenting work engage in discussion with the panel. The other students withhold their comments. On the one hand, they wouldn't want to strain the relationship with their fellow classmates „on stage“ - on the other hand, they wouldn't want to prolong the process any longer than is necessary. If this role-playing is constantly repeated, the students turn into passengers, guests or consumers. The focus of their interest is mainly on their own work.

The role of the critic, on the other hand, is characterized by her privileged interpretive jurisdiction, by an unlimited „right to speak“ and an exclusive vocabulary. Frequently, the technical terms that are used are private neologisms or hover over the discussion without any theoretical context.^{xvii} Moreover, the qualifying criteria are always derivative of the personal attitude of the critic.

Because the quality assurance of the project lies in the hands of the professor, the evaluation criteria of the students remains unspoken and thus untemplated.

Shifting the roles

In the communication setting described above, the professor assumes all responsibility for the evaluation and selection of appropriate design approaches. The goal of the course however, should be to support the students in their own design and decision-making process. Over a period of time, they should develop their own sense of quality and set of evaluation criteria.

As described, the process of the critique depends entirely on the distribution of roles. Through a simple shift in role assignments and their related forms of communication, the students can directly participate in the quality assurance of design projects. The following example illustrates this procedural change.

Project proceedings

At the first meeting, students and professors formulate the project goals and relevant course topics together. This culminates in a project timetable, or „road-map,“ confirmed by all participants.

In addition to the design groups, alternating organizational and design-theory groups are formed. The organizational groups take on tasks such as field trip preparation, materials procurement, exhibition preparation and documentation of the work. The design-theory groups prepare brief presentations on various aspects of the project theme. In accompanying weekly lectures, they introduce the whole group to basic concepts and important design theories. In the context of urban planning theory, for example, appropriate articles are found in the writings of Sitte, Corbusier, Rossi, Lynch, Rowe, Humpert and Sieverts. To stimulate reflection on the working and cognitive processes of design, articles by Arnheim, Rittel, Lawson or Gänshirt are suggested as appropriate reading material.

As the first step in the design process, master plans are created and selected within a competitive framework. Students assume the roles of various experts during an intermediary colloquium. They examine the interim results from the point of view of municipal

authority, investor, citizen, or planner, and come up with estimations and recommendations for each plan.

A jury is made up of students and professors. The composition of the jury and the proportional weight of their votes are determined beforehand by the students. As a result of the design competition, two master plans are selected, which will be handled in detail throughout the remainder of the semester.

Both master plans consist of areas, which are to be worked on individually or in pairs. To ensure compliance with the prerequisites of the master plans, two advisory boards are established. Students involved in the detail planning of the first master plan are members of the advisory board for the second master plan and vice versa. In this way there are no contradictions between the interests of the students as designers and their work as members of the advisory board. The professors are members of both boards.

Design ideas are to be presented weekly to the advisory board in the form of sketches, drawings, diagrams and models. The board is to evaluate the designs and where necessary suggest adjustments or changes. Whether the designer follows up on the board's suggestions depends on the persuasive power of the ensuing arguments.

All referenda are chaired in turn by each student on the advisory board. Among the chair's tasks are the concluding summarization of discussion results, the moderation of speakers and the monitoring of speaking-time limits.

As members of the advisory board, the professors are also integrated into the described discussion format. In order to not overly influence the course of the discussion, they often save their input until the end. Their task is to supplement the discussion with missing aspects, to clarify obscurities, to contradict one-sided judgements, or to introduce additional alternatives.

Consequences for the evaluation process

Several changes in the behaviour of the students have been observed as a result of the described shift in roles. These are described as follows.

Communicability of Design

The role of an expert or critic involves the ability to express her opinion. This eliminates the typical inhibition of students to discuss each other's work.

For the evaluation process, the entire group must be able to recognize and understand a given design. This requirement is no longer that of the professor's alone, as she is no longer the sole addressee of the presentation. The attitude of the 'misunderstood artist' or the appeal to the 'imaginative powers of the teacher' can simply not hold up to the group dynamic of fellow students.

For the students it goes without saying that their designs are to be presented in detail, using all available techniques.

Variety of Opinions

The students' criticism of their classmates' designs are comparatively tough. At the same time, they are more receptive to the criticisms of their peers.

Alliances of opinions arise during the discussions. Fractions of students who share similar positions find common ground in the dialogue. Instead of one school of thought, students are confronted with a wide range of opinions. The student recognizes that a design solution can be assessed in a variety of different ways.

In the case of weak designs, critique usually tends to be clear and unanimous. In contrast to the judgement of a professor, the critique of the entire group is not subject to individual capriciousness or subjectivity. Confronted by the judgement of the entire group, the student is thus forced to develop and improve her design choices.

For the overwhelming approval of a design, it is clear that the quality of the solutions must not only fulfil different prerequisites, but must also equally satisfy and convince a group of critics with widely diverging attitudes.

Reflection

All students find themselves in the role of the designer, but also in the role of critic. They each develop individual positions, which they must introduce and defend before a panel of their peers.

The change in roles also heightens their sensitivity to criticism. It becomes clear that any proposed design must be understood and endorsed by a group of decision-makers. It is also critical for the designer to understand the criteria and motives of her peers and to take the dynamics of the group into account.

Responsibility

The project topics, educational goals and semester timetable are all developed *with* the students. In this way, all decisions directly involve the students and they in turn assume a shared responsibility for the project results. The students thus shape their own education and thereby develop their own objectives. From the newly acquired responsibility for the course content, a strong sense of motivation emerges as the main effect^{xviii} of the process.

Strengths and Weaknesses

Within the described settings, the student takes on different roles: as producer, as expert, as speaker, as advisor, as jury member, as organizer, as decision-maker, as moderator... The student must orient herself within different group settings and thus be able to constantly renegotiate with new people. According to her strengths, she will successfully fulfil certain roles. In other roles she will have the opportunity to improve weaknesses and discover new potentials.

Relationship between theory und practice

Through the act of evaluating their own designs, the students begin to appreciate the value of evaluation criteria. The accompanying presentations of theoretical texts provide the group with specialized terms, concepts and possible lines of argumentation. Accordingly, the students are highly concentrated on the content presented.

The suitability and relevance of the offered theories are scrutinized on the basis of individual design solutions during the meetings of the advisory board. Here, the students develop their own vocabulary and are able to apply it within a corresponding theoretical context. At the same time, the presented theories allow the students to diversify and supplement their own design ideas.^{xix}

Role of the professor

With the change in setting, the role of the professor is also changed. The professor gives up certain characteristics of traditional leadership roles and takes on the attributes of advisor or coach.^{xx}

As the professor is no longer the central focus of the event, she has the opportunity to sit back and scrutinize the discussion process. She detects problems early on and gains enough time to develop alternative perspectives. Since many aspects of the process have already been brought into the discussion by the students, the professor's input may be much more precise. She can introduce missing points, clarify grey areas or offer alternatives. The positions already broached by the students offer the professor possibilities for connecting ideas.

By establishing a common conceptual framework, the professor forfeits part of her linguistic advantage. Her role is understood by all, undeniably, and in case of doubt she must even justify her position. If she contradicts the unanimous opinion of the group, the opportunity for intensive discussion arises. As the use of technical terminology is always embedded within a theoretical context, the ideas behind any given concept remain transparent and debateable for all participating parties.

SYNOPSIS

The didactic elements presented here should ease the students' entry into the working and cognitive processes of design. The essential aspects of these didactic elements include:

- the structuring of the semester plan and the formulation of complex design assignments as a series of interrelated tasks,
- the sensitisation of the potentials and limitations of particular working techniques in the design process,
- the linking of theoretical concepts and the evaluation process
- and the establishment of various communication scenarios with the goal of allowing students to reflect on their own design progress

With the described shift in role assignments, students experience a significant increase in competence and motivation. This also applies

to students with little experience and self-confidence in creative process.

The outlined teaching and learning scenarios have been inspired by various theories and discussions in the context of educational workshops and seminars. We believe that there is still much room for experimentation in this area of education. It seems therefore important to us to exchange and share experience and knowledge of design education in a broader context.

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Footnotes

ⁱ Cross (1984), p. 242

ⁱⁱ Rittel (1992), p. 22

ⁱⁱⁱ Gänshirt (2007), p. 45 continued

^{iv} Ehrlich (1999)

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- v Reinborn and Koch (1992), p. 36
- vi Ehrlich (1999)
- vii Ehrlich (1999)
- viii Rittel (1992), p. 136
- ix Reinborn and Koch (1992), p. 34 continued
- x Palmboom (2004), p. 19
- xi Archer (1984), p. 349
- xii The interplay between design solutions and their corresponding editing tools are very well documented by Gänshirt (1999, 2007).
- xiii Reinborn and Koch (1992), p. 11
- xiv Bielefeld and El Khouli (2007), p. 69
- xv Palmboom (2004), p. 19
- xvi Palmboom (2004), p. 18 continued
- xvii Kuhlmann (2006) "If educators do not provide enough help and insight on the criteria of the evaluation process involved with architectural practice and theory, it often happens that the students come to believe that mysticism is an indicator of the quality. Kuhlmann calls this phenomenon the "mastery-mystery".
- xviii Compare to Weblers (1991) Statement on "the responsibility of the students", p. 246
- xix According to Webler (1991), different parts of objects should be linked to one another and classified in an overarching theoretical context. In this context, conflicting expert opinions should also be considered. Science should not be presented as "the final sum of all lessons learned". Instead, it is to be understood as a "consistently cognitive process with the revisability of (interim) results.", p. 247
- xx Webler's (1991) impression of the educator is that of a „seeker and learner“ with „courage for self-criticism.“, p. 247